DESIGN CRITERIA WASTE ISOLATION PILOT PLANT (WIPP) REVISED MISSION CONCEPT—IIA (RMC—IIA)

FEBRUARY 1984

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DESIGN CRITERIA

REVISED MISSION CONCEPT - IIA
(RMC - IIA)

REVISION 4

WASTE ISOLATION PILOT PLANT
(WIPP)

ALBUQUERQUE, NEW MEXICO

FEBRUARY 1984

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INTRODUCTION TO DESIGN CRITERIA

This document provides Design Criteria which shall be used by the Architect-Engineer (A-E) in the Title II detail design of the Waste Isolation Pilot Plant (WIPP). The Design Criteria presents requirements which the A-E must address in the design of the Waste Isolation Pilot Plant. Variations to this criteria must be requested and dispositioned in writing. As the highest level design document in the WIPP Project, all lower level implementing documents, such as design bases, drawings and specifications, must be in compliance with the requirements of this Design Criteria document.

Specific criteria presented herein are based upon and reflect the cumulative results of the following preliminary design documentation applicable to the WIPP Project:

SAND77-0274, WIPP Conceptual Design Report

SAND78-1429, Revised Concept for the Waste Isolation Pilot Plant

Instructions to the Architect-Engineer

WIPP Title I Design Report (RMC-II) January 1980

In the context of this document, the above are referenced only to identify prior documentation upon which the current Title II effort has been based.

This edition of the Design Criteria, RMC-IIA, replaces WIPP-DOE-71, WIPP Design Criteria, RMC-II, Revision 3, December 1982.

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CHAPTER 1
DESIGN CRITERIA, GENERAL
WASTE ISOLATION PILOT PLANT (WIPP)
ALBUQUERQUE, NEW MEXICO

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1. INTRODUCTION. These criteria are for the design of a research and development facility to demonstrate safe disposal of radioactive wastes resulting from the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission. The wastes will include unclassified contact-handled (CH) and remote-handled (RH) transuranic wastes and high-level waste used for experiments. Transuranic (TRU) wastes are defined as wastes contaminated with activity concentrations of certain alpha emitting radionuclides of long half-life and high specific radiotoxicity greater than 100 nanocuries per gram. The nuclides included are U^{233} (and its daughter products), plutonium, and transplutonium nuclides. Both the CH and RH wastes will meet the requirements of WIPP-DOE-069, TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant. The experimental wastes will be high level waste from defense programs (DHLW).

The two primary objectives of the Waste Isolation Pilot Plant (WIPP) are to provide a full-scale facility to demonstrate through a pilot plant operation the technical and operational methods for permanent isolation of DOE CH and RH TRU waste and to provide a facility in which experiments can be conducted to extend the understanding of the behavior of high-level wastes in bedded salt.

No waste will be received at the WIPP until simulated waste package handling operations have been safely conducted through emplacement and retrieval.

The facility will be designed to handle about 500,000 ft^3 of CH TRU waste and about 10,000 ft^3 of RH TRU waste per year on a two-shift-per-day split basis (one for waste handling and one for underground construction) with an operating life of 25 years.

It has been assumed that 75% would arrive by rail and 25% by truck. Underground facilities and equipment will be designed to be compatible with retrieval operations of all CH and RH waste, with a retrieval decision to be made within 5 years after the initial emplacement of each species. All experimental waste will be retrieved and shipped off site by the end of the experimental program.

After the facility has fulfilled its intended purposes, it will be decommissioned. This operation will include backfilling the underground portions of the WIPP, sealing the shafts, and decommissioning the surface facilities. The design shall incorporate features that will facilitate this operation. Where practical the underground equipment shall be designed to be usable for decommissioning backfill operations, but that mode of operation shall not be considered as a primary function.

2. CONTACT HANDLED WASTE

a. Waste Quantities. The design capacity of the WIPP shall be 500,000 ft^3 of CH waste per year based on a one-shift-per-day, 5-day-per-week operation for handling waste. This quantity will arrive in drums, boxes, and M3 bins. The estimated volumes for CH waste are as follows:

- o 500,000 ft^3/yr maximum throughput
- o 1.41×10^6 ft^3 in storage at the end of the 5 year retrieval decision period
- o 6.33×10^6 ft^3 total storage capacity.

b. Waste Characteristics.

Nuclide Content. A large fraction of the CH TRU waste is contaminated with weapons grade plutonium whose typical isotopic content is given in Table 1-1. There are also small quantities of waste contaminated with other transuranics, including heat source plutonium (primarily ^{238}Pu), heat source curium (primarily ^{244}Cm), plutonium rework waste with enhanced amounts of ^{241}Am, and waste from the thorium-233 uranium reactor program being conducted at Bettis Atomic Power Laboratory.

The maximum allowable fissile contents are 200 grams in 55 gallon drums and 350 grams in the 4' x 4' x 7' boxes.

Table 1-1 Isotopic Content of Weapons Grade Plutonium

Isotope	% total activity (weight)	Specific Activity (Ci/g)	Total (Ci/gm Pu)
^{238}Pu	0.0003	1.74×10^{1}	0.0052
^{239}Pu	0.9388	6.14×10^{-2}	0.0576
^{240}Pu	0.0575	2.39×10^{-1}	0.0137
^{241}Pu	0.0031	1.12×10^{2}	0.3472
^{242}Pu	0.0003	3.9×10^{-3}	0
^{241}Am	0.0002	3.24	0.0006
			0.424

For accident analysis involving single containers it will be assumed that the drums and boxes will be loaded with 200 and 350 grams, respectively, of weapons grade plutonium. For accident analysis involving large numbers of containers, it will be assumed that for every 30 drums/boxes at most one contains the maximum quantity of weapons grade plutonium and the balance contain the average value.

Surface Dose Rate. By definition the surface dose rate on CH TRU waste containers is not greater than 200 mRem/hr.

Operating procedures are based on criteria to ensure that occupational radiation doses are as low as reasonably achievable (ALARA). The average surface dose rate on a drum or box of contact handled waste shall be assumed to be 10 mRem/hr. This is a conservative assumption which provides an adequate margin should there be an increase in surface dose rate due to radionuclide concentration in waste processing and/or ingrowth of AM-241.

Heat Generation. The CH TRU waste generates negligible heat. An average drum will generate less than 10 milliwatts and an average box less than 20 milliwatts. Drums containing heat source plutonium will generate as much as 10 watts, but there are very few of them.

Waste Form. As currently being produced and stored, CH TRU waste has a wide variety of forms, e.g., scrap metals, paper and rags, HEPA filters, sludges, solidified cutting oils, and concrete.

c. Handling Requirements. As a result of the uncertainty in long-term waste management policy, specifically as to processing or not processing the CH waste, the following design criteria shall be adhered to:

(1) Material handling equipment and hoist selection shall be based on the assumption that all CH waste received at the WIPP has been processed, using maximum container weights.

(2) The design of all ventilation and fire protection systems both above and below ground shall be based on the more conservative assumption of nonprocessed waste.

The Transuranic Package Transporter (TRUPACT, designed to accommodate all waste containers listed in Table 1-2) will be the shipping container for all CH waste. There will be two

Table 1-2 Contact-Handled TRU Waste Containers

Container Description	Dimensions (h x w x l)	Nominal Volume (ft^3)	Weight in Pounds		
			Maximum	Average Unproc.	Average Proc.
DOT 17C and 17H 55 gallon drums	35"x24"dia	7.4	840	330	800
M-3 Steel Bins	6'x4'x5'	120	3,200	-	-
Other: drums, boxes, culverts	7'x7'dia max.	270	19,000	-	-
Six-Pack of 55 gallon drums	36"x49.25" x73.5"	45*	5,200	2,200	5,000
Modular Steel Boxes	38.5"x50.5" x74.5"	84	8,000	6,500	-
Truck TRUPACT High Efficiency Box	38.5"x54"x68"	80	8,000	-	-
FRP Box Overpack	54"x54"x88"	148	11,000	3,800	-
Large Steel Box	72"x68"x112"	317	-	-	-

*Envelope Volume - 75 ft^3

transportation modes: a truck semitrailer and a flatbed railcar. For either mode the TRUPACTS will be lifted off the transporter and placed upon air pallets which will be used to move the TRUPACTS into the Waste Handling Building for unloading.

The TRUPACT is 9 ft. high x 8 ft. wide x 25 ft. long with a maximum gross weight of 50,000 pounds.

Container Specifications. Containers used to store defense CH TRU waste are listed in Table 1-2. A decision to process the CH TRU waste could increase the average weights of the containers but not the maximum weights.

The maximum envelope size for CH TRU waste containers will be 8'-6" high x 8' wide x 12' long and a maximum weight of 25,000 pounds. This maximum is constrained by cage size and does not consider off-site transportation limitations. For the purposes of determining the number of pallets to be transferred down the waste shaft per day and preparing the underground layout for the storage of CH waste, the apportionment of 80% of the waste containers being six-packs of 55-gallon drums, and 20% of the containers being modular steel boxes shall be utilized. Applying this criteria to both the total and annual quantities estimated to be received at the WIPP yields the following:

Container	Envelope Volume (ft^3)	Annual Quantity of Containers	Total Quantity of Containers
Six-Pack	75	9,616	121,700
Modular Steel Box	84	2,404	30,430

d. Retrievability. Underground facilities and equipment shall be designed to provide for a determination to effect retrieval of all CH TRU waste stored for a period of up to five years after the initial emplacement. Retrieval of the CH waste shall include storage of backfill for radiological evaluation, and for handling of the removed backfill material. The rate of retrieval need not match the original rate of waste emplacement; however, the design shall take into account the time required to reach the waste and retrieve it after the decision to do so is made and shall enable said retrieval within a target period of five to ten years.

3. REMOTE-HANDLED WASTE. The WIPP will receive two categories of remote handled waste: RH TRU and experimental waste. This section contains the criteria for systems and equipment which interface with both categories, e.g., hot cell, etc. It also presents requirements applicable to RH TRU waste. Section 4 contains additional requirements for experimental waste.

a. Waste Quantities. For the purposes of the facility design, it shall be assumed that the WIPP will receive a total of 1000 canisters of RH TRU waste at a maximum daily rate of 2 canisters and a maximum annual rate of 250. This represents about 25,000 ft^3. If this estimate turns out to be insufficient, additional waste storage will be accommodated within existing storage rooms during the operational phase of the WIPP.

b. Waste Characteristics. As much as possible the RH TRU waste characteristics are based on actual measured values, but for the most part, values had to be assumed. The characteristics outlined are conservative, i.e., the surface dose rates are high, and the waste is in its most hazardous form.

Nuclide Content. Since there are no data on the actual nuclide content RH TRU waste, a hypothetical nuclide content is assumed, and is given in Table 1-3.

Surface Dose Rate. The surface dose rate of RH TRU canisters will exceed 200 mRem/hr but will not be greater than 100 Rem/hr. The average surface dose rate will be approximately 1.6 Rem/hr.

Heat Generation. Analyses based on the assumed isotopic content (Table 1-3) indicate that the calculated heat generation is on the order of 60 watts/canister.

Waste Form. The same forms given for CH TRU should be assumed.

Table 1-3 Maximum Activity by Isotopic Content of RH TRU

Isotopes	Activity-Level (Ci/liter)
Co-60	1.38-01
Sr-90	1.10+01
Y-90	1.10+01
Ru-106	9.64-02
Rh-106	9.64-02
Cs-137	5.50-02
Ba-137m	5.50-02
Eu-152	2.75-02
Eu-154	1.10-01
Pu-238	9.22-04
Pu-239	1.02-02
Pu-240	2.43-03
Pu-241	6.13-02
Am-241	1.14-04
TOTAL	2.27+01

c. Handling Requirements. Uncertainties as to potential waste canister sizes and handling fixtures have required DOE to incorporate sufficient flexibility in the design to accommodate a reasonable canister envelope. It shall be assumed that RH TRU will be packaged in canisters 26" O.D. by 121" long, weighing 8,000 lbs. maximum. All canisters will be equipped with the Savannah River Plant (SRP) DHLW lifting pintle . In addition, an overpack canister must also be accommodated. The overpack size is 28" O.D. by 133" long with a maximum weight of 10,000 lbs.

Remotely-operated waste handling systems shall be designed utilizing the following guidelines:

(1) Equipment and facilities for handling of waste canisters shall possess sufficient safety features to assure that any operation can proceed to a safe conclusion in the event of a malfunction. Redundancy can be achieved by use of parallel components within the apparatus or by use of backup apparatus.

(2) Radiation "hardened" or radiation "tolerant" components and materials shall be used where necessary to prevent malfunctions due to radiation degradation.

(3) Apparatus shall be designed to facilitate decontamination. This applies to sealed enclosures and proper selection of materials and finishes.

(4) Load bearing components shall be designed utilizing safety factors which are commensurate with accepted regulations, standards and practices for critical hoisting equipment.

(5) Facility cask(s) shall be designed to be compatible with the canisters described above and in section 4.c. Consideration should be given to accommodating as many canisters in one cask design as possible, using inserts, etc.

The following guidelines shall be used in the design of the waste handling cells of the remotely-handled waste facility. (See also subsection 4.c.)

(1) Cells shall be equipped with a sufficient number of strategically located shielded viewing windows, periscopes, and closed circuit television cameras to provide for complete visual access to any point within the cells.

(2) Cell designs shall include features to facilitate decontamination. These features shall include curbs, cleanable or strippable surface finishes, surface protection, and methods to remove contaminated fluids. It is imperative that the designer realize that the goal in all potentially contaminable areas is to keep these areas clean and minimize the amounts of liquid radwaste.

(3) Cell designs must provide for equipment removal for repair or servicing.

(4) Cells shall include pass-throughs (shielded drawer transfer) for transferring small items such as canister surface assessment swipes from the cells into the cell control rooms.

(5) Cell designs shall provide for proper differential pressure control and adequate space for testing and changing of HEPA filters.

(6) HEPA filters shall be located or mounted such that personnel will not be exposed to radiation from accumulated material.

(7) Ductwork shall be installed to preclude buildup of radioactive material. Bends and other changes in ductwork routing shall be minimized.

(8) Cell designs shall provide for interfacing with the railroad shipping cask being developed for the Defense High Level Waste (DHLW) program, with a reference I.D. of 88.6 inches, containing up to 8 canisters (24" O.D. x 10' - 0" long). The cask has an O.D. of 106" and the largest head is 104" O.D. by 7" thick weighing 16,100 lbs. The cask length is 144.25", and the maximum loaded weight is 192,000 lbs. A truck cask containing one canister is also being developed. Its overall length is approximately 13'-6". It is assumed that RH TRU will be shipped in these casks. Allow sufficient head room to accommodate casks up to 17'-6" long, weighing up to 220,000 lbs.

(9) Cell designs shall provide for interfacing with facility casks (RH TRU and experimental waste) which are used for shielding during on site movements to the waste cage and underground.

(10) Cell designs shall provide for future work stations (decontamination, leak testing, etc.) and sufficient overhead working capability to handle the longest canister overpack identified plus 6' clearance.

d. Retrievability. The underground design shall accommodate emplacement of RH waste such that access is available to all emplacement positions throughout the retrievability period. CH waste shall not be emplaced in these specific locations until the end of RH waste retrieval determination period.

Provisions shall be made for emplacing both CH TRU and RH TRU waste in the same storage room. When both RH and CH TRU waste are scheduled for a room, the RH waste shall be emplaced first, then after the five year retrievability period has terminated, CH waste may be emplaced in that room.

4. EXPERIMENTAL WASTE

a. Waste Quantities. The experimental program has not been totally defined; however, preliminary scoping indicates that the equivalent of 40 canisters of high level defense waste should be sufficient. This waste would be handled through the same hot cell as the RH TRU waste and will arrive at the facility over several years; hence, no real impact on throughput capability is expected.

