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U.S. DEPARTMENT OF ENERGY

WASTE ISOLATION PILOT PLANT

ENVIRONMENTAL MONITORING

SYSTEM DESIGN DESCRIPTION (SDD)

SDD-EM00

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For

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ENVIRONMENTAL MONITORING SYSTEM (ED00)
SYSTEM DESIGN DESCRIPTION (SDD)

CHANGE HISTORY

REV. NO.	DATE	PAGES/SECTIONS AFFECTED	APPROVED BY
0	12/91	Sections 1.0, 2.0, 3.0, & 3.3	ECP 1-EM91-172 ECO No. 5907
1	5/93	Revised Sect.1.0, 2.0, 3.3, & App Added Sect.3.0, 4.0, 5.0, 6.0, 7.0	ECP 1-EM91-172 ECO No. 6713
1	7/95	Revised Sections 3.2.5 & 3.6.5	ECP 2-EU94-015 ECO No. 7231
2	5/97	All Sections	ECP 1-EM95-050 ECO No. 7866 ECP 1-EM94-101 ECO No. 8258 ECP 1-EM96-047 ECO No. 8357 ECP 1-EM96-086 ECO No. 8437
3	10/99	All Sections - Complete Revision	ECP 1-EM94-102 ECO No. 8642 ECP 1-EM97-053 ECO No. 8706 ECP 1-GP97-111 ECO No. 8907 ECP 1-EM98-028 ECO No. 9549

REV. NO.	DATE	PAGES/SECTIONS AFFECTED	APPROVED BY
4	6/03	Revised Summary, Appendix A & B, Sections 1.2, 1.2.1, 2.3; removed Section 1.2.2.	ECO No. 10287
5	12/03	Revised Sections 1.2.1 & 2.1	ECO No. 10907
6	1/06	Revised Section 2.0	ECO No. 11320
7	2/06	Remove instrument numbers from the EM04 section of Appendix D.	ECO No. 11410
8	12/06	Addition of Disposal Room VOC monitoring per PMR 311, removal of the EEG aerosol sampler skids.	ECP 1-EM07-002 ECO 11679
9	8/09	Add information to Section 1.3.1.1 Delete Section 1.3.1.2, and 3.3.2 Changes to Appendix B and D for EM04	ECO No.12125
10	02/10	Add EM01, Radiation Effluent Monitoring System (REMS) to SDD EM00 from SDD RM00.	ECO 12495

SUMMARY

The Environmental Monitoring System is made up of four separate instrumentation subsystems which provide data both on the impact of the WIPP Facility on the surrounding environment and on the effect of naturally occurring climatic and seismic events on the operation of the Facility. Subsystem (EM01) which describes radiological effluent monitoring within the facility is separately described in the Radiological Monitoring System Design Description (RM00 SDD), and is not included in this document.

The content and function of these subsystems may be summarized as follows:

Radioactive Effluent Monitoring subsystem (EM01) monitors the exhaust from the waste Handling Building (WHB) and underground. Effluent Fixed Air Sampler (FAS) collect airborne particulates on filters for analysis of total radionuclides in the exhaust air.

The Air Quality Monitoring Subsystem (EM02) collects suspended airborne particulates for the analysis of total suspended particulates, gross alpha activity, gross beta activity, and specific radionuclides near the site boundary and at remote locations surrounding the site. Portable air monitors (gas and VOC) are also included in this system.

The Meteorological Monitoring Subsystem (EM03) monitors atmospheric pressure, temperature, precipitation, moisture, wind velocity, wind direction, and solar radiation in the vicinity of the Facility to record and monitor weather data to characterize the local environment at the site. These measurements are taken at a meteorological monitoring station.

Seismic Monitoring Subsystem (EM04) detects and records data for strong ground motion earthquakes (>0.01g acceleration) that occur in the vicinity of the site. It provides computer analysis of the recorded data to generate response spectra plots of the events in near-real time and provides initiation signals for the closure of tornado dampers in the Waste Handling Building ventilation systems following a design basis seismic event. Seismic monitoring equipment is located both on the surface and in the underground.

The Volatile Organic Compounds Monitoring Subsystem (EM05) monitors the presence of selected organic compounds in the vicinity of the underground waste storage areas to provide monitoring of gaseous emissions from the TRU waste.

1.0 SYSTEM DESCRIPTION

1.1 EM01 – Radioactive Effluent Monitoring System (RMES)

This subsystem consists of effluent fixed air sampler (FAS) skids monitoring for radioactive particulates in the exhaust air at four locations. The Radiation Measurement System (REMS) provides continuous air sampling capability for the determination of the radioactive status of the exhaust effluent air from the waste handling areas.