Table 1-4 Radionuclide Content of Reference Defense High-Level Waste for WIPP Experiments*

Isotope	CI/LB	Isotope	CI/LB	Isotope	CI/LB
Cr 51	2.98-20	Sb125	2.79E-01	Tb160	8.76E-10
Co 60	5.73E-02	Sb126	7.08E-07	Tl208	8.52E-07
Ni 59	4.65E-D4	Sb126M	5.06E-06	U 232	2.85E-05
Ni 63	5.77E-02	Te125M	6.90E-02	U 233	8.39E-09
Se 79	4.72E-05	Te127	8.02E-05	U 234	8.96E-05
Rb 87	8.14E-09	Te127M	8.08E-05	U 235	2.98E-07
Sr 89	1.77E-08	Te129	7.66E-16	U 236	6.49E-06
Sr 90	1.01E+01	Te129M	1.19E-15	U 238	1.66E-06
Y 90	1.03E+01	Cs134	1.13E-01	Np236	5.85E-12
Y 91	8.21E-07	Cs135	2.50E-05	Np237	2.97E-06
Zr 93	8.78E-04	Cs137	1.09E+01	Pu236	2.07E-05
Zr 95	8.40E-06	Ba137M	1.03E+01	Pu237	1.51E-15
Nb 94	1.83E-07	Ce141	1.20E-14	Pu238	2.51E-01
Nb 95	7.14E-06	Ce142	8.19E-09	Pu239	2.86E-03
Nb 95M	4.19E--8	Ce144	8.80E+00	Pu240	1.50E-03
Tc 99	8.59E-04	Pr144	8.30E+00	Pu241	2.83E-01
Ru103	8.93E-12	Pr144M	8.98E-02	Pu242	2.07E-06
Ru106	5.23E-01	Nd144	1.61E-13	Am241	8.62E-03
Rh103M	8.82E-12	Pm147	8.08E+00	Am242	4.78E-06
Rh106	5.14E-01	Pm148	2.33E-14	Am242M	4.81E-06
Pd107	8.07E-06	Pm148M	3.37E-13	Am243	1.93E-06
Ag110M	4.38E-03	Sm147	6.57E-10	Cm242	1.17E-05
Cd113	1.27E-17	Sm148	1.90E-15	Cm243	1.86E-06
Cd115M	8.07E-13	Sm149	5.85E-16	Cm244	5.45E-05
Sn121M	9.99E-06	Sm151	8.17E-02	Cm245	2.22E-09
Sn123	8.86E-06	Eu152	1.24E-03	Cm246	1.77E-10
Sn126	5.03E-05	Eu154	2.09E-01	Cm247	2.18E-16
Sb124	2.40E-11	Eu155	1.60E-01	Cm248	2.28E-16

*This waste composition is the equilibrium Savannah River Plant glass products with a maximum thermal power density of 1.26 W/l. The density of the glass is 2.8 g/cm^3 and the reference WIPP HLW canister contains 643 liters of waste.

The DHLW railroad cask currently under development can carry up to 8 canisters at a time. DHLW truck casks would carry one at a time.

b. Waste Characteristics

Nuclide Content. See Table 1-4 for the assumed hypothetical nuclide content of the experimental waste. Although no waste currently exists with all of these isotopes, the plan calls for producing doped waste to provide the heat generation and dose rates specified.

Surface Dose Rate. The hot cell shall be designed for maximum surface dose rates of 4×10^5 Rem/hr for gammas and 45 Rem/hr for neutrons.

The Savannah River Plant (SRP) DHLW canisters have an average dose rate of 5500 Rem/hr and a maximum dose rate of 6550 Rem/hr.

Heat Generation. The specific heat generation rate for DHLW is estimated to be 0.12-1.26 watts per liter of solidified waste. The DHLW canister is assumed to hold 643 liters of waste; therefore, the canister will generate a maximum of 0.8 kilowatts of heat.

Waste Form. Reference waste for experiments is assumed to be DHLW in the form of borosilicate glass. Some canisters will be purposely compromised with defects prior to emplacement. For accident analysis purposes, it can be assumed that a maximum of one percent by weight of the small particulate waste (about one quarter of all experimental waste forms) will be in particles smaller than 10 microns.

c. Handling Requirements. The hazards of handling experimental waste shall not be the major consideration in the design of the facility. Special operational procedures will be adopted as required to reduce the hazards of the experimental wastes to acceptable levels. The experimental handling equipment shall be designed to handle:

- o SRP DHLW canisters 24" O.D. by 118" long weighing up to 5,000 lbs. with SRP pintle.
- o ONWI DHLW canister package up to 33" O.D. by 11'-7" long weighing up to 20,500 lbs. Material either carbon steel or TiCode 12.

Provisions must be taken in the overall design to eliminate contact of Ti Code 12 DHLW canisters with carbon steel components or residuals of carbon steel from previous handling operations. This is necessary because Ti Code 12 will experience hydrogen embrittlement when exposed to even residual amounts of carbon steel. Equipment which comes in contact with the Ti Code 12 canister or overpack should be stainless steel or other non-contaminating material. Equipment that must handle both carbon steel and Ti Code 12 may have replaceable pads or shields to eliminate contact with residual carbon steel from previous operations.

Other requirements, such as shipping casks, are the same as identified for RH TRU waste handling in subsection 3.c.

d. Retrievability. The underground design shall provide for the retrieval of all experimental radioactive waste by the end of the experimental program.

5. QUALITY ASSURANCE. Quality assurance, which includes quality control and inspection, shall be implemented on the WIPP to the extent necessary to obtain an appropriate level of quality and to assure compliance with design and operational requirements.

The WIPP Project Office (WPO) and the major project participants will be responsible for the establishment and implementation of adequate quality assurance programs for their respective scopes of work. These programs will comply with the intent of ANSI/ASME NQA-1-1979.

Specific quality-related technical requirements and quality control requirements will be applied to construction contracts through contract drawings and specifications. Hold and witness points shall be designated in technical specifications where outside inspection or verification is deemed necessary. The Construction Manager will establish contract requirements for construction contractor quality control.

6. DESIGN CLASSIFICATIONS. The design classification system determines the relative functional importance of nuclear safety, industrial safety, and reliability functions of systems, structures, and components. The physical facilities of WIPP, consisting of all systems, structures, and components, shall be classified according to the following general criteria as determined jointly by the A-E, the Technical Support Contractor, and DOE or its designated representative. Classifications shall be approved by the DOE.

Class I: Related to public radiological safety.

Class II: Related to on-site radiological safety or monitoring of off-site releases.

Class IIIA: Related to such matters where unique conditions affect operating personnel safety, plant reliability, continuity of on-site radiological monitoring, unique design/fabrication requirements, or other subjects of specific interest identified by the DOE.

Class IIIB: Those items not included in previous classes.

For purposes of these criteria, the classifications above are termed "Design Class" (DC) irrespective of whether they are applied to physical facilities or detail design activities.

More specific classification criteria are given below.

a. DESIGN Class I: Class I shall be applied to systems, structures, and components whose functions are essential to the prevention or mitigation of the consequences of accidents or severe natural phenomena that could result in a 50-year dose commitment beyond the protected area boundary in excess of 25 Rem to the whole body or 75 Rem to specific organs.

b. DESIGN Class II: Class II shall be applied to those items not included in Class I that:

(1) Provide permanent confinement, monitoring and control of radioactive effluents.

(2) Provide permanent shielding.

(3) Monitor variables to:

(a) Verify the selected WIPP operational limits are not exceeded.

(b) Indicate the status of safety system bypasses that are not automatically removed as a part of safety system operation.

(c) Indicate status of Class I items during all plant conditions.

(d) Verify that off-site radiological dose limits are not exceeded following accidental releases of radioactive material.

c. DESIGN Class III: This classification has been divided into subcategories as follows:

(1) DESIGN CLASS IIIA shall be applied to those items not included in Design Class I or Class II which involve any of the following functional considerations:

(a) Monitoring of on-site radiological dose rates including airborne radioactivities following accidental releases of radioactive materials.

(b) Where failure could cause a major sustained stoppage of waste handling and storage operations.

(c) Design and fabrication complexity or uniqueness.

(d) Potential for contamination if component fails.

(e) Where special considerations beyond those contained in nationally recognized codes and standards are required to insure the health and safety of operating personnel.

(f) Where failure could be of special significance to the health and safety of operating personnel.

(2) DESIGN CLASS IIIB: Class IIIB items shall be applied to those not included in previous classes.

Design, fabrication and construction practices for Design Class III items shall reflect the use of recognized industrial codes and standards and those elements of quality assurance program characteristics of commercial industrial practice (surface and underground).

7. RADIOLOGICAL DESIGN CRITERIA

a. Design Dose and Dose Commitment Criteria

- Radiation workers - 1 Rem per year above background, internal and external exposure, based on projected work activities and time line studies.
- On-site personnel, general - As Low As Reasonably Achievable (ALARA) but not to exceed 170 mRem per year above background.
- DOE Order 5480.1a - Chapter 11 "Requirements for Radiation Protection".

b. Effluent Concentrations - As Low As Reasonably Achievable (ALARA) - Effluent concentrations not to exceed those in DOE Order 5480.1a.

c. The A-E shall address and accommodate where necessary the following items during design in accordance with the above limitations.

- Radiation protection needs - (identified by analyzing design basis accidents and lesser but more credible accidents).

- o In-plant air monitoring and sampling.
- o Effluent air monitoring and sampling.
- o Environmental monitoring and sampling.
- o Personnel dosimetry and dosimeter laboratory.
- o Gamma detection.
- o Time and motion studies to aid in dose prediction.
- o Shielding and interlock warning devices.
- o Air clean-up systems and liquid waste treatment.
- o Contamination detection and confinement.
- o Safety system redundancy and backup, and need for emergency/UPS power.
- o Natural phenomena and systems, components and structures which must withstand them.
- o Laboratory support and equipment.
- o Calibration, maintenance, and repair of equipment.
- o Counting Laboratories.
- o Personnel decontamination.

8. INDUSTRIAL HYGIENE AND SAFETY. The A-E shall address and accommodate where necessary the following items during design.

- o Systems related to lifting: cranes, hoists, etc.
- o Normal lighting and emergency lighting
- o Electrical safety
- o Noise
- o Stairs and ladders
- o Air quality (toxic materials and particulates)
- o Mine Safety
- o Mobile equipment
- o Ground conditions
- o Safety systems engineering

9. FIRST AID AND EMERGENCY TREATMENT. Onsite facilities shall be provided for emergency medical treatment and care. Casualties from severe accidents and injuries shall receive emergency treatment, followed by evacuation to a local hospital in Carlsbad or Hobbs. Emergency facilities shall include a medical table and facilities for washing possible contaminated wounds. A means of collecting and sampling potentially contaminated wash solutions shall be provided.

Space to accommodate emergency first aid supplies and equipment shall be provided at appropriate locations, both above and below ground.

10. GENERAL DESIGN REQUIREMENTS. The facilities described in this document shall be designed in accordance with this design criteria and with the applicable requirements of DOE 6430. Deviations from DOE 6430 requirements shall be documented by the A-E. In the context of DOE 6430, the WIPP is not considered a plutonium facility. Proper codes shall be referenced in applicable design documents.

11. SITE POPULATION. The current estimated site population, which includes DOE, Operating Contractor and SNL personnel, is 285 for a split two-shift operation. In addition, there will be approximately 19 subcontract personnel. The facility shall be designed to accommodate sufficient personnel to efficiently conduct all operations when running at design capacity. Personnel studies shall be used to identify the number and locations of the necessary operating staff. The personnel studies shall be updated as the design progresses.

12. PLANT SECURITY AND ACCESS CONTROL. IMD 6105, "Physical Protection of DOE Property", shall be the basic guideline for the WIPP security system.

All facilities, with the exception of the mined materials pile and off site utilities, shall be surrounded by an 8-foot high chain link fence topped with three strands of barbed wire. The minimum distance between the security fence and site facilities, guard and security building excluded, shall be 50 feet. The area within the security fence is designated the Protected Area. Industrial lighting is provided around and within the Protected Area.

Primary access to the Protected Area shall be through a manned portal. Additional gates may be provided for a railroad entrance and for the road to the salt storage pile. These gates shall be monitored by closed-circuit TV. The only vehicles allowed in the Protected Area are those with official business: waste transporters, facility owned vehicles, delivery trucks, and contractors' vehicles. All employees and selected frequent visitors shall be issued badges and allowed access after presenting their badges. Others shall be required to sign in and establish a need for access. Waste shipments shall be admitted to the Protected Area immediately upon arrival. The tractor or locomotive that moved the waste shipment to the site shall be used to move the shipment into the Protected Area.

There shall be prominent signs at the portal that list prohibited items and a statement that all personnel, packages, and vehicles entering the area may be subjected to search. However, such searches will not be performed routinely.

Radioactive Materials Areas. All areas within the Protected Area that contain or could contain radioactive materials, including the Exhaust Filter Building, shall be designated Radioactive Materials Areas. Walls of buildings can serve as portions of the fence for Radioactive Materials Areas if appropriate measures are taken to assure that the wall presents a physical barrier equivalent to the chain link fence. Access to these areas shall be further controlled so that someone with access to the Protected Areas shall not be able to enter a Radioactive Materials Area without having some additional form of authorization. Depending on the specific requirements of the area, the form of authorization could be a key to a lock on the door, a coded badge that could be read by a manned or an electronic portal, or accompaniment by an escort authorized to admit persons not on the access list.

Space shall be allocated so that persons (or objects) leaving a Radioactive Materials Area can be monitored for radioactive material contamination. Additional space for storage of emergency equipment shall be allocated.

Physical Security of Radioactive Materials Areas. The normal entrances to Radioactive Materials Areas shall be designed to deter unauthorized entry. Also, unauthorized entry through other openings in the buildings, such as windows or vents, shall be prevented by appropriate measures.

Access Control System. A system shall be provided to control access to radiological and underground work areas that will provide an accurate count of personnel and their locations during emergencies.

All normal entrances shall be equipped with door alarms that will be activated during nonworking hours. Emergency exit doors shall include alarms which are automatically activated when opened.

An operations control center shall be located within the Central Monitor Room (CMR). The CMR shall provide a central location for receiving data from all alarm systems as well as other operating data. It shall also serve as the communication link between the WIPP and outside authorities in case of accidents and/or incidents.

Emergency Communications. At least two independent means of offsite communications shall be provided. Telephones can serve as one means, and the other can be a dedicated, reliable radio link.

Cattle Fence. A cattle fence shall be provided external to the perimeter fence. This fence shall consist of 4 strands of barbed wire and shall be located as directed by DOE. It is expected that this fence will enclose an area of up to 160 acres.

APPENDIX

APPLICABLE DOCUMENTS

1. WIPP-DOE-069, Revision 1, "TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant."

2. ANSI/ASME NQA-1-1979, "Quality Assurance Program Requirements for Nuclear Power Plants."

3. DOE 5480.1A - Chapter 11, "Requirements for Radiation Protection."

4. DOE 6430 - General Design Criteria Manual for Department of Energy Facilities, Draft, June 10, 1981.

5. IMD 6105 "Physical Protection of DOE Property", September 29, 1977.

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CHAPTER 2
DESIGN CRITERIA, ARCHITECTURAL-STRUCTURAL-CIVIL
WASTE ISOLATION PILOT PLANT (WIPP)
ALBUQUERQUE, NEW MEXICO

1. INTRODUCTION. This chapter of the Design Criteria presents the Architectural/Structural/Civil requirements for the design of the WIPP Project. The information contained provides design bases for natural phenomena as well as the requirements for such systems as energy conservation, special coatings and finishes, and roof access. Following is a listing of facilities which includes specific architectural/structural/civil design criteria.

2. DESIGN BASES FOR NATURAL PHENOMENA

a. Design Basis Tornado. Tornado-resistant structures shall be designed for tornado loadings not coincident with any accident condition or earthquake. The loadings are calculated based on the following tornado characteristics. The parameters used for the design basis tornado (DBT) are the result of a site-specific wind and tornado study by Dr. T. T. Fujita (A Site Specific Study of Wind and Tornado Probabilities at the WIPP Site in Southeast New Mexico, T. Theodore Fujita, SMRP Research Paper No. 155, February 1978 revised August 2, 1978).

Maximum wind speed, mi/h	183
Translational velocity, mi/h	41
Tangential velocity, mi/hr	124
Radius of maximum wind, ft.	325
Pressure drop, $lb/in.^2$	0.5
Rate of pressure drop, $lb/in.^2/s$	0.09

The above tornado parameters are based on a return period of 1,000,000 years. The maximum wind speed is the vector sum of all velocity components.

b. Design Basis Wind. Design wind loads shall be based on the requirements of the ANSI A58.1-1972 Code, with exposure C terrain classification. Design wind velocities are as follows:

Class I & Class II Facilities:	Design Basis Tornado (DBT) or 1,000-yr mean recurrence level wind = 110 mph, whichever governs the design
Class III Facilities: Support Building & Exhaust Filter Building	100-yr mean recurrence level wind = 99 mph
Warehouse/Shop Building & Water Pump House	50-yr mean recurrence level wind = 91 mph
Other Facilities:	50-yr mean recurrence level wind = 91 mph

c. Design Basis Earthquake. The A-E shall perform a site specific study and recommend the Design Basis Earthquake (DBE) to DOE, and select those facilities, systems or components which must be designed to withstand the DBE.

3. ENERGY CONSERVATION. The following items represent the major architectural energy conservation methods which as a minimum shall be investigated and utilized as permitted by construction.

Insulation shall be required to achieve the following U-values:

	Office Areas	Work Areas	Warehouse
Roofs	0.07	0.08	0.10
Exterior Walls	0.084	0.098	0.126

Light-colored exterior surfaces shall be used to reduce the solar heat gain. Exterior openings shall be adequately weather-stripped. Vestibules shall be provided at major building entrances as appropriate.

4. SPECIAL COATINGS AND FINISHES. Special coatings and finishes shall be provided for the interiors of radioactive waste handling facilities. Durability, maintenance, and cleanability after radioactive material spills and/or fires shall be addressed. Studies shall be conducted to determine the extent of special coatings required in each radioactive area.

Cleaning material used with stainless steel will not be compounded from or treated with chemical compounds containing elements that could contribute to corrosion, intergranular cracking, or stress corrosion cracking.

5. ROOF ACCESS. Roof access where required shall be by OSHA approved ladders or stairs with metal walkways. Walkways and roof-mounted equipment shall be designed so that built-up roofing may be easily repaired and/or replaced.

6. MECHANICAL AND ELECTRICAL EQUIPMENT ROOMS. The space allocated for mechanical and electrical equipment in site facilities shall be generous and accessible. The requirement for ease of maintenance, repair, replacement of HEPA filters including needs for shielding, and equipment replacement dictate that adequate aisles, turn-around areas and special handling apparatus such as jib cranes and monorails be provided. Grade level location is preferred; however, other level locations are acceptable if provisions for easy access to grade are provided. Critical equipment which requires immediate access for maintenance, repair, or replacement shall not be located

in a portion of the building which has limited access or time consuming access such as the necessity of removing a concrete plug to gain entry. HVAC equipment may be located on the roof.

7. WASTE HANDLING BUILDING. Functional and Space Requirements: The Waste Handling Building provides facilities for site personnel involved in the receipt, preparation and transfer of CH and RH waste prior to transfer to the underground storage horizon. It is divided into the CH Waste Area, the RH Waste Area and the Waste Shaft Area.

a. Contact Handling (CH) Waste Area. This area of the building provides facilities for personnel and equipment required to transfer CH waste from incoming shipping containers to the shaft. Wide-open spaces are characteristic of the design; this allows acceptance of a wide variety of packages and shipping configurations.

Unloading/Loading Area. Facilities to unload waste shipping containers (TRUPACT) from incoming transport vehicles and load empty containers on outgoing vehicles shall be outdoors. This area shall contain sufficient space to accommodate three tractor trailers. Hoisting capacity shall be provided in this area to remove the TRUPACT from its transport vehicle. An unloading pad shall be provided outdoors; it shall be level and smooth to accommodate the movement of air pallets used to move TRUPACTS.

WHB Entry. An air pallet shall be used for movement of the TRUPACT into the building. Airlocks shall be provided at points of entry for the air pallets. Interlocking doors shall be located at the ends of each airlock. Emergency personnel egress from the airlock shall be provided.

Inventory and Preparation Area. Provide space for TRUPACT unloading, inspection, inventory control,and temporary storage of CH waste containers. Provide for opening the shipping containers, removing the waste packages and transferring them to a pallet. This area will also provide access to the overpack and minor repair areas. A locked storage area for the temporary storage of up to 80 each 55 gallon drums with a surface dose rate of 100 to 200 mRem/hr shall be provided, designed as a high radiation area in accordance with 10CFR20.203.

Cage Loading Room. Provide access to load waste pallets into the shaft cage and to serve as an airlock between the inventory and preparation area and the waste shaft. The room shall have two doors that are interlocked to minimize air movement from the inventory and preparation area to the shaft.

Overpack and Repair Room. Accommodates a supply of overpack containers and provides work space for repairing and overpacking contaminated CH waste containers. Provide hoisting capability. Airlocks shall separate the overpack and repair room from adjacent areas. Provisions for decontamination of containers and handling equipment shall be provided. A change area shall also be provided.

Site Generated Waste Room. A site generated waste room shall provide space for compacting, packaging and assaying site produced solid radwaste and solidification and packaging of site produced liquid waste. This room shall be separated from adjacent areas with airlocks.

Liquid waste is collected from various waste handling areas and stored in a waste collection tank. A concrete curb and a sump with sump pump shall be provided to contain spillage. A space envelope shall be provided for future liquid radwaste solidification facilities.

Battery Recharge Area. An area for recharging forklift batteries shall be provided within the CH waste handling area. This area shall accommodate forklifts in parallel. Ventilation of the area shall safely dilute hydrogen concentrations produced during recharging. In the event the WIPP is operated more than one waste handling shift per day, batteries will be exchanged for charging.

Decon Room. A small equipment decontamination room shall be provided, including cleaning tanks and ultrasonic cleaning equipment. This room shall be accessible from the overpack room and from the site generated waste room.

b. Remote Handling (RH) Waste Area. The RH waste area shall provide the facilities for personnel and equipment involved in the transfer of RH waste and Experimental waste from incoming waste shipping casks to the mine shaft.

Cask Receiving Area. The cask receiving area shall be used to unload shipping casks from incoming transporters and to load empty shipping casks onto outgoing transporters. Truck transporters and rail transporters are unloaded at the same location.

This area shall be sized to allow offloading the cask with 140 ton overhead crane. The receiving area shall be sized to accommodate the largest rail transporter, without its prime mover, plus six feet of clearance (87 feet minimum.) The overhead clearance for cask movement shall be 35 feet. The floor of the area shall be level and smooth to accommodate the movement of an air pallet used for cask movement. The overhead crane shall be designed to lift casks from the transporter to the air mover.

This area shall provide space for the removal and storage of cask tie-downs and other components which must be removed from the transporter. For design purposes, 1000 square feet for laydown space and four feet of workspace at all points around the transporter shall be allowed. This area also allows access to the facility cask. This is done by moving the cask out of the cask loading room into the cask receiving area. A space for decontaminating the shipping cask and facility cask exterior shall be provided within the cask receiving area.

This area is also used to receive Experimental waste and transfer it to the hoist cage.

Cask Preparation Station. The cask preparation station shall provide space and equipment for shipping cask venting and preparation.

Cask Unloading Room. The cask unloading room shall provide for the unloading of shipping casks through the floor of the hot cell. A shield door capable of providing personnel radiation protection during cask unloading shall be provided at the entrance to the cask unloading room. A minimum of five feet of access space shall be allowed around the cask.

An airlock shall be provided for personnel access to this room when the shield door is closed. Further, when radiation levels reach or are likely to reach 100 mRem/hr or greater, access shall be controlled in a manner comparable to provisions of 10CFR 20.203(C)(2). Access shall be prohibited when casks are being unloaded.

When unloading casks, the ventilation system shall maintain the pressure in this room higher than the hot cell and lower than the cask receiving area. This room shall serve as an airlock between the hot cell and the cask receiving area. Entry to the hot cell shall be controlled in a manner comparable to provisions of 10CFR 20.203 (c)(2) when required.

Hot Cell. The hot cell shall be a shielded room where RH waste canisters and experimental waste canisters are removed from the shipping cask, inspected, and overpacked as required by remotely operated equipment. Shielding adequate to limit personnel exposure to 1 Rem/yr shall be provided.

Shielded viewing windows shall be provided at each work station within the hot cell. Additional shielded viewing windows shall be provided to assure near 100% visual observation of all areas within the hot cell. Window shielding shall be equivalent to hot cell wall shielding.

Airlocks shall be provided for personnel access to the hot cell.

Two hatches shall be located in the floor of the hot cell. One hatch shall connect with the cask unloading room and one with the transfer cell. The hatches shall be sized to allow passage of a cylinder 28 inches in diameter. The minimum required clearance height for canister transfer is 17 feet. The hatch connecting to the cask unloading room shall also allow passage of the shipping cask covers into the hot cell.

The thickness of the floor above the cask unloading room shall be minimized to permit maximum visibility and control during cask unloading operations, but radiation protection considerations shall take precedence.

All penetrations provided in the hot cell walls or floor shall be designed to prevent radiation streaming.

Crane Maintenance Room. A crane maintenance room shall provide space for maintenance of the bridge crane used in the hot cell. This room shall be located to allow the crane to remain on its rails and be isolated from the high radiation environment within the hot cell. A means for personnel access to this room and a method of equipment removal shall be provided.

Transfer Cell. A canister transfer cell shall be located below the hot cell and the cask loading room. Canisters shall be transferred from the hot cell to the facility cask in the cask loading room through this room. This cell shall connect to the hot cell and the cask loading room by shielded hatches. Provide surge storage for 7 RH waste canisters (with overpack) or 7 DHLW canisters. Provisions shall also be made for restricting personnel access when the RH or DHLW canisters are in storage. Access to this room must be controlled in a manner which meets the requirements of 10CFR 20.203(c)(2).

Cask Loading Room. The cask loading room shall provide a space to contain the facility cask during loading of the waste canisters. A hatch with movable shields shall be provided in the floor of this room to allow transfer of RH canisters from the transfer cell below. The movable shields shall mate with the bottom of the facility cask, thus allowing personnel access to this room while the cask is being loaded. Additional shield panels may be provided for ALARA considerations.

Operating Gallery. An operating gallery shall provide space for hot cell operating personnel to monitor and control all operations occurring within the hot cell. The master/slave manipulators shall be operated from this area, and they shall be removed through this area to the manipulator repair room for maintenance and repair. The gallery shall provide enough space to accommodate a fully extended manipulator as it is withdrawn through the manipulator port. The operating gallery shall include an overhead monorail or equivalent capability to move a manipulator to the repair rooms.

Manipulator Repair Room. The manipulator repair room shall provide space to repair the hot cell master/slave manipulators. This room shall be adjacent to the hot cell operating gallery. It shall provide space for temporary shielding or temporary containment devices and for an open face hood.

Filter Gallery. The hot cell filter gallery shall provide space for hot cell ventilation filters. This gallery shall be an enclosed space that is isolated from personnel areas. Personnel access to this gallery shall be provided through an airlock. Filters will normally be changed by contact methods; however, space shall be provided for portable shielding during filter removal if it becomes necessary.

c. Crane and Crane-Related Systems. Overhead cranes which will carry potentially critical loads, and those cranes classified critical (see definition, next paragraph) shall be designed to retain control of and hold the load during the Design Basis Earthquake (DBE). The bridge and trolley (with load) shall be designed to remain in place on their respective runways in the event of a DBE. The bridge and trolley need not be operable after the DBE.

Critical loads are defined as loads which if dropped onto building floors, rail or truck equipment, radioactive waste containers, or other objects, could result in the airborne release of significant amounts of radioactive material within the facility confines. Cranes are classified as critical if they handle critical loads or if in the event that they should drop from their runways they would cause the same effect as loss of a critical load.

All cranes shall be designed and static load tested at 125% of the rated load and dynamic load tested at 100% of rated load. The dynamic tests should include all positions of hoisting, lowering, and trolley and bridge travel.

When a failure has occurred in an overhead crane carrying a critical load and the load is supported and retained in the safe (temporary) position with the handling system immobile, means shall be provided for manually lowering the load, or means shall be provided for safely moving the immobilized handling system with load to a safe laydown area, so that repairs can be made.

d. Waste Shaft Area. See Chapter 5, Item 9.b, Waste Hoist System.

8. SUPPORT BUILDING. The Support Building provides general support services for all facilities and activities on the WIPP Site. It provides for administrative, operations control, technical support and underground personnel support functions.

a. Administration Area. Provide space for DOE personnel, contractor personnel, visitors and service personnel, as follows:

Lobby. Space for a receptionist and seating for visitors.

Administration and Technical Offices. Space for administration functions to support plant operations, space for DOE and operating personnel, storage vault, files, and conference room. Movable office partitions based on a modular layout shall be used in this area.

Presentation and Conference Room. Space to seat 50 persons using movable seating. It is used for audiovisual programs that introduce and explain the WIPP and related subjects, for instructional and educational purposes, for conferences, briefings and meetings. It includes a 16-mm projector, audio system and control desk.

Reproduction/Mail/Storage Rooms. Space for facility reproduction equipment and for handling incoming/outgoing correspondence as well as storage space for supplies and extra tables and chairs for the presentation room.

Master Records Center (MRC). Space for microfilming, storing, and retrieving official records.

Toilets. Men's and women's toilets with fixtures for the physically handicapped near the receptionist/presentation area and the lunch room/reproduction areas. Janitors' closets are provided at each set of toilets.

Lunch Room. Provide seating space for 50 persons and space for vending machines.

Dispensary. Space for a dispensary with treatment and examination rooms and access for a paramedic van. The dispensary area shall include provisions for treating contaminated and injured personnel. A toilet shall be provided near the examination room.

b. Operations Control Area. This area is the central monitoring point for all activities in the facility.

Central Monitor Room (CMR). Houses the process, radiation, fire, security and environmental computer input/output devices including display board, alarms and operator's console.

Computer Room. The computer room contains the central computer including associated consoles and peripherals and the process, radiation, fire, security and environmental computer. Raised floors for cooling plenums and cable routing shall be provided.

c. Technical Support Area. This area provides space for the following general support services for the Waste Handling Building:

Radiological Control/Lockers and Showers. Space for radiological control of construction and waste handling personnel, men's and women's showers, lockers, dressing areas, toilets, and an anticontamination (anti-C) clothing storage/issue area.

Analytical Laboratory. A high level counting room for anlaysis of operational level samples, a low level counting room for environmental level samples, and a sample preparation room. All rooms shall be shielded; radiation levels in the low level counting room must be reduced to below 100 mRem per year.

Dosimetry Laboratory. Space for the thermoluminescent device (TLD) readers, secured record storage area and an office for the Health Physicist responsible for dosimetry. The area shall be shielded as needed to achieve ambient background radiation levels or lower and should therefore be located away from the waste handling areas and the radiological instrument calibration area.

Radiological Instrument Calibration Room. Calibration of portable radiation survey instruments (for high and low sensitivity instruments). Shielding shall be provided as needed to reduce radiation of 10 Rads per hour of Cs 137 gamma to 170 mRem per year external to the room.

Instrument Maintenance Room. Maintenance and repair of portable survey instruments, continuous air monitors, and other radiological and non-radiological instruments.

d. Underground Personnel Area. This area provides facilities for site personnel involved in developing the mine area and in handling waste material in the underground facilities. The major areas are described as follows:

Offices. The office area is large enough to accommodate the Mine Superintendent, the Waste Storage Superintendent, a secretary, additional supervisory staff, mining engineers and radiation protection, safety, and security personnel. A safety training room shall be provided with seating for 25 personnel. A janitor's closet shall be located next to this area to provide for frequent cleanup of the miners' waiting area.

Change Rooms. Men's Change Room: Space for miners and waste handlers. Space as required for overhead baskets. A gang shower with a capacity for 14 persons, toilet facilities. A protective clothing issue room located near the entrance to the change rooms.

Women's Change Room: Space for workers, supervisors, visitors, and baskets as required. Personal showers and drying rooms, toilet facilities.

Supervisors' and Visitors' Change Room: Space for 28 lockers, showers, and toilets.

Mine Support Area. A mine rescue equipment room shall be provided to meet the requirements of 30 CFR 49. Lamp storage racks and shelving for lamp-battery-recharging stations shall be provided along the wall in the miners' waiting area. The adjacent lamp-repair room provides space for one repairman and a built-in work counter.

Personnel moving into or out of the mine pass through the waiting area. Provide bench seating for personnel and adjacent offices for shift foremen to impart special instructions to mining crews prior to starting downhole. Locate a "brass board", with pegs to keep track of mine personnel, on a wall.

Provide space for a filter respirator testing booth and associated testing equipment.

9. EXHAUST FILTER BUILDING. This facility contains the ventilation equipment required to exhaust and filter air from the waste storage horizon or construction side of the mine via the exhaust shaft. Routine HEPA filter maintenance shall be contact handled, but the

layout and access shall not preclude the setup of temporary localized shielding to permit quasi-remote-handled maintenance. Plenums shall be sized adequately for maintenance, HEPA replacement, and DOP testing.