1.1.1 Station A

- **Station A skids are located in a building above the exhaust shaft elbow. Three 45-foot ten inch transport lines with a shrouded probe extend down into the shaft, 21 feet below the elbow. The probes are located approximately 2.5 feet from the shaft wall, with a circumferential spacing of approximately 90˚ between probes.**

- **Station A consists of three FAS skids (A1 – east, A2 – west, and A3 – south). They sample unfiltered air from the underground.**

- **A switch on each skid's power distribution box can be used to designate that skid as the primary skid of record or to serve as backup. The primary skid will shut down after 100 seconds, upon a shift-to-filtration, so as to better measure any radioactive particulate exhausted to the atmosphere.**

1.1.2 Station B

- **Station B is located at the end of the exhaust duct from 60,000 cfm (860) fans.**

- **The transport lines and shrouded probe extend up into the exhaust duct. The sample inlets for the probes are 69 feet from the discharge point of the closest 860 fan. This is the equivalent of 11.5 duct diameters. The probes are 9 feet (1.5 duct diameters) from the discharge elbow entrance plane. The probes are in a horizontal position at the duct centerline, two feet apart.**

- **Station B samples High-Efficiency Particulate Air (HEPA) filtered air from the mine through the Exhaust Filter building (EFB). Station B consists of two skids, each with its own shrouded probe and transport line.**

1.1.3 Station C

- **Station C is located on the second floor of the Waste Handling Building (WHB), in the mezzanine, below the filtered air exhaust duct. It uses an isokinetic rake to sample the HEPA filtered exhaust from the WHB. Isokinetic sampling rate is variable, depending on the flow rate of the exhaust air, so as to provide a representative sample.**

1.1.4 Station D

- **Station D is located underground at e300/S400. It samples unfiltered air from the waste panel area. A shrouded probe is extended into E300 exhaust air from the sampling skid located within an enclosure. Station D serves as backup to Station A.**

At Stations A, B, & D, air samples are drawn at a rate of 6 cfm, and then divided by a three-way splitter at a rate of 2 cfm, each with its own filter holder. Each REMS skid consists of filter assemblies, air flow regulators, vacuum pumps, sampling probes, power supplies, backup power and pressure instrumentation. Output signals for air flow and differential pressure are sent to the Central Monitoring System (CMS).

1.2 EM02 – Air Quality Monitoring (AQM) System

This subsystem is comprised of a number of stand alone aerosol samplers to collect airborne particulates on a replaceable filter. The filters are periodically replaced and the filter is analyzed for measurements of alpha and beta radiation, radionuclide determination, and total particulate loading. Each aerosol sampler is equipped with a run timer and an air flow control valve and flow monitor. The aerosol samplers are adjusted for about two cubic feet per minute of air flow and the filters are replaced every week.

- A minimum of six low volume fixed air samplers are provided at locations with the following features:

- A low volume fixed air sampler located at the northwest air quality sampling station, which is downwind of the prevailing wind direction.

- A low volume fixed air sampler located upwind of the prevailing wind direction and well away from the site to function as a background or control location.

- Low volume fixed air samplers located at a minimum of three locations, at or near locations of maximum predicted ground level radionuclide concentrations (averaged over a year) from site releases.

- Low volume air samplers located to monitor surrounding population centers.

Each enclosure is lockable to enable the responsible organization to safeguard and prevent entry to the enclosure by others. All necessary electrical power for the instrument enclosures is provided by WIPP.

The location of the environmental aerosol sampler instrument skids are listed in table below together with the organization responsible for monitoring and maintaining the instruments.

TABLE 1 – AEROSOL SAMPLER SKID LOCATIONS

Location	Skid No.	Use
Mills Ranch	105-Z-003	WIPP
Carlsbad	105-Z-004	WIPP
Smith Ranch	105-Z-006	WIPP
East of Site	105-Z-008	WIPP
South of Site	105-Z-009	WIPP
Far Field	105-Z-011	WIPP
S. E. Control	105-Z-014	WIPP

1.3 EM03 – Meteorological Monitoring System

The meteorological monitoring system provides equipment to monitor and record local weather data. The meteorological monitoring station is located at the WIPP site outside of the property protected area.

1.3.1 Meteorological Monitoring Station

The station is located approximately 500 meters northeast of the Exhaust shaft. The station consists of a meteorological monitoring panel, located in Building 472, and an instrumented 50 meter tower. The instruments are arranged as follows:

Parameter	Approximate Elevation
Air Temperature	2, 10, and 50 meter
Wind Speed	2, 10, and 50 meter
Wind Direction	2, 10, and 50 meter
Precipitation	ground level
Relative Humidity	2 meter
Barometer Pressure	within 2 meter of ground level
Solar Radiation	within 2 meter of ground level

Each of the sensors is wired to the data logger mounted in the meteorological panel. The data logger transmits temperature, delta temperature (10 m-2 m, & 50 m-2 m), wind speed, wind direction, relative humidity, barometric pressure, precipitation and solar radiation signals to the Central Monitoring System (CMS) for display and historical storage.
The data logger also provides a local display of the meteorological parameters and calculates and stores 15 minute averages and daily maximums and minimums. The data logger can store more than four weeks of data onboard and has data transfer capability via a RS-232 serial port and a phone modem. This data storage and retrieval capability is provided as a backup to the CMS historical storage.

A tower elevator system is provided for raising the 10 and 50 meter sensors to the proper tower height and lowering the sensors to ground level for maintenance and servicing.

The temperature sensors use a precision composite thermistor as a sensing element. The temperature sensor is installed in a protective aspirated shield assembly that includes a fan and a loss of air flow detector. The shield assembly shields the sensor from direct and reflective solar radiation.

The fan is provided to ventilate the temperature sensor.

The wind speed sensor is a rotating, highly responsive, three cup anemometer which utilizes a photon coupled chopper to produce a pulse output with frequency proportional to wind speed. The rotating part of the outdoor anemometer is heated by a 20 watt heater to prevent ice formation. The heater is controlled by a thermostat.

The wind direction sensor consist of a counterbalanced lightweight vane attached to a shaft which is coupled to a precision, low torque, potentiometer. The rotating part of the wind direction vane assembly is heated by a 20 watt heater to prevent ice formation. The heater is controlled by a thermostat.

The precipitation instrument uses tipping buckets with an eight-inch funnel as a rain and snow gage to determine the amount of precipitation. Based on the area of the funnel top opening and the volume of the bucket, each tipping of a bucket is equivalent to 0.25 millimeter (0.01 inches) of precipitation. The precipitation gauge has an "altar" type wind screen to ensure proper collection of the precipitation when there are winds or updrafts, and thermostatically controlled electric heaters to allow measurement of frozen precipitation. The precipitation sensor is mounted at ground level 50 feet southeast of the meteorological tower.

The relative humidity sensor consists of a temperature compensated capacitive probe with a hygroscopic polymer dielectric. The relative humidity sensor is mounted in the same aspirated shield assembly as the 2 meter level air temperature sensor.

The barometric pressure instrument uses a piezoresitive sensor with an integral sealed preamplifier. The sensor is mounted in the junction box at the base of the 50 meter tower.

The solar radiation instrument uses a pyranometer to measure incoming Global Solar Radiation. As solar radiation passes through the earth's atmosphere, some of it is absorbed or diffused by air molecules, water vapor, aerosols, and clouds. The solar radiation that passes through directly to the earth's surface is called direct solar radiation. The direct component of sunlight and the diffused component together make up global solar radiation. The solar radiation sensor is mounted at ground level 50 feet southeast of the meteorological tower.

1.4 EM04 – Seismic Monitoring System

The seismic monitoring is performed at two locations at the WIPP site. One is on the surface near the Exhaust shaft and the other is 2150 feet underground on the floor of the mine within the shaft pillar area. The two monitoring areas utilize identical equipment, perform identical measurements, and are not interconnected in any way. The surface seismic monitoring station initiates closure of the tornado dampers in the Waste Handling Building ventilation system whereas the underground station performs no operational function.

Additional seismic monitoring information is available from the United States Geological Survey (USGS), and New Mexico Tech seismographs in the area. Geotechnical Engineering also has numerous ground motion sensors in the underground. These sources provide backup when a site seismic panel is unavailable or a seismic event is below detectable levels.

1.4.1 Surface Seismic Station

The electronics, signal conditioning equipment, computer, printer, and power supplies are located in the Seismic Monitoring Panel which is housed in Building 413A.

The seismic sensors are all located on a single concrete slab (Free Field Station) approximately ten feet east of Building 413A.

The seismic monitoring stations function provides signals to other systems.

1.4.1.1 Seismic System

The strong motion accelerograph system consist of triaxial accelerometer sensors, triaxial seismic switch sensors, solid state recording systems, solid state playback computer systems, graphics printers, floating battery DC, and power supplies, Uninterruptible Power Supply (UPS) and interconnecting cables and connectors.

Site 120 V AC electrical power is brought into the Seismic Monitoring Panel and distributed to the Power Supply Unit for the Seismic Switch (DBE), the Record Panel, Alarm Panel and Triaxial Accelerometer Sensor, and to the UPS for the Playback and Analysis Computer and Printer.

The Record Panel and UPS contain their own batteries and battery chargers to ensure that these units and the remainder of the system will perform their seismic monitoring function during and following an earthquake even if site electrical power is lost.

The Record Panel supplies 12 V DC to the Seismic Switch Sensor mounted on the concrete slab outside of Building 413A. The front panel of the dual recorder chassis contains two sets of four indicator LEDs and an access door to the PCMCIA flash storage cards. An internally mounted follower relay provides a Design Basis Earthquake (DBE) alarm signal to the Central Monitoring System (CMS) and a control signal to the HV00 system for tornado damper closure.

The Seismic Switch Sensors, located on the outside concrete slab, are an over damped triaxial low frequency acceleration switch, with individually adjustable vertical (V), longitudinal (L), and transverse (T) detectors that send a relay contact signal to the Record Panel and follower relay whenever the ground acceleration in any one of the three orthogonal directions exceeds the DBE acceleration value (0.1g). A signal bandpass of 1-15 Hz was selected to preclude false triggering on non-seismic events, such as industrial operation, vehicular and other local vibrations.

The Record Panel which then provides 12 V DC continuously to the Triaxial Accelerometer Sensors located on the outdoor concrete slab. It includes a 12-volt battery and charger for uninterruptible power supply to the Record Panel. It also contains relays for Seismic Recording, Seismic Event, Loss of AC, and Loss of DC alarms which are connected to the Central Monitoring System for display and annunciation in the Central Monitoring Room.

The Triaxial Accelerometer Sensors consists of three independent, orthogonally mounted (longitudinal, vertical, and transverse), highly damped, force balance accelerometers. Each functions separately; supplying a voltage signal to the Record Panel which is proportional to the acceleration in its orthogonal direction.

The Record Panel has a digital triggering system which continuously monitors the signals sent by the Triaxial Accelerometer Sensors to the dual recorders. When the seismic motion exceeds the preprogrammed trigger threshold the recorder begins sampling data concurrently on three channels, one channel for each of the orthogonally mounted accelerometers, and stores it on a PCMCIA card. The recording continues for a reselected amount of time after the seismic activity drops and remains below the trigger threshold. The event data remains in memory until erased by the Administrator.