10. WAREHOUSE/SHOPS BUILDING. The Warehouse/Shops building houses personnel and equipment required to maintain the site and all its surface facilities. Tasks performed here are the loading, unloading, and subsequent storage of material and equipment from trucks and the assembly, repair, or preventive maintenance of miscellaneous items and equipment. The Warehouse/Shops is divided into three areas described as follows:

Office. Provide space for maintenance personnel in supervisory or administrative positions. Provide a toilet near the office.

General Shop Area. The general shop area shall accommodate the following functions: painting, carpentry, sheet metal, air conditioning, plumbing, electrical, millwright and machining. Provide personnel and equipment doors to exterior.

Warehouse and Dock. Provide space for receipt, storage, and distribution of materials required for WIPP operation.

11. VEHICLE FILLING STATION. An outdoor fuel dispensing station shall be provided. It shall consist of a pump station having two pumps on a central raised island. Water for vehicles and compressed air shall be provided at the island. Two buried fuel storage tanks, one for diesel fuel and the other for unleaded gasoline, shall be located near the island.

12. GUARD AND SECURITY BUILDING. The guard and security building is located at the main entrance to the controlled area. It provides the initial control point for all site visitors and contains both public and site telephones.

The guard area provides space for a guard and the communication equipment required to register visitors and control their access into controlled areas.

An office area provides space for one guard and communication/closed-circuit TV equipment connected to the other site facilities. This building also includes a lobby, display area, administration office, visitor waiting area, auditorium, food preparation area, and lunch room. Locker and toilet facilities are provided. Parking for security vehicles is provided adjacent to the building, under a canopy.

13. WATER PUMPHOUSE. The Water Pumphouse shall contain the domestic water and fire protection pumps. Water chlorination equipment and storage space for chemicals shall also be provided. The domestic distribution system shall be separate from the fire protection distribution system.

14. WATER STORAGE. Two 50% capacity water storage tanks will be required at the site. These storage structures shall be located adjacent to the pumphouse.

Refer to Chapter 3 of this Design Criteria for a description of the water system.

15. STORM DRAINAGE SYSTEM. The site shall be protected from storm runoff by two means. First, a berm system shall be provided to

divert runoff from local probable maximum precipitation (PMP) around the site perimeter.

The second means of runoff control shall be an on-site collection system. The system shall collect runoff from paved areas and the buildings and direct it to the low side of the site for release to a drainage channel.

Shaft collars and Class I, II, and IIIA facilities shall be located above ponding caused by onsite PMP. Base PMP design on Hydrometeorological Report No. 51, NOAA, 1978.

16. RAILROAD SYSTEM. Railroad service to the WIPP Site will originate from a spur at the Duval Corporation mine. A proposed alignment shall be designed consisting of approximately six miles of new standard-gage railroad tracks using 112-lb rails. The on-site railroad system shall be standard gage with 112-lb rails, and all frogs No. 8 or greater. The railroad layout shall provide for transfer from commercial locomotives to WIPP railcar movers on a siding inside the facility fence and sufficient on-site railcar parking space for 30 each 70-ft railcars.

17. ROADS, SIDEWALKS AND PARKING. Main access to the site is from U.S. 62-180. Total length of the main access road is approximately 12 miles. A secondary access road from U.S. 62-180 for site personnel is provided from a convenient tie-in point to the east of the site. A south access road is provided from N.M. State Highway 128. On-site roads shall be provided as needed to serve the surface facilities.

On-site parking shall be provided for employee vehicles, site maintenance and staff vehicles as well as for waste transportation vehicles. The parking area for waste transportation vehicles shall provide special concrete pads to support the trailer stands when uncoupled from the tractors.

Site parking capacities shall be based on approximately 75 cars and 6 buses plus 12 visitors and a waste transport trailer park for 26 trailers.

Additional parking for government vehicles shall be provided as needed at each surface facility. A locked, fenced, parking area for a truck trailer containing waste containers with a surface dose rate of 100 to 200 mRem/hr shall be provided and designated as a high radiation area per 10CFR20.203.

Walkways shall be gravel and vary in width as required to meet pedestrian traffic requirements.

18. PERIMETER SECURITY FENCE. The perimeter security fence and the cattle fence shall be installed as specified in Chapter 1, item 12.

Emergency (one-way) exits in the perimeter fence shall be provided as required for evacuation. These emergency exits shall be alarmed and automatically activated when opened.

19. SEWAGE TREATMENT. A sewage treatment system shall be provided for the site. See Chapter 3 for additional design criteria.

20. TRUPACT MAINTENANCE FACILITY. This facility shall be for the annual/semiannual maintenance of TRUPACT. The maintenance involves the decontamination of the entire TRUPACT including the roller platform; maintenance and repair of the outer door drive mechanism and seal, the inner door bolts, inserts, seals and filter, the

roller platform rollers and hydraulic components; and the leak test of the door seal system. This facility shall encompass the following:

a. Decontamination station: an area that provides facilities for decontaminating the TRUPACT using minimal water, a decontamination tank for the roller platforms, lay down space for the roller platforms, and hoisting capability.

b. Maintenance and Repair station: this area shall have parts, supplies, and facilities to maintain and repair the TRUPACT door drive mechanism, bolts, and inserts. It shall also have the leak test fittings, tubing, replacement seals and filters, and a leak test facility for testing the door seal system. Welding capability shall be available.

c. Other facilities to be provided include a personnel change room, solid and liquid radwaste collection system, a paint shop for touch-up painting, an airlock to enter decontamination areas, air pallets, straddle carrier, and an HVAC system that has HEPA filtration for the decontamination areas.

This facility shall be located within the radioactive materials area of the site, adjacent to the loading/unloading area for rail and road transporters. An unloading pad shall be provided outdoors; it shall be level and smooth to accommodate the movement of air pallets used to move TRUPACT.

APPENDIX

APPLICABLE DOCUMENTS

1. T. Theodore Fujita, A Site Specific Study of Wind and Tornado Probabilities at the WIPP Site in Southeast New Mexico. Department of Geophysical Sciences, the University of Chicago, SMRP Research Paper No. 155 (February 1978) and its supplement dated on August 2, 1978.

2. American National Standard Building Code Requirements for Minimum Design Loads in Buildings and other Structures, American National Standard Institute, New York, ANSI A 58.1-1972.

3. 10 CFR 20, Standard For Protection Against Radiation

4. Federal Occupational Safety and Health Act (Public Law 91-956) (OSHA)

5. Hydrometeorological Report No. 51, NOAA, 1978

6. DOE 5480.1A - Chapter 11, "Requirements for Radiation Protection."

7. 30 CFR 49, Mine Rescue Team

8. "System Description: Contact-Handled Transuranic Waste Transportation System, (Preliminary Design)", GA-A16936, TTC-0293 GA Technologic, April 1983.

9. DOE/EV/1830-T5 - A Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable.

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CHAPTER 3
DESIGN CRITERIA, MECHANICAL
WASTE ISOLATION PILOT PLANT (WIPP)
ALBUQUERQUE, NEW MEXICO

1. GENERAL

a. Domestic Water Systems. Surface buildings shall be provided with cold water from the domestic water distribution system and with hot water from electric water heaters.

b. Soil, Waste and Vent Systems. A standard soil, waste and vent system shall serve toilet rooms, janitor's closets and other normal services.

c. Air Filters. During the early years of the WIPP operation, the construction-disturbed sandy soil and mine salt muck piles will create a very dusty atmosphere; therefore, the roughing and intermediate fresh air filters shall have high capacity suitable for severe dust conditions.

The use of HEPA filters on a fresh air intake is anticipated in only the Central Monitoring Room and on the compressed air systems in the Waste Handling Building and the Exhaust Filter Building. Appropriate pre-filters shall be mounted in front of the HEPA filters.

Under normal operations, those HEPA filters serving the Central Monitoring Room will be bypassed. The HEPA filtered operational mode shall provide habitability of this area under the design basis accident or natural phenomenon.

d. HVAC Controls. All HVAC controls at the WIPP shall be fail safe. See Chapter 6, Item 3.a.

Pneumatically powered mechanical operators shall be considered, however, particular attention must be given to pneumatic lines that penetrate radioactive waste confinement barriers and the fire protection of those pneumatic lines.

The sensing and control logic shall be compatible with and connected to the Central Monitoring System (CMS).

2. WASTE HANDLING BUILDING

a. General. The Waste Handling Building consists of two major functional areas: RH Waste Handling and CH Waste Handling, including site generated radwaste. The building also houses the waste shaft collar station, headframe and hoist, which interface with the RH and CH waste handling systems.

b. Systems. The mechanical systems serving the building may be combined into central systems as long as each major area can operate independently with respect to the status of the other areas and the safety of each respective system is not compromised.

c. HVAC Basic Concept. The entire waste handling facility must be maintained at a negative pressure with respect to the ambient atmosphere, except for outside-door airlocks which may be neutral to positive. The intent is that all radioactively contaminated particles shall be safely contained within a cleanable controlled environment. The static pressure within each separate functional area must be continuously monitored and automatically maintained to assure controlled air flow from the area of least hazard to that which is greater. Airlocks must be provided between areas of large pressure differences to provide a tolerable pressure

transition and to eliminate high velocity dust entraining eddy currents while transferring personnel or material between these areas. A means for equalizing the airlock pressure with the adjacent area before opening either door shall be provided.

Exhaust air from waste handling building radioactive materials areas shall be collected in a system of ducts under a negative pressure and released to the atmosphere through at least two stages of certified High Efficiency Particulate Air (HEPA) filters. Moderate efficiency roughing filters shall be installed upstream of HEPA filters to extend the life of the HEPA filters. The filters shall be either self contained or housed in plenums, designed and tested to appropriate leak rate specifications. Filters housed in plenums shall be held in place by multi-tie-down devices, and adequate between stage spacing for DOP testing shall be provided. ERDA 76-21, "Nuclear Air Cleaning Handbook", shall be the primary reference source for design of nuclear exhaust air handling systems. DOE/EV/1830-T5, "A Guide to Reducing Radiation Exposure to As Low As Reasonably Achievable," (Section 5.1, Pressure Differential, Page 5.17) shall be a secondary design reference. Total system redundancy is not required; systems with 2-50% fan and filter units are acceptable. Provisions for representative exhaust air sampling and monitoring shall be provided, as per ANSI N13.1. Design shall include proper selection and installation of tornado dampers to prevent blowout during the low pressure phase of a tornado.

Special attention must be given to prevent cross contamination between the exhaust air and the fresh supply air. Intake air must be reliably safe and clean.

d. HVAC System for Battery Charging Areas. To remove hydrogen gas generated by the forklift battery charging operation, air shall be exhausted through exhaust ducts and shall be discharged through HEPA filters to the stack. Exhaust system shall have roughing filters, two stages of HEPA filters, and exhaust fans with spark resistant wheels.

e. Compressed Air Systems. A combined house and control air duplex type non-lubricated compressor shall be provided. House air shall be used as a motive source of pneumatic tools, paint spraying, and lab use, but not for breathing. Control air shall be dedicated to pneumatic control only.

All pneumatic control lines shall be noncombustible to permit control operation under fire conditions.

Breathing air capability shall be provided for some long period tasks, lasting up to 4 hours. This system shall be separate from both the house air and HVAC control air. Provide breathing air in the mine rescue station. A separate breathing air apparatus shall be provided at the CH and RH areas.

f. Liquid Radioactive Waste. Liquids which are contaminated or potentially contaminated shall be collected and brought to central tankage for storage, treatment or solidification. Appropriate space shall be allocated for these activities.

The entire system must be designed to permit easy access and contain isolable segments to facilitate routine inspections, maintenance, and replacement.

g. Solid Radioactive Waste. A solid radioactive waste compacter and packager shall be included in this building and located within a room served by the central HVAC system consistent with the basic ventilation concept noted in item b. above. The compactor unit itself shall be serviced by local ventilation and a HEPA filter. An assay gauge shall be provided to assay site generated radwaste.

h. Decontamination Oriented Systems. All mechanical systems must be designed on the premise that they may become radioactively contaminated and therefore must have provisions for ease of decontamination.

3. SUPPORT BUILDING

a. HVAC Systems. The interior and exterior zones shall be served by a variable volume (VAV) system. Zoning shall be by means of compensating electronic/pneumatic controls.

Radioactive materials area systems shall be designed according to Section 2.c.

b. Computer and Central Monitoring Rooms. Temperature and humidity design conditions shall be as recommended by the equipment manufacturers.

The fresh air supply to the Central Monitoring Room (CMR) shall have a HEPA filter option to permit continuous occupancy in the event of a serious atmospheric radioactive material release.

Water removal facilities shall be provided under the raised floors with adequate capacity to handle anticipated sprinkler discharge. Drains shall be arranged to prevent backflow of water and escape of Halon.

c. Compressed Air. The CMR equipment room control air compressor(s) shall be sized not only for the pneumatic controls but also for the Health Physics lab. The inlet air for the compressor(s) and the cross connection from the main system must be HEPA filtered. A separate air compressor(s) shall be provided for the administrative areas, locker rooms, etc.

d. Decontamination Shower. Locate a centralized personnel decontamination shower in this building. Proper disposal of potentially contaminated water from this shower shall be considered.

4. WAREHOUSE AND SHOPS BUILDING. The storage area of the warehouse shall not be cooled. Electric unit heaters shall be provided to protect critical supplies. The shop area and office shall be heated and cooled for personnel comfort.

In the shop area, a welding-fume exhaust system and adequate filtered and preheated make-up air shall be provided, and compressed air shall be piped to work stations.

5. EXHAUST FILTER BUILDING

a. HVAC Basic Concept. The entire Exhaust Filter Building shall be maintained at a slight negative pressure with respect to the ambient atmosphere, except for the personnel entrance/exit airlocks, support equipment room and filter exhaust valve gallery which may be ambient to positive. The design intent is that all radioactively contaminated particles which could be released from the underground ventilation system shall be safely contained within a cleanable controlled environment. The static pressure within each separate functional area must be continuously monitored and automatically maintained to assure air flow from the area of least hazard to that which is greater. Airlocks must be provided between areas of large pressure differences to provide a tolerable pressure transition and eliminate high velocity dust entraining eddy currents while transferring personnel or material between these areas.

The Exhaust Filter Building houses the HEPA filtered exhaust system which is part of the underground ventilation system. HEPA filters shall be required for the exhaust system for reasons related to "As Low as Reasonably Achievable" (ALARA) and to prevent contamination buildup on site or in the immediate environment. Exhaust air will be normally unfiltered, bypassing the HEPA filters. In the event of airborne radioactivity detection underground or in the effluent air stream, exhaust air shall be diverted through the HEPA filters. Specifications for the airborne radioactivity monitoring system shall be subject to a continuing feasibility review pending actual in situ demonstration that the system is adequate. Means of activating the flow diversion system from the CMR shall be provided. Provisions for adequate stack effluent monitoring and sampling shall be provided according to applicable criteria in ANSI N13.1. The stack monitors shall automatically initiate the diversion system when effluent concentrations exceed specified limits. The exhaust system shall fail in the filtered mode.

Special attention shall be given to prevent cross-contamination between the exhaust air and the fresh supply air to the building. Intake air must be reliably safe and clean.

b. Decontamination Oriented Design. All mechanical systems, especially those related to the underground ventilation system, shall be designed on the premise that they may become radioactively contaminated and shall have provisions for decontamination. For example: exhaust ducts shall have access doors or panels, radiused corners, smooth nonporous interiors; piping systems shall have union type joints for easy disassembly and removal of components, be noncorrosive, etc.

c. Compressed Air Systems. A duplex compressed air source shall be designed for this facility.

The system shall be used as the motive source for pneumatic tools, etc., and for the HVAC control air system, but not for personnel breathing. A personnel air breathing system shall be provided separately.

All pneumatic control lines shall be noncombustible to permit control operation under fire conditions.

d. Exhaust Fans. The type of fans selected for the exhaust system shall be such that the HEPA filters will not be subjected to an unstable fan characteristic or inadvertent operation adjustment which could cause a filter blowout or a fan flow starvation.

6. WATER PUMPHOUSE. The water pumps, both domestic and fire, shall be located in a single above-grade pumphouse adjacent to two above-grade water storage tanks. All yard piping shall be buried, whereas the piping within the pumphouse shall be arranged such that easy access for repair, maintenance or replacement of the pumps, chlorinator and ancillary water system equipment is possible.