The Playback and Analysis Computer is an automatic data retrieval and analysis system based on a high speed, industrial quality, and rack mount computer. The computer remains on at all times monitoring the triggering activity of the Record Panel. When the Record Panel records an event and has detriggered the computer interrogates the Record Panel and downloads the event files to retrieve the time history data for automatic response spectrum analysis. If the preprogrammed response spectra values of 0.015g, over a frequency range of 1 to 50 hertz, are exceeded a signal is generated to activate the Seismic Event alarm light on the Alarm Panel and

audible and visual alarms in the Central Monitoring Room. The Playback and Analysis Computer is powered from an Uninterruptible Power Supply.

The System Printer automatically receives response spectra plots and an event summary from the Playback and Analysis Computer for immediate printout following a seismic event. The System Printer is powered from the same UPS that provides power to the Playback and Analysis Computer.

Past events are saved on the computer and may be retrieved for printing or copying to other media storage.

1.4.2 Underground (U/G) Seismic Station

The U/G seismic station is identical to and completely separate from the surface seismic station. The U/G free field station is located near the intersection of drift E-140 and S-90. The U/G Seismic Monitoring Panel is located in the S-90 crosscut near E-100. The U/G Power Supply Unit in the Seismic Monitoring Panel does not provide a signal for tornado damper closure in the HV00 system.

1.5 EM05 – VOC Monitoring System

The VOC monitoring system is provided to determine if there are airborne emissions of VOCs from the TRU waste emplaced in the underground. The VOC monitoring system consists of instrumentation and sampling canisters for taking air samples to be analyzed for target VOCs. The analysis of the samples is used to confirm there is no introduction or migration of target VOCs above the EPA health-based criteria into the ventilation exhaust air from the underground. The sampling canisters are taken to an offsite laboratory for performing gas chromatographic and mass spectrometer analysis measurements of the air sample constituents. The samples taken at these stations are also used to verify that concentrations of target VOCs does not exceed levels established in the RCRA Permit.

The VOC monitoring system is designed to collect samples to be analyzed for the following target organic compounds using the EPA Compendium Method TO-15 as guidance:

- 1,1-Dichloroethylene
- Carbon tetrachloride
- Methylene chloride
- Chloroform
- 1,1,2,2-Trichloroethane
- 1,1,1-Trichloroethane
- Chlorobenzene
- 1,2-Dichloroethane
- Toluene

The VOC monitoring system consists of the Repository and Disposal Room Monitoring Programs. Each VOC enclosure consists of a sampling system made up of one or two canister samplers. Canister enclosures are located outside the waste emplacement panel. The Repository Sampling stations are located at the entry (VOC-B) and exit (VOC-A) areas of the waste emplacement panel. The Disposal Room sampling heads are located at the inlet and outlet of each room within the waste emplacement panel, except Room 1, which does not have an inlet side sampler. There is at least one VOC enclosure at each waste emplacement panel.

There are two VOC Repository monitoring stations located in the underground. The VOC-B monitoring system located in the TRU waste disposal area air inlet drift is used to measure the background concentrations of target VOCs in the ambient inlet air. The VOC-A monitoring system located in the outlet drift air stream of the TRU waste disposal area is used similarly to take samples of the outlet air for analysis. VOC-A monitors the outlet air for potential releases of target VOCs. An increase in the VOC concentrations detected at VOC-A over VOC-B represents the amount of VOCs being emitted from the TRU waste disposal area.

There are seven (7) Disposal Room VOC sampling sets (inlet/outlet sampler heads and tubing) located at each waste emplacement panel, one for each Room, starting with Panel 3. Equipment numbers are assigned per Room, and sampling sets become active once waste emplacement has begun in the associated room, remaining active until panel closure activities commence. Valves are installed on the sample tubing so that one sampler can service multiple Rooms, including both the inlet and outlet of the disposal rooms. The samples that are taken monitor the air for potential releases of target VOCs. An increase in the VOC concentrations detected in the outlet sample over the inlet sample represents the amount of VOCs being emitted from the TRU waste disposal room.

The VOC monitoring systems sample the inlet and outlet ambient air of the TRU waste disposal area. Each station employs the same equipment and includes an enclosure, sampling system, and tubing.

The enclosures are designed to minimize the entry of dirt or salt particulates and provide shelter from falling salt rock. The enclosure is key-lockable for chain-of-custody procedures. The tubing penetrations to the enclosures are sealed with non-toxic sealants to prevent entry of salt dust. A current monitoring device is mounted in the enclosure for the vacuum pump motor. Each enclosure has an electric receptacle 120 volts, single phase AC power service.

The sampling system for ambient air sampling consists of a primary sampler to direct the air sample into 6 liter SUMMA passivated canisters. The sampling system is portable and is periodically removed and replaced with a newly cleaned and certified sampling system. The basic components for the sampling system are: Vacuum Pump; Pump head pressure gage; Flow controller and indicator; Solenoid-operated valves; Electronic relay timer; Sample vacuum/pressure gage; Needle valve; Sampling canisters; Tubing.

The vacuum pump is capable of pulling a sample of ambient air at a nominal rate of 3 liters per minute.

The flow controller can be adjusted so the flow rate into one or two sample canisters can be set between 0 to 100 milliliters per minute while bleeding the remainder of the air to the atmosphere through the bleed vent port.