Provide adequate ventilation and drainage to minimize corrosion.

7. WATER SYSTEMS

a. Water Supply. Water will be furnished to the WIPP site from the Double Eagle Water System owned by the City of Carlsbad and located in the Cap Rock area approximately 40 miles due north of ERDA No. 9. This distribution system extends 33 miles west (approximately 7 miles from Artesia) and 19 miles south of the well fields. Transmission lines are bare steel, cement-asbestos, or PVC. Most of the mains are steel pipe and are not looped.

The tie-in point is approximately 31 miles north of the WIPP Site and connects with an existing 10 inch main. Flow to the tie-in point is by gravity from existing 126,000 gallon storage reservoir located approximately 7 miles from tie-in, with alternative source from existing 210,000 gallon reservoir located approximately 9 miles from tie-in.

For approximately 16 miles from the tie-in point, the water supply line shall be over-sized to 24 inch diameter. This portion of the water supply line shall be designed for 6375 gpm, of which 6000 gpm is allocated to the City of Carlsbad for future tie-in. For the remaining distance of approximately 15 miles to the WIPP site, the water supply line shall be sized for 375 gpm.

The flow in the water supply line will be by gravity and pressure reducing stations shall be provided to maintain an acceptable pressure in the line. Each pressure reducing valve shall have manual bypass and isolation valves for servicing, repair and replacement. Each valve pit shall be inconspicuous to the casual passerby and have at least one tamper-proof barrier.

The water supply line shall terminate at two storage tanks on site. Flow to the site shall be metered.

b. On-Site Water Systems. The total fresh water demand is based upon:

(1) Domestic consumption: 50 gallons per capita daily, 75,000 gallons average daily demand, and peak flow as determined by the A-E.

(2) Fire Flows: 1500 gpm for 2 hours with a residual pressure of 55 psi plus normal domestic demand, and a 8 hour fire reserve recovery of 180,000 gallons.

The total water storage requirement is 330,000 gallons. Two 165,000 gallon water tanks shall be provided along with a looped distribution system. Water from the Double Eagle System is not potable. It shall be chlorinated at the pump house before storage and distribution. Chlorination is the only treatment required.

Domestic Water System. A duplex constant pressure (60 psi) pumping system with a capacity as determined by the A-E shall be provided at the storage tank. The system shall be separate from the fire protection system.

Fire Protection System. The surface fire protection system shall consist of water storage/pumping station and a looped system of underground water mains. See Chapter 6 for specific criteria.

c. Systems, On-Site and Off-Site. Provisions for pressure testing and flushing the mains, both domestic and fire protection, shall be provided. Provision for disinfecting shall be provided only for the domestic water mains.

8. SEWAGE TREATMENT AND SANITARY SEWER. The sewage treatment facility shall be capable of handling 50 gallons per day per person of raw sewage. The raw sewage is expected to be of medium strength with a five-day biochemical oxygen demand (BOD_5) of 220 mg/l.

The facility shall consist of two parallel stabilization lagoons. Recycling treated effluent for landscaping irrigation, dust control, or fixing salt muck may be employed if practical.

Laboratory analysis of effluent shall be in accordance with New Mexico regulations. Analyses may be performed by an independent test laboratory as required.

The site sanitary sewer system shall meet State and EPA regulations where appropriate. Sewage collection shall be by gravity flow throughout the site, terminating at the treatment plant.

9. TESTING, CALIBRATION, AND BALANCING. The following list of mechanical systems or equipment will require a Test, Calibration, and Balance Specification to appropriate standards.

- HVAC - air distribution
- Filtered exhaust systems-(specifications and testing to include materials, proper pressure test or leak test, in-place DOP test.)
- Fire protection
- Emergency power diesel generator
    - starting air
    - fuel
    - cooling
- Water system - domestic
    - fire protection

APPENDIX

APPLICABLE DOCUMENTS

1. ERDA 76-21 - Nuclear Air Cleaning Handbook
2. DOE/EV/1830-T5 - A Guide to Reducing Radiation Exposure to As Low As Reasonably Achieveable.
3. ANSI N13.1 - Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.

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CHAPTER 4
DESIGN CRITERIA, ELECTRICAL
WASTE ISOLATION PILOT PLANT (WIPP)
ALBUQUERQUE, NEW MEXICO

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1. INTRODUCTION. The WIPP shall require complete site, building, and underground electrical services. The electrical work shall include primary service, substations, standby generator, telephone, security, fire alarm, closed circuit T.V., intercom, monitoring, control, computer, instrumentation, cathodic protection, lighting, grounding, receptacles, power, and lightning protection.

Electrical power to the proposed site will be provided by the Southwestern Public Service Company (SPS) through a single circuit open wire transmission line.

Ease of maintenance shall be of primary concern for all systems. Of special concern shall be the ease of lamp replacements and the ability of material at selected locations to withstand decontamination washdown operations.

Use of polyvinyl chloride (PVC), asbestos, and polyethylene (PE) cable insulation and jacketing materials shall be avoided for personnel safety considerations. Cables shall be specified having ethylene propylene rubber (EPR) insulation and hypalon (chlorosulfonated polyethylene), neoprene, or chlorinated polyethylene (CPE) jacketing.

2. POWER SYSTEMS

a. Exterior Power Systems Design. Electrical power is provided by SPS from a switching station by a single circuit open wire transmission line approximately 14 miles long. The switching station is fed from two separate sources, SPS Potash Junction and SPS Cunningham plant station. The transmission line terminates at the WIPP switchyard.

A main transformer shall be provided with sufficient capacity to handle the full plant load. Automatic load ratio control and provision for adding fan cooling to increase the capacity shall be provided. The site standby generator shall be 480V and shall feed the electrical system via the 480V switchgear in the area substation located near the Exhaust Filter Building.

Primary service to the mine underground area shall be provided by two 13.8 kv feeders in two separate shafts or individual drill holes for system redundancy and reliability.

Cables in nonmetallic ducts encased in concrete shall be used where required, including: below building slabs, structural foundation pads, and in the vicinity of the utility switchyard. Direct burial cables in sandfilled trenches shall be used for the power distribution system in open areas, along roadways and the site perimeter. PVC ducts in sandfilled trenches shall be used for instrumentation and communication distribution systems. At least 25% spare conduits shall be provided in inaccessible areas.

Certain loads, including selected safety instruments and those loads considered necessary to evacuate personnel (such as the hoist) and to allow for a safe shut down, are considered essential. They shall be fed from the utility system under normal conditions and from the site emergency generator when utility power is not available.

An uninterruptible power supply (UPS) shall furnish power to loads that must not be deenergized for the time required to energize the standby power system or cannot tolerate power "bumps" or other perturbations.

A grid-type grounding system shall be installed. Each grid shall consist of a loop of stranded, annealed copper wire at least 4/0 AWG in size and completely encircling a building or area, together with a number of cross connections. Copperclad steel ground rods, at least 10 ft. long, shall be driven into the ground at each corner of the loop and at intermediate points, if necessary, to obtain a resistance from each grid to earth of not more than 5 ohms as measured by the "fall of potential" method.

- o The grounding system in the plant shall consist of the following ground grids:

  1) Utility
  2) System or safety (13.8 kv system ground)
  3) Plant
  4) Facility.

- o The utility grounding grid shall be physically isolated and insulated from the rest of grounding grids.

- o The facility ground grid and the safety ground grid shall be connected to the plant ground grid with a minimum of two connections.

The following items shall be connected to the plant ground grid, either directly or through the facility ground grid:

- o Alternate outside columns of steel-framed buildings and not fewer than one-third of all the inside columns of the buildings.

- All metal noncurrent-carrying parts of motors and major electrical equipment.

- All metal pipes, metal tanks, lightning rods, etc.

- Instrumentation, communication, radio and computer signaling systems of each facility through a removable link at one point only.

- The secondary neutrals of all power transformers.

- Ground buses of switchgear, switch racks, motor control centers, distribution boards and instrumentation frames.

The ground grid in the mine shall be common with the surface grid via the grounding conductor in the shaft. This ground shall be hung on messenger cables and shall be distributed throughout the mine, terminating at the ground grid of the underground 13.8 kv switchgear.

b. Building Power Systems. Provide secondary distribution centers for building loads. Provide panelboards for lighting, power, and convenience receptacles.

120/208v, 1-phase and 3-phase receptacles sized to the work being accomplished shall be provided in all facilities, except that 208v need not be provided in office areas. 480v, 60A, 3-phase receptacles shall be provided in the Waste Handling Building in welding areas and elsewhere as required. 120v duplex receptacles shall be provided in all office areas, lobbies, restrooms, and in welding areas and elsewhere as required. 120v duplex receptacles shall be provided in all office areas, lobbies, restrooms and in areas where where portable equipment may be used. In office areas or large open areas in which moveable partitions may be used, underfloor raceways will be installed only if they can be shown to be capital cost effective.

Convenience receptacles shall be designed for a load of approximately 3 amps each for general office areas and approximately 8 amps each for laboratory and shop areas. Provide clock outlets in selected locations.

c. Uninterruptible Power Systems. Provide uninterruptible battery/inverter (UPS) power for distribution of instrument power. The UPS shall service the following loads:

Central Monitoring System
Security Monitoring Equipment
PA and Intercom System
LPU's in WHB/SB
Radiological Monitoring System

A centralized UPS may be used if cost effective.

d. Underground Power Systems. Provide dual 13.8 kv power feeders for primary service to feed load centers, etc.

All the electrical equipment in the mine shall be designed and installed to operate efficiently in the dusty and possibly corrosive atmosphere of the mine.

e. Standby Generator. Provide generator unit, controls, fuel tank, feeders, trenches, and switchgear for a standby power system. This system shall make power available for all essential loads, including the waste hoist or the underground ventilation system, as and when required. These loads will be switched on as and when required.

f. Electric Metering. Energy (KWH) and power demand (KW) metering shall be installed at the main transformer substation.

3. LIGHTNING PROTECTION SYSTEMS DESIGN. Lightning protection shall be provided by the use of a dissipation arrays system. The dissipation arrays to be installed on the C&SH shaft head frame and the Waste Handling Building shall not extend more than 23 feet above these structures, and the diameter of the arrays shall not be larger than 15 feet.

4. LIGHTING SYSTEMS DESIGN

a. Security Lighting Systems Design. Exterior lighting will be provided for roadway and perimeter areas by high pressure sodium vapor fixtures mounted on poles. Obstruction lighting will be provided for the surface structures in accordance with Federal Aviation Administration regulations.

A street, parking, and perimeter security lighting system shall be provided for the WIPP facility. The lighting system shall be designed, and raceways, cable and equipment provided, for a minimum illumination level of 0.8 footcandles. Selected perimeter security lighting shall be provided with backup power.

Provide lighting for the truck and rail security inspection areas at an illumination level of 10 footcandles.

b. Interior Lighting Systems Design. Non-uniform lighting principles shall be followed, commensurate with amendment D-48 to the Federal Property Management Regulations (FPMR), Subchapter D, Part 101-20.116-2. The 50-30-10-footcandle area illumination criteria (for work stations, work areas, and nonwork areas) shall be adhered to wherever practicable. Where higher levels of illumination are determined to be necessary for specialized tasks (task lighting), or for personnel safety or interior facility security reasons, they may be provided. In these cases, however, the illumination levels should not exceed the applicable recommended levels of the Illuminating Engineering Society (IES), as contained in the latest edition of the IES Lighting Handbook, and also as contained in ANSI A11.1, Practice for Industrial Lighting. Where higher illumination levels are required, consideration shall be given to providing local or task-supplemental lighting to minimize general overhead lighting requirements.

For general requirements, fixtures shall be of standard, high-efficiency, commercial grade. Emphasis shall be placed on energy-efficient fixtures, selected on the basis of minimum life-cycle costs and satisfaction of visual task requirements.

For lighting fixtures with ballasts, the ballasts shall be UL listed, thermally protected, and shall conform to CBM-ETL (Certified Ballast Manufacturers Electrical Testing Laboratory) requirements.

Light switches shall be provided at doorways to each area and room where appropriate. Light fixtures shall be conveniently grouped and switched to provide selected task lighting throughout the individual areas with flexibility for future selection of appropriate fixtures on a switch.

Exit and emergency lighting systems shall be provided in accordance with NFPA Code No. 101, "Safety to Life from Fire in Buildings and Structures." Special attention shall be given to emergency lighting requirements in windowless buildings. Exit signs shall be the self energizing type.

Where suspended ceilings are provided, all lighting conduits or interlocked armor cable shall run above the ceiling with a junction box for each fixture.

c. Underground Lighting Systems Design. Underground shaft stations, shop, office, warehouse, radcon and experimental areas shall have fixed lighting at a level of intensity consistent with the function being performed. Lighting within experimental rooms of the experimental area shall be selected on the basis of intermittent use.

The main entries, excluding the storage exhaust entry, shall have a lighting fixture at each intersection with a cross cut. The intake submain entry to the active storage panel and the intake and exhaust submain entries of the construction panel shall have portable lighting fixtures at an interval of not more than 300 feet. Lighting fixtures shall be provided at the intersections of the submain entries and the active storage and construction rooms.

Lighting in the submain entries, main entries and experimental areas shall be incorporated into the mine warning, evacuation alarm system.

5. ALARM SYSTEMS. The Central Monitoring Room will receive data from alarm systems.

a. Security Alarm Systems Design. Wiring for the security alarms shall be in metal raceway or equivalent protection.

All buildings shall have door alarms.

Provide cables, cable raceways, and splices for distribution of the reporting alarms from the remote facilities to the CMR. Provide door switches on emergency exit doors and gates and such other doors as appropriate. Provide a key operated access-secure switch by the main access-exit door for each alarm circuit. Security alarm system cabling can be run in conduit in common with other non-power cables. All security system junction boxes and terminal cabinets shall be equipped with tamper switches connected into the alarm circuit of the area where they are located. All terminal cabinets shall be provided with locks. Provide consistent color coding throughout the alarm circuit loops.

b. Evacuation Alarm and Fire Alarm Systems Design. Evacuation alarm and fire alarm systems shall be run in dedicated conduits or interlocked armored cables for both surface and underground areas.

The evacuation alarm system shall include provisions for discharge of a mercaptan type gas into the underground ventilation system.

Provide raceway, cable, and splices for distribution of the reporting fire alarm cables from the remote facilities to the Central Monitoring Room.

Provide valve tamper switches and status controls per the fire protection criteria in Chapter 6, which contains a further description of the Fire Protection and Alarm System.

6. COMMUNICATIONS SYSTEMS

a. Telephone Service. Telephone service will be provided by the General Telephone Company of the Southwest, originating from General Telephone Company's facilities in the Carlsbad, New Mexico exchange, and terminating in a PBX switchboard in the WIPP Support Building. The PBX will also handle in-plant telephone communications and placement of outgoing calls. The telephone communication system will interface with the PA and intercom systems to provide a complete communication system. The telephone system will provide for communication between the Support Building and other surface buildings.

Provide for telephone cabling to the site and installation of an electronic telephone system that has sufficient capacity to serve the site population. The system shall also be capable of being interconnected with the underground communication system.

The telephone system must have capability of direct in and out dialing without operator intervention. Sufficient trunks shall be provided to the electronic switch to provide P02 grade local, long distance and FTS service. Off-site cabling shall also provide for dial access and dedicated data transmission lines to off-site locations via long distance toll and FTS services.

The site telephone system shall be designed, and cable raceways and splices provided, for a complete communications system. It shall include telephone service to the water pump house and switch yard.

Exterior cabling shall be routed through instrumentation and communication raceway for distribution of the telephone system cables from the Support Building to the other surface facilities.

On-site telephone cabling shall include flexibility for local data transmission between various above and below ground stations at the site via dedicated wire lines.

In office and large open areas in which movable partitions are used, provide (if it can be shown to be capital cost effective) underfloor telephone ducts as part of a three-way underfloor duct system (power, telephone, and special systems).

Provide 3/4 inch minimum size conduit runs to telephone outlets. Provide a pull wire in every conduit. Utilize junction boxes no smaller than 4S for telephone outlets. Place a maximum of six outlets on a conduit run from a terminal cabinet.

b. Radio systems. Radio systems shall be located in the operations control area (located in the Central Monitoring Room) of the Support Building to provide mobile and portable two-way communications for facility vehicles and security guards. Transceivers will be provided to maintain contact with civilian, fire and law enforcement agencies.

c. PA Systems. Both local and master public address (PA) systems shall be provided.