A pressure gage is provided to read the pressure supplied by the vacuum pump.

An electronic mass flow controller is used to control the flow of air to the sample canisters.

Four stainless steel solenoid operated valves are provided for each sampling system. Two solenoid valves are used to fill the sample canisters. A sample inlet solenoid valve allows gas to flow to the vacuum pump. A bleed port solenoid valve allows air to vent to the atmosphere.

The primary sampler is provided with an electronic timer with a set of relays. The timer/relays are used to activate the solenoid-operated valves and operate the vacuum pump on a preprogrammed schedule. The electronic timers include battery backup for memory retention and light emitting diodes for indicating when a given channel is in use. The timers are readily programmable and are capable of being automatically restarted after restoration of power following a power failure to complete the sampling cycle.

A sample vacuum/pressure gage is provided and mounted next to the pump head pressure gage on the front of the primary sampler panel. The sample vacuum/pressure gage has a range of 30 inch Hg to 30 psig to monitor the vacuum or pressure of the sample canisters.

One stainless steel needle valve is provided for the bleed port vent line. The needle valve is used for regulating the vacuum pump head pressure by controlling the release of air bypassed to the atmosphere via the bleed port vent when the bleed port solenoid valve is opened by the primary sampler electronic timer.

Manually operated stainless steel valves are provided for the sample canisters. The manually operated valves are used to isolate and disconnect the sampling canisters from the samplers when removing or replacing the canisters.

The sampling systems are capable of pressurizing evacuated canisters to a minimum of 15 psig. The air sample inlet is bent into an inverted U-shape to minimize the entry of dust and salt particulates.

Two removable filters are provided and placed in the air inlet vertical entry section of the tubing. Both filter assemblies are standard 47 mm diameter radiation assessment type filters and housings. The first filter through which the inlet air passes is used as a particulate filter to prevent dirt and salt airborne type of particulates entering and passing into the primary sampler. The second filter assembly is used as a standard

radiation assessment filter. Only filters that do not remove gases, fumes, or volatile organic compounds can be selected and used.

2.0 DESIGN REQUIREMENTS

The functional classifications are defined in the Documented Safety Analysis (DSA) and the General Plant Design Description (GPDD).

2.1 General

The operation of the Environmental Monitoring system shall comply with DOE Order 5480.4 with regard to Environmental and Safety requirements, and to DOE Orders 420.1B and 430.1B with regard to Design and Construction Criteria. It shall satisfy requirements of the Mine Safety and Health Administration Title 30 CFR, Part 57. The revision of these codes in effect at the time of design or design change shall apply.

Equipment assemblies and parts shall be commercially available, interchangeable, standard products to the maximum extent possible.

Electrical systems and equipment shall be in conformance with the National Electrical Code (NFPA 70), National Electrical Safety Code (ANSI C2), and applicable electrical standards.

Electrical and instrumentation equipment shall be suitable for operation from electrical power sources rated: 120 V AC ± 10% 60 Hz ± 2.2% 1-phase.

Environmental Monitoring System equipment located outdoors or underground shall be suitable for operation in the local environment.

The Environmental Monitoring System equipment shall be capable of continuous operation in the following range of ambient conditions:

SURFACE

Environmental Condition	Range
Altitude	3000 ft to 4000 ft
Temperature Extremes	-17° F to 120° F
Relative Humidity	1% to 99%
Airborne Dust (including salt)	up to 0.02 g/m^3
Wind Velocity	up to 110 mph
Precipitation Average annual	12 inches
24-hour Maximum	6 inches

UNDERGROUND

Environmental Condition	Range
Altitude	1000 ft to 2000 ft
Temperature Extremes	35° F to 110° F
Relative Humidity	0% to 20%

Airborne Dust (including salt)	up to 0.02 g/m^3
Wind Velocity	up to 20 mph

This requirement may be satisfied by the design of the equipment, by providing protective enclosures or by placing the equipment in locations with controlled environments where this is feasible.

2.2 EM01 – Radioactive Effluent Monitoring System (REMS)

The REMS shall provide a method for the measurement of airborne radioactive particulates in the exhaust effluent from the WHB and underground. It shall conform to the requirements specified in ANSI N13.1, and capable of continuous operation. Probes are located so as to acquire a representative sample of the effluent exhaust air.

Protective devices shall be provided to prevent damage to electronics, pumps, and accessories. Each skid shall be equipped with a backup power supply that will allow the skid to continue operating for at least 30 minutes, in the absence of AC power. Station A, Building 364, and instrumentation were built and tested to meet seismic qualifications.

Sampler filter material shall meet the following requirements:

- The filter shall be a membrane-type capable of withstanding a flow rate up to 3 cfm.
- The pore size shall be such that it retains a good particle collection efficiency, maintain a low pressure drop, and be compatible with the type of radiation being measured.
- The differential pressure across the filter shall not exceed 3 in Hg at nominal flow for a clean filter (not applicable to Station C).

Filter holder assembly shall meet the following requirements:

- The filter assembly shall be positioned so that the airflow to the filter is unimpeded.
- The filter holder shall have a corrosion resistant porous backing screen or plate.
- The filter holder shall be designed to insure a uniform position seal between the filter media and the filter holder.
- The filter assembly shall not reduce the active collection area of the filter by more than 15% and shall not cause any localized buildup of material on the filter.

Air flow regulation for the REMS shall meet the following requirements:

- The airflow regulator shall have an adjustable flow rate of 0.5 cfm to 3.0 cfm.
- The airflow regulator shall be capable of operating from a negative header pressure of at least 12 in. Hg.
- The airflow regulator shall maintain a constant flow rate +/-10% with a pressure drop across the filter of up to 10 in. Hg.
- A flow indicator shall be provided for each sample leg.
- An indicator for differential pressure across the filter shall be included.

2.3 EM02 – Air Quality Monitoring (AQM) System

The AQM system shall collect airborne particulates for the analysis of total suspended particulates, gross alpha activity, gross beta activity and specific radionuclides near the site boundary and at remote locations surrounding the site.

The samples collected from the air sampling stations shall be analyzed for total suspended particulates and for gross alpha and beta activity. If alpha and beta counts indicate that specific radionuclide determination is required, this shall be performed.

2.4 EM03 – Meteorological Monitoring System

The meteorological instruments at the 50 meter tower shall have the capability of being monitored and recorded locally and being transmitted to the Central Monitoring System for monitoring and data storage.

Instrumentation support booms shall be provided on the 50 meter tower to support the instrumentation at a minimum distance of two tower widths from the tower to minimize the influence of the tower on the measurements.

Lightning protection shall be provided to protect the meteorological instrumentation, sensors, and signal lines.

2.5 EM04 – Seismic Monitoring System

The Seismic Monitoring system provides the instrumentation and related signal conditioning and computer equipment required to monitor, record, and provide response spectra data for strong-motion (>0.01g acceleration) seismic events.

Seismic instrumentation is designed to meet the intent of ANSI/ANS 2.2. This satisfies the requirement for seismic monitoring per DOE Order 420.1B [Chapter IV, para. 3.d]

2.6 EM05 – VOC Monitoring System

Each ambient air VOC monitoring system shall provide the following:

- An inlet sample line to transport the sample from the sampling point to the sampler. Inlet sample lines shall have particulate filters.

- A sampler for pressurized representative sampling with standard six liter canisters. The sampler shall pull an air sample from the inlet sample line; direct a portion of that air into a canister, then release the remaining air back into the atmosphere. Repository Stations VOC-A and VOC-B shall have two-canister samplers. Disposal Room VOC Samplers have at least one (1) two-canister enclosure per waste emplacement panel.

- A programmable timer to automatically control pump operation and sample canister(s) selection.

- The sampler shall be capable of controlling the sample flow rate within ± 10% of the average flow rate in order to take a representative sample.

2.7 Codes and Standards

Listed below are the codes, standards, regulatory requirements, DOE orders, etc., to be applied to the system design, construction, and operation.

10 CFR 830,§A	"Nuclear Safety Management", "Quality Assurance Requirements"
29 CFR Part 1910	"Occupational Safety and Health Standards"
30 CFR Part 57	"Safety and Health Standards - Underground Metal and Nonmetal Mines"
40 CFR Part 61, Subpart H	National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities
40 CFR Part 191, Subpart A	Environmental Radiation Protection Standards for Management and disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes – Environmental Standards for Management and Storage
40 CFR Part 268	"EPA Land Disposal Restriction"
DOE Order 420.1B	Facility Safety
DOE Order 430.1B	Real Property Assessment Management
DOE Order 440.1A	Worker Protection Management for DOE Federal and Contractor Employees
DOE Order 450.1	Environmental Protection Program
DOE Order 5400.5	Radiation Protection of the Public and the Environment
DOE Order 5480.4	Environmental Protection, Safety, and Health

	Protection Standards
Federal Register, Vol. 55, No. 67 April 6, 1990	EPA Notice Proposing to Grant a Conditional Variance to the DOE Waste Isolation Pilot Plant (WIPP) from Land Disposal Restrictions
Federal Register, Vol. 55, No. 220 Nov. 14, 1990	EPA Conditional No-Migration Determination for the DOE Waste Isolation Pilot Plant (WIPP)
EPA, 1999	Compendium Method TO-15
MSHA 30 CFR 29, 57 & 75	Mine Safety and Health Administration
NFPA 70	National Electrical Code
NFPA 101	Life Safety Code
ANSI/ANS 2.2, 1988	Standard for Earthquake Instrumentation Criteria for Nuclear Power Plants
ANSI/ANS 2.5 1984	Standard for Determining Meteorological Information at Nuclear Power Sites
ANSI/HPS N13.1	Sampling and monitoring Releases of Airborne Radioactive substances from the Stacks and Ducts of Nuclear Facilities
ANSI C2-90	National Electrical Safety Code
ASME NQA-1	Quality Assurance Requirements for Nuclear Facilities
ASME NQA-2	Quality Assurance Requirements for Nuclear Facility Applications
ASME NQA-3	Quality Assurance Program Requirements for the Collection of Scientific and Technical Information for Site Characterization for High-Level Nuclear Waste Repositories
CAO-94-1012	Quality Assurance Program Document

3.0 OPERATIONAL INFORMATION

3.1 EM01 – Effluent Monitoring

Effluent monitoring skids are used to provide the confirmatory measurements necessary to verify that off-site dose limits have not been exceeded. Filters are changed on a regular basis to provide those measurements. All potential radioactive effluent release points are monitored.

Radiological Control (RadCon) is the operator for the effluent monitoring skids. If they are unable to collect samples from any of the skids at Stations A or B, RadCon may have to initiate a contingency plan to collect air samples via an alternate method and/or location.