Each local system shall have a master page station to control communications within the individual facility. The master station will be typically located in the building lobby or central office and will be controlled from the operation control center in the Support Building.

All PA systems shall have talk-back capability, with handsets located at the speakers. Local systems shall be connected to the operations control master "all call" station that shall have tone generators to sound "immediate evacuation" and other emergency signals over all (or selected) speakers.

The CMS operator shall have the capability of overriding individual PA systems.

d. Shaft Communications. Shaft communications shall be basically the same as those in conventional mines. Audible and visual signaling between the hoistman, the shaft conveyance and each level station are via electrical circuits.

e. Mine Page Phone System. A Mine Page Phone System shall be provided. It shall consist of self contained battery operated units. Each unit shall be operable with identical units up to a 3000 feet distance between units.

7. SPECIAL SYSTEMS

a. Central Computer System. A central scientific/business computer system shall be located in the Support Building computer room. The systems shall be designed, and conduit, cable and equipment cabinets provided, for the central computer system which shall provide engineering, scientific and administrative data processing functions.

Central computer system remote terminals shall be provided in appropriate locations to support waste inventory, scientific, health physics and business computations.

Provide a communications link from the Support Building central computer system to remote terminals in the Support and Waste Handling Buildings and such other areas as required. Central computer systems communication shall be routed by using dedicated cables.

The central computer system shall provide a wide range of data processing needs on a continuous 24-hour basis. The central computer consists of a central processor and peripheral equipment, with extensive software capabilities.

The central computer will require:

- o Network software
- o Data communication protocols and software
- o Software security and accounting protocols
- o Industry-standard high-level languages for scientific (BASIC, FORTRAN) and business applications (COBOL or PASCAL) and for report generation
- o Compilers for high-level languages
- o Assemblers for machine-level languages and loaders to link and convert both high-level and machine-level programs into an executable format
- o Local and remote terminals for data entry and output.

All data bases will be updated at regular intervals and copied to magnetic tape(s) to provide a permanent data library and to prevent saturation of the mass storage devices.

The data bases will include:

- o Waste inventory information
- o Time-based parameters from underground
- o Radiation history for WIPP waste-handling personnel
- o Payroll and Plant Engineering inventory
- o Maintenance Records

b. Central Monitoring System. A Central Monitoring System (CMS) shall be provided with a fire, security, process, radiation and environmental computer system located in the Support Building Computer Room.

The CMS shall monitor for the following types of data as appropriate for the particular facility, building or area:

- o Environmental including meteorological, air quality and seismic
- o Mechanical operating systems, including HVAC system status
- o Radiation levels and airborne radionuclide concentrations
- o Fire detection and alarms
- o Security
- o Status of the 13.8 Kv breakers at the plant substation
- o Status of the 480V breakers at Substation No. 3 (Exhaust Filter Building)
- o Electrical demand at the diesel generator
- o Electrical demand and consumption for the plant substation.

The CMS shall be designed, and conduit, cable, and equipment cabinets included, to provide supervision and monitoring of WIPP operations from the Central Monitoring Room (CMR).

Individual sensors located within a building or area shall feed output signals through local processing units (LPU's) to the CMS computer. Local monitoring and control of the parameters fed to the CMS shall also be available, with appropriate audible and visible alarms as required.

The CMS shall provide data from systems and equipment required for normal plant operation, safety-related systems and equipment to be used in the event of fires or accidents, and instrumentation to be used to monitor site environmental conditions and radioactive release. The operator in the CMS shall be provided with annunciated alarms, hard-copy printout of systems status on both scheduled and demand basis, and direct in-plant communication capability through the paging system. He shall also be provided with information from the fire-alarm system. The CMS shall also control starting and stopping of the diesel generator, opening and closing of the 13.8Kv breakers at the plant substation, and closing and opening of all 480V breakers at substation No. 3 and at the diesel generator.

The only control from the CMR will be for exhaust shaft filtration switchover, start/stop control of the emergency diesel generator, and open/close control of the appropriate associated breakers. However, the CMS computer shall retain the capability for adding control functions to meet future requirements.

Cathode-ray tube terminals (CRT's) shall provide the capability to demand and display data, issue instructions, and retrieve stored information. The CRT's shall also provide visible and audible alarm functions including logging functions, preprogrammed data on the type of alarm, location, and other pertinent information.

In the event that a significant number of alarm or indicator lights are required to complement the CRT displays, the following light convention shall be followed (CMR only):

(1) red, indicating unsafe and/or alarm condition;
(2) yellow, indicating deteriorating or abnormal conditions not requiring immediate action;
(3) green, indicating normal and/or safe conditions;
(4) white, indicating informational data;
(5) blinking, indicating an unacknowledged alarm or status change; and

(G) other colors for specialized applications.

A printer shall provide hard-copy records of the logs, alarms and other data displayed to the operator on the CRT's. The intercom module and paging controls with desk microphone shall provide the operator with the ability to communicate throughout the facility.

WIPP CMS computing requirements shall be accomplished by following a distributed network scheme using a large central supervisory minicomputer interfaced with small processing systems. The CMS computer is linked via redundant direct wire lines with the local processors and terminals. The smaller processors monitor and process real-time events such as meteorological data, ventilation parameters, radiation levels, and alarm and control systems.

c. Experimental Area Computer System. An Experimental Area Computer shall be installed in a utility building or trailer. Its purpose is to monitor and acquire data from underground experiments.

The Experimental Area Computer System shall monitor the instrumentation required for the experimental areas. Thermal field and rock mechanics experiments require many measurements of temperature, stress, strain and displacement. Some measurements will use techniques with mechanical indicators that are hand-recorded or manually entered into the computer, but most result in electrical outputs with real-time recording. These measurements shall be processed by the Experimental Area Computer.

Experimental computer system remote processsing units shall be provided in the experimental area to monitor and acquire data from underground experiments.

d. Cathodic Protection System. Cathodic protection shall be provided if steel piping or other ferrous equipment is embedded in the soil. Cathodic polarization shall conform to critieria described in NACE Standard RP-01-69 (1972).

APPENDIX

APPLICABLE DOCUMENTS

1. Amendment D-48, Federal Property Management Regulations

2. Illuminating Society (ICS), Lighting Handbook

3. ANSI A11.1, Practice for Industrial Lighting

4. NFPA 101-1976 Code for Safety to Life from Fire in Building and Structures

5. NACE Standard RP-01-69 (1972)

6. Federal Aviation Administration (FAA), AC 70/7460-IF, Obstruction Marking and Lighting

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CHAPTER 5

DESIGN CRITERIA, UNDERGROUND FACILITIES AND SYSTEMS

WASTE ISOLATION PILOT PLANT (WIPP)

ALBUQUERQUE, NEW MEXICO

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1. INTRODUCTION. This section of the Design Criteria presents the underground requirements for the design of the WIPP Project. Operational criteria, methods and procedures are not included.

The criteria follow the general outline of 30 CFR, Part 57, Mine Safety and Health Administration (The MSHA code), which is the basic federal code regulating underground metal and nonmetal mining. In addition, the intent of the New Mexico Mine Safety Code for All Mines is applicable as design criteria. For radiological protection systems refer to Chapter 1 of this Design Criteria.

2. GROUND CONTROL

a. Shaft Design. Shafts shall be designed to be structurally stable throughout the operating life of the underground facility and for the period of time thereafter required for decommissioning of the facility. The shaft designs shall preclude shaft wall deformations which would interfere with the functions of the shafts or affect the safety of shaft operations. Rock supports shall be used as required to limit rock deformations and to prevent loosening and fallout of wall rock.

The time-dependent closure of shafts due to salt creep shall be considered in the design of shafts. Shafts shall be dimensioned so that the minimum dimensions required for shaft functions are maintained for the entire design life. Provisions for instruments to measure creep closure shall be included in the design.

Groundwater inflow to the shaft shall be controlled so that no uncontrolled groundwater reaches the storage horizon via the shafts. Groundwater shall be controlled by positive cutoffs (such as grouted barriers or chemical seals) wherever possible or by interceptor systems (drains, water rings and sumps) where positive cutoffs are not effective. Groundwater pressures and inflows shall be measured throughout the construction period and operating life of each shaft. Groundwater inflow will not be required to be measured with instrumentation. Seepage into collection tanks shall be used to estimate inflows.

Design of shafts shall consider the requirements of decommissioning and backfilling upon termination of operations. The design shall accommodate the need to ultimately seal the potential pathways between the storage facility and the biosphere.

b. Shaft Liner Design. The shaft liners shall be designed to:

- o Help ensure that dimensions remain within limits required for shaft functions
- o Prevent groundwater inflow to the shaft
- o Protect wall rock from deterioration
- o Preclude risk of rock fall from shaft walls

c. Mine Design. Mine design includes the design of entries, rooms, pillars, shaft pillar, experimental and storage areas.

The mine shall be designed to provide structurally stable excavations and pillars. In this context, "stable" means that deformations of excavations and pillars shall remain within limits required for structural function, ventilation and safety. Rock bolts shall be used where necessary to provide positive support of roofs and walls. Surface subsidence resulting from underground excavation shall not exceed one inch within a 500 foot radius of the waste shaft.

Excavations and pillars shall be located and dimensioned to avoid geologic discontinuities (such as fractures, clay seams and geological folds). However, if geologic discontinuities are encountered, remedial action shall be engineered to correct the problem. The design of the excavations and pillars shall be based on established mining procedures, including area extraction ratios, stability analysis and other considerations. The predicted behavior of the salt shall be verified by in situ testing (SPDV) before proceeding with the construction of the storage area.

The underground excavation shall be designed to accommodate creep closure and maintain the minimum dimensions required for the operating life of the opening. Creep closure rates used for design shall be confirmed or modified by instrument observations in the excavations. Excavation dimensions shall include allowance for creep closure sufficient to prevent container breeching by creep-induced stresses during the retrievability period. Underground excavations shall be designed to minimize the potential for repository rock fracturing.

Underground waste storage procedures shall include a designed backfill plan for fire protection. Backfilling shall be performed as waste containers are stored, such that a practical minimum number of waste containers are uncovered at any one time. The backfill thickness shall be 1 to 2 feet. The excavation shall be designed to permit isolation of panels of rooms with plugs after storage and backfilling are completed.

See Chapter 4, Item 4.c for underground lighting system design.

d. Emplacement Criteria. The underground storage rooms and access drifts shall be designed to be compatible with the waste transport vehicle and with the waste container sizes, shapes, weights, stacking configurations, and the handling and backfilling equipment requirements identified in Chapter 1 of this document. The storage rooms shall be sized for efficient handling and stacking of the CH waste containers.

Provisions shall be made to accommodate backfilling over and around the CH waste containers. The design shall enable backfilling at the end of each operating shift.

Each storage panel shall have provisions for being isolated from other panels upon completion of storage operations in that panel.

A separate area of the underground facility shall be provided for the emplacement and retrieval of experimental waste. This area shall also have the necessary facilities and equipment for testing and monitoring required by the individual experiments.

e. Retrievability. All wastes placed into the WIPP are retrievable, with retrievability to be demonstrated, until such time as the pilot plant is converted to an operational repository for permanent disposal of wastes. Refer to Chapter 1 for specific information.

The storage room shall allow for salt creep and shall be sized to minimize breaching of the CH waste containers for a period of 10 years.

The underground design shall provide for the retrieval of all experimental radioactive waste at the end of the experiments.

f. Instrumentation. Underground instrumentation is required to measure phenomena important to the performance of the facility or which cannot be otherwise observed or quantified. Instruments shall be provided to measure such phenomena as rock behavior, gases, seismic activity and groundwater pressures in order to confirm or revise design assumptions. Examples of phenomena to be measured by these instruments are:

- groundwater pressures around the shafts
- deformations of rock around shafts and mine excavations
- stresses in the rocks around shafts and mine excavations

Measurements considered critical to design shall be obtained with redundant detectors or systems wherever possible. Instruments with appropriate range and precision shall be selected.

In general, sensors shall be designed for remote readout, and signal output shall be compatible with selected data acquisition systems. Wherever possible, instruments shall be installed in accessible locations for repair or replacement. Sensors and associated materials shall be selected for maximum service life in the salt environment.

3. AIR QUALITY AND VENTILATION

a. Separation of Storage and Construction Areas. The ventilation system for the underground portion of the WIPP shall be divided into three independent systems: one supports construction activities, a second supports storage activities, and the third supports experimental area activities. This independence shall commence near the air supply shaft and shall be maintained through the air distribution systems to the exhaust shaft. The method devised to provide this system independence shall minimize congestion and limit the number of people exposed during normal waste handling operations or during an accident-induced environment.

The ventilation system supporting waste storage shall be devised so that personnel are not downstream from stored radioactive material during the performance of their normal duties.

Permanent air quality monitoring systems shall be provided in the underground area to monitor for and alarm when abnormal levels of hazardous gases are present. Monitoring devices shall be located at strategic locations and transmit alarm signals to a local alarm panel and to the CMR in the Support Building. Refer to Chapter 4, Item 2.c for UPS requirements.

b. Emergency Ventilation. The Construction and Salt Handling Shaft will normally be the air supply source for the waste storage area, the construction area, and the experimental areas. Flow reversal capability shall be provided for the C&SH Shaft and station in the event of a fire. Flow reversal is not required for the waste storage area, as control of radioactive particles would become impossible. Construction panel area and experimental area flow reversal is not required, as it would only further complicate underground flow control. Emergency ventilation may use the Construction and Salt Handling Shaft for (1) intake, (2) neutral or (3) exhaust, and use the Waste Shaft as (1) intake or (2) neutral. The exhaust Shaft shall remain exhaust. On detection of abnormally high concentrations of airborne radioactive particulates by the radiation monitoring system, a reduced exhaust flow shall be diverted to the HEPA filters by isolation and diversion dampers on the exhaust fans and ductwork.

c. Air Locks, Dampers, Regulators and Doors. All bulkheads and stoppages used to maintain the independence of the two ventilation systems shall be built of non-combustible material. These structures shall be adequate to support the maximum pressure differential that can occur if one side of the system is not operating. These structures shall be designed and installed in such a manner that they can accommodate ground motion (creep) without impairment to their ability to maintain ventilation separation.

d. Temperature Variations - Spot Cooling & Heating. Due to the wide temperature variation from summer to winter, the shop work stations and office areas shall have provisions for heating and/or cooling to establish a suitable working environment, to be determined by specific engineering analyses and/or operating conditions.

e. Radiation Protection. A radiation monitoring system shall be provided in the underground facilities to monitor the quality of the mine environment to ensure that both workers and the general public will not be exposed to excessive amounts of direct radiation and/or airborne radioactivity. Monitoring systems shall be adequate to determine both the general radiation background and concentration of airborne radioactivity. Refer to Chapter 1 for further details on protection from radiation and to Chapter 4, Item 2.c for UPS requirements.

In the storage area, general radiation background monitoring shall be conducted using state-of-the-art detectors for gamma radiation. The detectors, through their associated local processing units, shall transmit data to the CMS. The system shall be capable of annunciating both an audible and visible alarm at both the CMS and in the area of the monitor when a preset value is reached.

Airborne radioactivity shall be monitored through the use of instrumented air monitors and non-instrumented air samplers. The instrumented system shall continuously monitor the repository air for concentrations of alpha and beta activity using state-of-the-art detection equipment. The instruments shall be capable of transmitting data to the CMS via local processing units and annunciating audible and visible alarms both locally and remotely when a preset value is reached. Non-instrumented samplers, which shall be located in various areas within the mine, consist of a sample filter holder and a vacuum pump. These samples shall be analyzed in the counting laboratory and provide a legal record of the airborne activity within the mine. The storage exhaust effluent shall be both monitored and sampled in the exhaust stack to determine effluent quantities and concentrations being released to the atmosphere and to provide alarms. The stack monitors shall automatically initiate the diversion system when stack effluent concentrations which exceed specified limits.

In the construction area continuous air monitors shall be placed at selected locations in the construction area of the mine and in the construction exhaust system to verify that radioactive material is not present in the construction air.

Radcon facilities shall be provided in the underground area to fulfill the following requirements:

Personnel contamination surveys
Protective clothing change areas
Personnel and equipment decontamination
Portable instrument storage
Provide space for a small radcon office and check point technician.