3.1.1 Station A

At least one Station A skid will be operating during normal operations to provide the required confirmatory measurements. The skid that has been selected as primary will stop automatically, 100 seconds after a shift-to-filtration, so as to more accurately measure a release of radioactive particulates to the atmosphere through the 700 fans.

3.1.2 Station B

At least one Station B skid will be operating when underground exhaust air is diverted through the Exhaust Filter Building by a shift-to-filtration. The filters will be counted to verify that radioactive particulates have been released to the atmosphere after passing through the HEPA filters, exceeding the off-site dose limit.

3.1.3 Station C

Station C will be operating to sample the exhaust air from the WHB, to verify that radioactive particulates have not been released to the atmosphere, exceeding the off-site dose limit. All exhaust air from the WHB is passed through HEPA filtration.

3.1.4 Station D

Station D is operated on a continual basis, so that it will serve as backup for Station A, in case the ability to sample at Station A is compromised.

3.2 EM02 – Air Quality Monitoring

Operation of the air samplers is totally automatic except for periodic replacement of the particulate sample filter paper.

3.3 EM03 – Meteorological Monitoring

Normal operation of the meteorological monitoring instruments is totally automatic and requires no operator action.

3.4 EM04 – Seismic Monitoring

3.4.1 Seismic System

The system operates continuously and automatically. Surface Facility Operations and Underground Operations serve as the operators of their respective seismic panels. They are responsible for the performance of the quarterly functional test, as well as routine and off-normal operation.

When seismic activity at the site exceeds a predetermined ground acceleration level, operation of the Seismic Monitoring system takes place as follows:

- A simultaneous recording of the triaxial force balance accelerometer signals is initiated and a Seismic Recording event alarm signal is sent to the Central Monitoring System for display in the Central Monitoring Room.

- A near-real time analysis of the recorded seismic data is performed by the on-board system computer.

- Printouts of spectral acceleration plots for each of the orthogonally positioned sensors (north-south, east-west, and vertical) are provided, along with an event summary.

- A computer-generated Seismic Event alarm signal is sent to the Central Monitoring System when earthquake activity exceeds a preset level. The Seismic Event alarm signal activates audible and visual alarms in the Central Monitoring Room.

- A triaxial seismic switch sends a Design Basis Earthquake (DBE) alarm signal to the Central Monitoring System which activates audible and visual alarms in the Central Monitoring Room when earthquake activity exceeds a preset level. A signal is also transmitted for the closure of the tornado dampers in the Waste Handling Building ventilation system, by a DBE alarm from the surface seismic panel.

- An inspection of the structure of the WHB, Waste Hoist, and Station A shall be conducted following an earthquake with an acceleration of 0.015g or greater.

The seismic monitoring instrumentation includes functional test features to allow a simplified operator-initiated calibration check of the equipment.

3.5 EM05 – VOC Monitoring

VOC sampling systems are capable of taking up to two consecutive 24-hour integrated samples.

The VOC monitoring system is designed to operate continuously and unattended except when removing and replacing sample canisters, testing, maintenance, and calibration.

Each VOC sample-monitoring system has the following operational capabilities:

- A means of determining any loss of sampling time due to loss of power.
- The capability of being programmed for sampling times and for single or double (duplicate) samples to be taken.
- The capability of indicating the sample flow rate and adjustment of the sample flow rate.
- Local indication of which sample canister(s) is currently in service and the pump head pressure.
- Local control of which sample canister is in service.
- Calibration by the injection of test samples of the target analytes.

APPENDIX A - MAINTENANCE

EM01 – EFFLUENT MONITORING SYSTEM

Summary of Preventive Maintenance

Preventive Maintenance		
Equipment	**Time**	**Description**
Flow Control	1 Y	Calibrate and clean
Vacuum Pump	1Y 6 M	Calibration check and clean Replace vacuum pump filters
UPS	1Y	30 minute backup power check
Shrouded Probes	As needed	Clean, inspect, replace

EM02 – AIR QUALITY MONITORING SYSTEM

Summary Preventive Maintenance and In-Service Inspection

Preventive Maintenance			In-Service Inspection	
Equipment	Time	Description	Time	Description
Air Sampler	1 Y	clean/calibrate flow	1 M	observe flow

APPENDIX A - MAINTENANCE

EM03 – METEOROLOGICAL MONITORING SYSTEM

Summary Preventive Maintenance and In-Service Inspection

Preventive Maintenance			**In-Service Inspection**	
Equipment	Time	Description	Time	Description
cabinet	1 Y	clean	6 M	cleanliness
data logger	6 M	calibration		none
batteries	6 M 1 Y	capacity replace	6 M	visual/abnormalities
wind speed sensors	6 M 1 Y	calibration replace	6 M	bearings
wind direction sensors	6 M 1 Y	calibration replace	6 M	bearings
heaters		none	6 M	operation
air temperature sensors	6 M	calibration		none
humidity sensor	6 M	calibration		none
precipitation sensor	6 M	calibration	weekly	visual/cleanliness
barometric pressure sensor	6 M	calibration		none
aspirator (fan)	6 M	clean		none
solar radiation sensor	6 M	calibration	weekly	clean
tower		none	2 Y	guy wire tension corrosion & loose parts
elevator		none	6 M	visual/loose parts & oil