The facilities shall be designed for ease of decontamination. Water or other fluids shall not be piped into the decontamination area. Power, work benches and a small storage area shall be provided for the decontamination facility.

The layout of the radcon facilities shall be such that entry into potentially contaminated areas requires passage through a monitored control point.

f. Instrumentation and Controls. The total underground ventilation system shall be adequately instrumented to provide for continuous verification or checking of proper system function. Additionally, provisions for continuous evaluation of air quality shall be included so that deviations from acceptable air quality can be immediately identified.

The ventilation system shall be equipped with controls and control features which will provide for the safe initiation of the diversion system in the event of an underground accident which could cause the release of radioactive material to the atmosphere. Automatic controls and detection devices shall be considered and used where deemed necessary for safety.

g. General. Calculations supporting the design of the ventilation system shall include effects of leakage through stoppages and brattices, flow friction, air density, and natural convection contributions. The analysis shall include calculations which assess the consequences of the failure of those portions of the system which provide system separation, personnel safety, and prevent the release of radioactive materials.

4. UNDERGROUND EXCAVATION AND HAULAGE

a. Excavation Rate. The underground excavations shall be designed to provide an underground storage system in which CH and RH waste can be efficiently and safely handled and stored. The excavation rate shall be designed to provide excavated areas prior to their need for the waste storage operations and in a manner not to interfere with the storage operations.

b. Methods. Mining shall be performed with continuous miners or equivalent machine type devices. Drill and blast-type mining shall be prohibited except where authorized in initial development of the shafts and stations or required to provide safe working conditions. The underground design shall provide maximum stability for excavated rooms and entries. Haulage for the underground salt handling system shall be by a combination of loading and hauling vehicles.

c. Underground Salt Handling System. The underground salt handling system shall interface with the salt handling hoist and shall have capacities consistent with both the hoist and the designed excavation rate.

d. Crushing and Backfilling. Salt crushing and screening equipment shall be provided as part of the backfill placement equipment, if required, to prevent oversize material from being emplaced. A system to provide temporary underground storage of the backfill material shall be provided to allow for waste storage and backfilling during periods when mining activity has been stopped.

The design shall not preclude reclaiming stored salt from the surface and backfilling all rooms, entries and shops for decommissioning the site.

e. General. The design shall address the total required excavated material, haulage capacities, ventilation requirements, power consumption and hazards to personnel.

The intent of the applicable requirements of the MSHA in 30 CFR 57.9 and the New Mexico Mine Safety Code for All Mines shall be met or exceeded in the design of the underground excavation and haulage.

5. TRAVELWAYS AND ESCAPEWAYS. The mine entry design shall include crosscuts between entries at 300' intervals to provide access for personnel from the storage ventilation system to the construction

ventilation system. At least two separate escapeways to surface shall be maintained so that damage to one shall not lessen the effectiveness of the other. The design shall conform to the requirements of 30 CFR 57.11.

6. USE OF EQUIPMENT. Suitable guards of sufficient strength shall be provided for all drives, gears, sprocket chains, couplings and similar moving machine parts where contact by personnel could cause injury. Guards shall also be provided in areas where flying or falling material presents a hazard. Welding installations shall be furnished with adequate shielding and shall be well ventilated.

7. PERSONNEL PROTECTION. Facilities and equipment provided for personnel protection shall be in accordance with 30 CFR 57.15. Refer to Chapter 6 of this document for details.

8. MATERIAL STORAGE AND HANDLING

a. CH TRU Storage and Handling Criteria. The design shall accommodate two transporters, each with a fully loaded pallet of CH TRU waste, from the waste shaft to the storage room.

Provisions shall be made for temporary warehousing in the vicinity of the storage station. An area for temporary storage of empty pallets shall also be provided.

Provisions shall be made to accommodate the CH transporters while they are being unloaded and the waste is being stacked.

b. RH TRU Storage and Handling Criteria. Provisions shall be made for the vehicle operation required to pick up the facility cask, transport it to the storage area, return with an empty cask, and load the empty facility cask onto the facility cask car. Storage or parking for the facility cask car (and a spare facility cask) shall be provided near the waste shaft.

The waste storage area shall provide sufficient operational space for conducting all emplacement activities such that no operations require personnel to be downstream of the stored waste relative to the ventilation flow. This includes horizontal augering of the holes and insertion of the steel sleeves prior to emplacement.

c. Experimental Waste Storage and Handling Criteria. Provisions shall be made for off-loading the experimental waste facility cask, or special shipping/emplacement cask, from the waste cage and transporting it to the experimental waste area.

Provisions for waste equipment operation including vertical hole emplacement, retrieval and contaminated salt handling shall be made in the design of the experimental area. This includes establishing a temporary contamination zone with air locks and ventilation equipment during retrieval of compromised experimental waste canisters, backfill material and contaminated salt from the overcoring operations.

d. General Materials and Storage Requirements. The above requirements apply specifically to radioactive material handling requirements. Provisions shall be made to store the non-radioactive materials in the shaft pillar area at locations marked as "additional material storage" and "core storage." In addition, the requirements of 30 CFR 57.16 also apply to radioactive material and all other material stored and handled underground.

9. MAN AND MATERIAL HOISTING

a. General Hoist Requirements. Two mine hoists shall be provided in separate shafts to provide access between the storage level and the surface facilities. All personnel, materials, supplies and radioactive waste shall be carried on these hoists.

All hoists shall be designed utilizing conventional mine hoist design practice, except where radiological conditions require greater reliability and safety. Hoist operations shall be continuously monitored by the Central Monitoring System (CMS).

Conveyance guide systems should allow for the effect of creep induced shaft closure.

The hoist operating systems shall meet the requirements of 30 CFR 57.19 and the intent of New Mexico Mine Safety Code for All Mines.

The applicable mandatory requirements of 30 CFR 57.19 and of the New Mexico Mine Safety Code for All Mines shall be met or exceeded in the design of the hoists. The rope safety factors as defined in ANSI, M11.1 shall be met as a minimum.

b. Waste Hoist System. The waste hoist system shall be designed to transport radioactive waste containers and casks, as well as personnel, between the surface and the storage level. The waste hoist system shall interface the surface radioactive waste handling facilities with the underground radioactive waste storage facilities, and shall be located inside the Waste Handling

Building. The waste hoist tower shall house the friction hoist and deflection sheaves. The tower shall have a service elevator to provide access to each floor. The tower shall be fully enclosed and accessible only through air locks. Air locks shall be designed to accommodate RH and CH waste containers as well as mining equipment, materials and supplies. Provisions shall be made to accommodate mining and construction equipment that is too large or too heavy to be handled in the Construction and Salt Handling Shaft. A 30 ton capacity overhead crane shall be provided in the hoist tower to service the hoist.

Consideration shall be given to ventilation flow, air locks, pressure differentials, contamination control, fire protection and structural support.

All design codes and safety requirements applicable to hoisting personnel shall be applied in the design of hoisting radioactive materials. The hoist shall be designed for hoisting of personnel.

The hoist shall meet all load carrying requirements and shall be provided with controls allowing manual or semi-automatic operation.

c. Salt Handling Hoist System. The salt handling hoist system shall be designed to transport mined material from the underground level to the surface. The hoist shall interface the underground salt handling system with the surface salt handling system.

The hoist shall also provide for hoisting of construction personnel. The hoist shall be provided with controls allowing manual, semi-automatic or automatic operation. Loading and dumping of the skip shall be done automatically.

d. Emergency Hoist. The emergency hoist shall be on site during construction and WIPP operation. The hoist shall be independently operated and powered and shall meet the mandatory requirements of 30 CFR 57.19.

e. Surface Salt Handling. The surface salt handling system shall interface with the salt handling hoist and shall provide for haulage from the salt handling hoist to the surface salt storage pile.

Sufficient surge capacity shall be provided at the headframe to dump one loaded skip, should the surface salt handling system become inoperable. The design of the surface salt handling system shall minimize spillage and dust generation.

The salt storage pile shall be sized to allow for storage of all excavated material produced by the shaft sinking and underground mining operations except that rock will not be mixed with salt.

The salt storage pile and surface salt handling equipment shall be designed to minimize environmental impact and shall be compatible with other site facilities and priorities.

The design of the surface salt handling system shall provide for reclaiming the stored salt for backfilling the underground excavated areas and shafts during decommissioning of the facility.

10. EQUIPMENT SERVICING. The underground support area shall also be provided with a mechanical and electrical shop to service and maintain all underground equipment used for mining and waste storage operations.

APPENDIX

APPLICABLE DOCUMENTS

1. 30 CFR, Part 57 - Mine Safety and Health Standards - Metal and Non-Metallic Underground Mines (MSHA)

2. New Mexico Mine Safety Code, 1981

3. ANSI M11.1 - 1980 - Wire Ropes for Mines

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CHAPTER 6
DESIGN CRITERIA, FIRE PROTECTION
WASTE ISOLATION PILOT PLANT (WIPP)
ALBUQUERQUE, NEW MEXICO

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1. INTRODUCTION. This chapter outlines the fire protection considerations for design of WIPP facilities and systems.

2. GENERAL. The A-E shall include in the design provisions to (a) identify and mitigate potential fire problems, (b) detect, measure and record parameters associated with fire protection activities, and (c) establish audible and visible alarm warning systems for life safety or personnel protection.

3. FIRE PROTECTION DESIGN CONSIDERATIONS

a. General. The fire protection system design effort shall be focused on prevention, detection, and extinguishment or limitation. Structures, systems, vehicles and components with critical safety functions shall be designed and located so that they can continue to function effectively under credible fire conditions. Heat resistant and non-combustible materials shall be used where practical. Automatic fire suppression shall be used where needed, and proper detection systems shall be provided with both local and central alarm systems.

Fire protection needs shall be determined by analyzing design basis fires and more credible but lesser fires. Items to be considered are (a) quantities of combustibles, (b) ignition sources, (c) heat and smoke transfer, (d) fire duration, (e) involvement with radioactive materials, and (f) effectiveness of proposed detection and suppression systems. Failure of the automatic and manual firefighting efforts to control a fire shall be assumed in establishing the design basis fires.

Water (automatic sprinkler systems) shall be the principal above ground fire suppressant. Provisions for special hazards shall be designed as needed. Provisions for underground fire protection shall preclude use of water.

Fire protection designs shall require use of appliances, equipment and materials listed or approved by such organizations as Underwriters Laboratories, Inc. (UL) and Factory Mutual Research Corporation (FM). Fire protection systems shall conform to provisions of the following codes and standards as applicable.

- National Fire Codes of the National Fire Protection Association (NFPA)
- Loss prevention data sheets of FM
- Uniform Building Codes of the International Conference of Building Officials (UBC)
- Wash 1245-1, Standards for Fire Protection of DOE Electronic Computer Data Processing Systems.

Where possible, each fire protection system shall be designed so that failure of any one component will not disable the entire fire protection system. Onsite emergency power systems including a UPS shall be provided to operate certain fire protection systems and alarms.

Fire ratings shall be applied to certain walls and barriers. Doors to these areas shall carry an appropriate rating to match the walls. Penetrations shall incorporate appropriate protection to make them equivalent to the walls. Cable trays shall be metal or concrete construction. Where cable trays penetrate fire barriers, the penetration shall be sealed to provide a fire rating equal to that of the barrier. Cable trays shall be adequately separated or protected to minimize flame propagation.

Where flammable fluids must be used, volumes shall be minimized and fire barrier isolation shall be provided, as well as means for collection and confinement.

Actuation of the fire detection and suppression systems shall automatically cause the ventilation and exhaust systems to change to a predetermined "safest mode" of operation. (Reference Chapter 3, Item 1.d).

Plugging of exhaust system filters by smoke and debris as well as degradation of the filters by heat and fire brands and flame impingement shall be considered by the A-E in the design of the filter protection system.

Fresh air intakes for HVAC systems shall be designed to preclude smoke and toxic exhaust gases from being captured and recirculated.

Fire hydrants shall be installed adjacent to paved roads or driveways spaced at approximately 300 foot intervals around each facility. Fire hydrants shall be no closer than 50 feet from each facility, but no farther than 100 feet. Fire hydrants shall be of the "traffic" type, which if sheared off, will break at predetermined points and water will not flow.

Sectional control valves shall be arranged such that no more than 3 systems and 2 hydrants will be removed from service.

Sprinkler piping within 8 feet of the floor shall be painted "Fire Protection Red" and elsewhere shall be painted or labeled.

Means of egress from all facilities shall conform to NFPA No. 101, "Safety to Life from Fire in Buildings and Structures."

Exit and emergency lighting systems shall be provided in accordance with NFPA No. 101. Special attention shall be given to emergency lighting requirements in windowless buildings. Exit signs shall be provided as required.

The use of combustible materials in shafts shall be minimized. Materials used for construction of underground support facilities shall be fire resistant with flame spread and smoke development ratings of 0 to 25.

Construction materials used on the surface shall have a flame spread rating of 25 or less and smoke contribution rating of 50 or less. In addition, the following specific restrictions shall apply:

- Acoustical lay-in ceiling panels shall be of the mineral fiber type.

- Mineral fiber or fiberglass insulation shall generally be used. Foamed plastic insulation shall not be used except in sprinklered buildings where the foam is (1) in wall panel assemblies rated for non-sprinklered building use by UL or FM or sandwiched between masonry, concrete, plaster or gypsum board construction with a minimum fire resistance of one hour; (2) used in a Factory Mutual approved Class 1 metal deck roof construction or Factory Mutual approved "noncombustible" roof construction as per Factory Mutual System Approval Guide; (3) used as pipe insulation only where other products are unsuitable and where all spaces where the piping is located are sprinklered; or (4) used in exterior metal doors when required to achieve an effective "U" factor.

- Raised floor in electronic or computer areas shall be constructed of metal panels on metal supports. Floor covering material shall not present a flame propagation hazard.

- Interior partition wall covering shall have a flame spread rating of 25 or less and a smoke developed rating of less than 50.

- Use of polyvinyl chloride (PVC), asbestos, and polyethylene (PE) cable insulation and jacketing material shall be avoided. Cables shall be specified having ethylene propylene rubber (EPR) insulation and hypalon (chlorosulphonated polyethylene), neoprene, or chlorinated polyethylene jacketing.

Space for storage of a 750 gpm pumper, paramedic vehicle, protective clothing and individual fire-fighting equipment, self-contained breathing air cylinders, spare fire extinguishers, and recharging facilities shall be provided. See Chapter 4, Section 9, of the Fire Protection Handbook (14th Ed.) for typical requirements.

A hose drying rack shall be provided on a concrete pad adjacent to the fire-fighting vehicle storage area.

b. Waste Handling Building. Fire barriers shall be provided at the following locations: (1) walls of the surface shaft station, (2) walls of the cask loading room, shielded storage area, hot cell, and CH air lock, (3) walls enclosing stairwells, and (4) walls of the overpack and solid waste handling areas.

The A-E shall determine the required fire rating and exact location of these barriers based on analysis of the Design Basis Fire (DBF). Adequate means of egress as well as a means of access for re-entry teams under abnormal conditions such as fire shall be implemented in the design of the facility. Methods to prevent sprinkler water flooding shall be provided to prevent the flow of potentially contaminated water from the facility to the environment.

c. Support Building. Provide two-hour fire walls with a one and one-half-hour Class B fire door on each opening around the computer and central monitoring area. One and one-half-hour rated fire dampers are required in each duct penetration, if any, through the fire wall. Openings around pipe, conduit, cable, and other penetrations shall be closed with construction equal in fire resistance to the fire barrier.

A fire resistive (two-hour) vault shall be provided for magnetic tape and disc storage, the purpose of which is to both protect the tapes from a fire in the electronics areas and also to protect the electronics from a fire involving the tape reels and discs. Storage for an emergency 24 hour supply of computer related paper goods shall be accommodated in the vault.

The fire barrier assemblies should meet the requirements of ASTM-E-119, "Fire Test of Building Construction and Materials," including the hose stream test. A minimum of a one-hour barrier shall be provided around the mechanical equipment and uninterruptable power supply areas.

Refer to DOE WASH 1245-1, Standards for Fire Protection of DOE Computer/Electronics Data Processing Systems, and NFPA No. 75 for additional design requirements of the computer and central monitoring room.

d. Underground. Diesel fuel shall be delivered by portable storage tanks to the U/G facility level. The quantity of diesel fuel stored underground shall in no case exceed that quantity required for two days of operation.

Fuel shall be stored underground in portable tanks, located within structures providing a three-hour fire rating or in a portable trailer meeting NFPA requirements for diesel fuel transport. Entrances into the fuel storage structure shall be equipped with fire doors which, when both are closed, will provide a fire rating equal to or greater than that of the constructed underground walls and barriers. The fuel storage structure shall include a fire suppression system, utilizing appropriate suppression with connected reserves, automatically activated. The fuel storage area shall have a collection sump for spilled fuel so that accumulated fuel may be promptly removed for disposal. The floor of the final storage structure shall be sloped toward the collection sump so that any spillage occurring during fuel transfer will flow into this sump. The fuel storage structure shall be ventilated. No blower or other type ventilation drive shall be located in the exhaust air stream. Inlets and exhausts for ventilation shall be equipped with closures activated by the fire suppression system.

Waste storage rooms shall be backfilled with salt and isolated using permanent bulkheads as fire, ventilation, and personnel barriers. See Chapter 5, Item 2.c and 2.d for additional information. Processed wastes are treated in the same manner as nonprocessed wastes.

e. Exhaust Filter Building. Fire barriers shall be provided around each filter room. The A-E shall determine the required fire ratings and exact location of these barriers based on analysis of the Design Basis Fire (DBF). Adequate means of egress as well as a means of access for re-entry teams under abnormal conditions such as fire shall be implemented in the design of the facility.

f. Water Pumphouse and Yard Fire Water System. The pumphouse floor shall be sloped to drains or wall scuppers that will prevent accumulations of liquid around the base of the pumps.

g. Warehouse and Shops Building. A two-hour fire wall with Class B, 1-1/2 hour fire doors on all openings and fire dampers at duct penetrations shall be provided between the shop and warehouse areas.

4. FACILITY FIRE PROTECTION SYSTEMS

a. General. Potable and process water systems shall be arranged so they can be shut down without affecting the water supply to the fire protection underground mains.

The water supply to the permanent fire protection installation shall have a minimum of two reliable, independent storage systems and sufficient combined capacity (based on the maximum water demand) for firefighting. Water supplies containing salt or other materials deleterious to the fire protection systems shall be avoided wherever possible.

Water for firefighting and fire suppression systems shall be furnished on the site by a looped distribution system encircling the site buildings. Hydrants served by this system shall be strategically located around the loop. Valves or valve assemblies listed by UL or FM shall be provided for proper sectional control of the loop.

Fire water pumps shall be equipped with automatic starting features and listed by UL or FM for fire service. Where water supply pressure is provided by pumps only, there shall be a minimum of two pumps, at least one of which should be driven by a diesel engine. Multiple fire water pumps shall be selected so that the maximum water demand for firefighting will be supplied by either the diesel or electric driven pumps.

Interior hose connections equipped with 75 or 100 feet of 1-1/2 inch woven-jacket-lined hose and plastic on-off, adjustable spray and straight stream nozzle shall be located so that all areas can be reached by at least one effective hose stream. National standard fire hose threads shall be specified. NFPA 14 shall be specified.

Unless otherwise noted, sprinklers having a temperature rating of 165 degrees F shall be used except near a heat source where higher temperature sprinklers shall be used as recommended by NFPA-13.

Fire extinguishers shall be installed throughout the facility in accordance with NFPA No. 10.

Consideration may be given to the Grinnel Aquamatic on-off sprinkler for use on wet pipe systems. These heads provide a degree of assurance for limiting unwanted water flow. The susceptability to failure or premature operation should be addressed.

Surface buildings furnished with recirculating type ventilation systems shall be designed for non-recirculation in the event of a fire to aid in exhausting smoke. Manual override controls accessible to the fire fighters shall be provided to shut off all fans or return the ventilation system to the normal mode of operation.

b. Waste Handling Building. An ordinary hazard group 2 wet pipe sprinkler system shall be installed throughout the waste handling building except for the mechanical equipment room and support areas of the remote handling facility, which shall be ordinary hazard group 1. Water supply connections to this building shall be remote from each other to minimize a common incident failure.

c. Support Building. An ordinary hazard group 1 wet pipe sprinkler system shall be installed. Sprinklers in the computer and central monitoring room, tape vault, office, and storage room are redundant to the Halon 1301 extinguishing system provided for those areas. The electrical battery room shall be protected by an ordinary hazard group 1 automatic wet sprinkler system.

Sprinklers within the computer and central monitoring room shall be 212^{o}F minimum.

An automatic total flooding Halon 1301 extinguishing system with a connected reserve supply of Halon shall be installed in the computer and central monitoring rooms. The Halon system shall be designed to achieve a 6 percent concentration within 10 seconds per NFPA No. 12A. The protected volume shall include: the space below the raised floor, the occupied space (between the raised floor and the suspended ceiling) and the volume of any ducts or plenums which must be flooded. Doors or dampers shall be arranged to close automatically to contain the Halon 1301.

Upon actuation of the Halon 1301 system, the ventilation system will be designed to retain the extinguishant gas in the protected volume. This may be accomplished by closing dampers, shutting off the air handling fans, or by other acceptable methods. The air conditioning design should contemplate possible damage to cooling equipment when the refrigeration load is suddenly removed.

d. Underground. An automatic fire suppression system shall be installed over the vehicle fueling area, including the fuel storage area. This system will utilize a dry chemical fire suppressant (ABC type). The fuel storage structures shall be located so that in the event of fire, the smoke and hot gases generated will be carried directly to the exhaust shaft without passing through areas normally occupied by operating personnel.

All underground diesel powered vehicles shall have crashproof, puncture resistant fuels tanks that can survive a 200 mph impact with an unyielding surface. Waste handling vehicles shall be geared for a maximum speed of 20 mph; construction vehicles shall be geared for a maximum speed of 35 mph.

A designated area shall be provided for an underground fire fighting vehicle.

See Chapter 5, Section 3 for additional underground ventilation requirements.

e. Exhaust Filter Building. Provide an ordinary hazard group 1 wet pipe sprinkler system.

Collection systems should be provided in potentially contaminated areas for runoff water from firefighting activities, water breaks or leaks. Confinement, sampling, volume determination, and retrievability of liquids and solids should be considered in the design of collection systems. The size of the collection system for firefighting water should be based on the maximum amount of water that could be used in fighting a credible fire.

f. Water Pumphouse and Yard Fire Water System. An ordinary hazard group 2 wet pipe fire protection sprinkler system shall be provided.

The surface fire protection system shall consist of a water storage/pump station and a looped system of underground water mains. An appropriately sized UL or FM listed electric fire pump and a UL or FM listed diesel fire pump shall be provided taking suction from the tanks. The controllers and associated equipment for the fire pumps shall be UL or FM listed for their intended use. The pumps shall be designed for 0 psi suction and have a minimum rated discharge pressure of 100 psi.

The installation shall conform to all mandatory and advisory provisions of NFPA No. 20 and applicable sections of NFPA No. 30 and No. 37. The piping layout in the pump station shall provide reliability of redundant pumps during maintenance and impairments.

The electric motor driven fire pump shall be powered from the normal power source.

Fire pumps shall be arranged to start automatically upon operation of any sprinkler or fire hydrant. An approximately 20 gpm jockey pump shall maintain pressure on the fire protection water mains. Fire pumps shall start if a pressure drop corresponding to a flow of 25 GPM is detected.

The method of flow testing fire pumps shall consist of testing the condition of all suction piping as well as the pump and shall provide for the convenient handling and flow metering of the discharged water. A metered line discharging back into the water storage tank is recommended.

The surface facilities shall be connected to a looped underground water main system supplying fire hydrants and sprinkler systems, capable of delivering an adequate supply of water for 2 hours at a residual pressure of 55 psi at each building when fed through the loop in one direction only. The minimum size for the looped pipe shall be 10 inches. The minimum size feeding fire hydrants and sprinklers from the looped mains shall be 6 inches.

Post Indicator Valves (PIVs) shall be provided on the looped mains to provide sectional control to minimize the impact of a single water main break. Sectional PIVs shall be provided on each side of the fire pump connections to the loop and also at the sprinkler system connections to site buildings. Curb box valves shall be provided at connections for fire hydrants. Hydrant curb box valves shall be anchored independently from the hydrants they isolate. The underground water system shall be installed in accordance with NFPA No. 24, Standard for Outside Protection.

Portable fire suppression systems shall be provided near the diesel generator and the Warehouse and Shops fuel island.

g. Warehouse and Shops Building. An ordinary hazard group 3 wet pipe sprinkler system shall be installed throughout the warehouse/shops building. A welding-fume exhaust system shall be provided. Sprinklers need not be installed above suspended ceilings if no combustible materials exist in the concealed space.

h. Guard and Security Building. An ordinary hazard group 1 wet pipe sprinkler system shall be installed throughout the building.

5. FIRE DETECTION, SIGNAL, AND ALARM SYSTEMS

a. General. As a minimum, manual fire alarm stations shall be installed throughout the facilities at readily accessible locations. These stations shall be connected to the plant-wide alarm system and shall sound the fire alarm tone in the immediate building. Automatic fire detection systems shall be considered for use both above and below ground and provided where deemed necessary.

Fires shall be indicated audibly by alarms that are set off by fire detection and suppression systems. Each fire protection system shall be equipped with an alarm on the plant-wide alarm system.

The fire alarm systems shall be designed, and conduit, cable, and terminal cabinets provided, for a complete evacuation and fire alarm system.

Alarm bells or other distinctive tone reserved throughout the WIPP for fire alarms shall be located so that they are clearly audible throughout all areas of the affected building or area but shall not exceed 100 db at a distance of 10 feet from the tone generating device. In areas of noisy equipment or soundproof construction, additional alarm devices shall be installed. Visible alarms may supplement audible alarms in noisy areas.

Alarms in the CMR are both visible and audible and shall continue until acknowledged by the CMS operator. An alarm condition shall also automatically initiate the sounding of a fire alarm signal throughout the fire zone. The CMS operator shall have the capability of alerting and advising occupants of any part of the facility. All fire alarm wiring shall be in dedicated conduits or interlocked armor cable. All wiring shall be continuous without splices from terminal strip to device. Provide consistent color coding throughout the alarm circuit functions.

Provide fire alarms, proper ventilation, and valve tamper controls throughout the facility.

Building fire alarm system components shall be located for accessbility by building occupants and fire fighters under emergency conditions.

b. Waste Handling Building. This building shall have a local fire alarm system that transmits signals to the Central Monitoring System (CMS) in the Support Building.

The following types of automatic and manual alarm initiating devices (as applicable) shall be connected to the building fire alarm system and site central fire alarm system:

o Manual fire alarm boxes

- o Sprinkler water flow alarm switches
- o Smoke detectors
- o Combination fixed temperature/rate of rise thermal detectors

In the waste handling shaft headframe combined photoelectric smoke and thermal detectors shall be provided on a 400 square feet per detector spacing and shall be connected to the building and site fire alarm system.

c. Support Building. The Support Building shall have a local fire alarm system meeting the requirements of NFPA No. 72A and shall transmit signals to the site central system at the CMS.

The following types of manual and automatic fire alarm initiating devices (as applicable) shall be connected to the building fire alarm system and site central fire alarm system:

- o Manual fire alarm boxes
- o Sprinkler system water flow alarm switch
- o Smoke detectors
- o Halon 1301 discharge and trouble alarms (computer and CMR only)

Manual fire alarm boxes shall be provided at each building pedestrian exit door and in corridors so that the travel distance from any point in the building to a manual fire alarm box shall not exceed 100 feet. Manual fire alarm boxes shall be wired in series and connected to both the building and site central fire alarm systems.

The building ventilation fire alarm system when actuated shall sound the fire alarm tone and activate the building ventilation system for non-recirculation.

Sprinkler systems shall be connected to the building fire alarm system and to the site central fire alarm system.

The Halon 1301 system shall be connected to the building fire alarm system and to the site central fire alarm system.

The discharge of the Halon 1301 shall shut off all equipment and ventilation power to the protected areas. Manual switches located at area exits shall be provided to activate the Halon 1301 system. There shall be no time delay associated with the manual activation of the Halon 1301 system. The Halon 1301 system shall also be activated automatically by cross-zoned ionization and photoelectric type smoke detectors. Halon control system shall have battery power back-up.

Smoke detectors shall be provided on approximately 250 square feet per detector spacing both below the raised floor and at the ceiling of the computer and central monitoring area. Detectors on the two zones shall be located on a staggered pattern. There will be a total of eight zones of smoke detectors, as follows:

2 cross zoned circuits below the computer room floor.
2 cross zoned circuits at the ceiling of the computer room.
2 cross zoned circuits below the monitoring room floor.
2 cross zoned circuits at the ceiling of the monitoring room.

Upon activation of any one detector in the first zone, the building fire alarm system shall be energized, and a signal shall be sent to the central monitoring room. The computer and central monitoring ventilation system shall be shut down and all door closers activated.

Upon activation of a smoke detector in the second zone of the cross-zone circuit, the fire alarm system shall initiate the Halon 1301 extinguishing system and kill power to the equipment in the protected area.

The site central alarm system is located in the central monitoring room. A computer readout and display shall be provided in this area, and the system shall be programmed to receive alarms related to fire and fire protection system equipment and emergency response.

d. Underground. The Underground Area shall have an independent local fire alarm system that transmits signals via a local fire panel to the Central Monitoring System (CMS) in the Support Building. Primary service to the fire alarm system is obtained from dual high voltage feeders, see Chapter 4.

e. Exhaust Filter Building. The Exhaust Filter Building fire detection and alarm system requirements are similar to those of the Waste Handling Building described in section 5.b. of this chapter.

f. Water Pumphouse and Yard Fire Water System. The fire pumps and water storage tanks shall be constantly monitored. The mandatory and advisory provisions of NFPA No. 20, No. 22, No. 30, and No. 37 shall be considered the minimum requirements. Fire alarm signals from the fire pump controllers, water flow switch, and manual pull box shall be connected to the site fire alarm system.

g. Warehouse and Shops Building. Manual Fire Alarm Boxes shall be located at each pedestrian exit door.

h. Guard and Security Building. The fire detection and alarm system associated with this building shall be similar to the system for the warehouse and shops building.

The building fire alarm system when actuated shall sound the fire alarm tone and send a signal to the site central fire alarm system.

The sprinkler system water flow alarm switches shall be connected to the building fire alarm system and to the site central fire alarm system.

Manual Fire Alarm Boxes shall be wired in series and connected to both the building and site central fire alarm systems.

The electrical equipment in this building shall be designed in accordance with the National Electric Code, NFPA No. 70.

APPENDIX

APPLICABLE DOCUMENTS

1.	DOE 5480.1a	-	Chapter 5, "Safety of Nuclear Facilities"
2.	DOE 5480.1a	-	Chapter 11, "Requirements for Radiation Protection"
3.	UL	-	Underwriters Laboratories Fire Protection Equipment List
4.	FM	-	Factory Mutual Research Corporation including Loss Prevention Data Sheets of FM and Factory Mutual System Approval Guide
5.	WASH-1245-1	-	Standards for Fire Protection of DOE
		-	Computer/Electronic Data Processing Systems
6.	ASTM E-119	-	Fire Test of Building Construction and Materials
7.	UBC	-	Uniform Building Codes of the International Conference of Building Officials
8.	NFPA	-	Fire Protection Handbook (14th Edition)
9.	NFPA	-	National Fire Codes of the National Fire Protection Association including:
	NFPA No. 10	-	Portable Fire Extinguishers
	NFPA No. 12A	-	Halon 1301 Systems

APPENDIX

APPLICABLE DOCUMENTS (continued)

NFPA No. 13	-	Sprinkler Systems, Installation
NFPA No. 14	-	Standpipe and Hose Systems
NFPA No. 20	-	Centrifugal Fire Pumps
NFPA No. 22	-	Water Tanks
NFPA No. 24	-	Outside Protection
NFPA No. 30	-	Flammable and Combustible Liquids Code
NFPA No. 37	-	Stationary Combustion Engines and Gas Turbines
NFPA No. 70	-	National Electrical Code
NFPA No. 72A	-	Local Protective Signaling Systems
NFPA No. 75	-	National Fire Protection Association "Standard for the Protection of Electronic Computer/Data Processing Equipment."
NFPA No. 101	-	Code for Safety to Life from Fire in Buildings and Structures.

10. DOE/EV-0043 - Standard on Fire Protection for Portable Structures