APPENDIX A - MAINTENANCE

EM04 – SEISMIC MONITORING SYSTEM

Summary of Maintenance and In-Service Inspection
Seismic Monitoring System

Preventive Maintenance			**In-Service Inspection**	
Equipment	Time	Description	Time	Description
Triaxial Accelerometer Sensor	1Y* 1 Y* 3 M	Replace Desiccant Center Masses Functional Test	3 M	Visual
Record Panel	3 Y 3 M	Battery Replace Functional Test	3 M	Visual
Playback and Analysis Computer and Printer	3 M	Functional Test	3 M 3 M	`Visual Check Paper
Uninterruptible Power Supply	3 Y	Battery Replace	3 M	Visual

* Complete calibration of all units should be performed every eighteen months, per vendor recommendation. However, to support the test of the closure function of the tornado dampers when a DBE alarm is received by the CMR, vendor calibration of the seismic system will be performed annually.

APPENDIX A - MAINTENANCE

EM05 – VOC Monitoring

Since the VOC monitoring equipment is located in the underground specific attention must be provided to periodically clean (vacuum) the enclosures housing the electronic equipment. All equipment will be checked for any obvious deficiencies (i.e. valve position, tubing connections, burned-out indicating lights, etc.). Table below provides a summary of the minimum recommended preventative maintenance that should be performed.

Preventative Maintenance VOC Monitoring System

Subsystem	Preventative Maintenance	Time
Sampling System	Clean and Certify	yearly

Each of the VOC monitoring equipments are periodically attended (twice a week or sooner) in order to remove filled sampling canisters and replace them with empty sampling canisters. The equipment will be physically examined at the time of removing and replacing the sampling canisters for any abnormalities and physical damage. Example of items that may require servicing are parts need to be replaced, instruments realigned or recalibrated, equipment cleaned, loose wiring connections tightened, etc. All noted observations will be recorded in a log maintained at each of the VOC monitoring equipment stations.

Since the samplers are regularly replaced (every 3 months) with replacement units which are certified clean, the system is checked and aligned for operation at this time. The calibration of the VOC pump discharge pressure gage and sample pressure gages are performed when the sampler is removed for cleaning and certification. Thus, the monitoring equipment receive a continuous in-service type of inspection.

Environmental Monitoring System maintenance is performed in accordance with site procedures and the vendor's instruction manuals on file in the Engineering File Room.

APPENDIX B - INTERFACES

Interfacing System

The interfacing systems are divided into primary and secondary systems as defined below:

Primary System	The primary system in an interface is the system that required the functions and services or support provided by others at the specific interface so that the primary system can satisfy required design criteria
Secondary System	The secondary system in an interface is the system which provides the functions and services or support required by others at the specific interface so that the primary system can satisfy the required design criteria.

Primary System Interfacing

System EM00 is the primary system in interfaces with system listed below:

System	Title
AU00	Underground Facility and Equipment
CF00-GC00	Plant Bldg, Facilities & Misc. Equipment
GC00	Plant Bldg. Facilities & Misc. Equipment
CM00	Plant Monitoring and Communication System
ED00	Electrical System (Surface and Underground)
HV00	Heating, Ventilation, and air Conditioning System
VU00	Underground Ventilation
WH00	Waste Handling System

Secondary System Interfacing

System EM00 is the secondary system in interfaces with the systems listed below:

System	Title
HV00	Heating, Ventilation and Air Conditioning System

System Interfaces

The Environmental Monitoring system EM00 requires services, facilities, and/or space for housing equipment from the U/G Facility and Equipment System (AU00), General Civil and Structural System (GC00), Central Monitoring System (CM00), Waste Handling System (WH00), Underground Ventilation (VU00), and Electrical Distribution System (ED00). EM00 provides services required by the Heating, Ventilation, and Air Conditioning System (HV00). Listed below is a summary of the interfaces for the EM00 system.

APPENDIX B - INTERFACES

EM01 Effluent Monitoring System

Primary Interface

AU00	**Provides space to house the U/G Effluent Monitoring Station D at S400 and E300.**
CF00	**Provides structures to house Effluent Monitoring Stations A (Bldg. 364), B (Bldg. 365), and C (second floor of WHB)**
CM00	**Provides display and recording of air flow and differential pressure for all Effluent Monitoring Stations.** **Provides auto-stop signal to Station A primary skid during a shift-to-filtration.**
ED00	**Provides 120 VAC, single-phase power to Effluent Monitoring Stations.**
HV00	**Provides the exhaust airstream from CH/RH waste handling areas in the WHB and the lab area of the Support Building to be monitored by Station C. The sample rate is isokinetic and depends on the exhaust air flow rate from the WHB.**
VU00	**Provides mine exhaust airstream t be monitored by Effluent Monitoring Stations A, B, and D.**

Secondary Interface

HV00	Provides environmental controls to buildings housing the Effluent Monitoring Stations A, B, and C.

EM02 – Air Quality Monitoring

Primary Interface

GC00	Provides space for the air quality monitoring equipment in the Far Field atmospheric monitoring shed. (Building 471)
ED00	Provides 120 volt, single phase ac power for the air quality monitoring equipment in the atmospheric monitoring shed (Building 471)
WH00	Provides space to setup portable air monitors and carrier gas (cylinders and tubing)

Secondary Interface

There are no secondary interfaces.

APPENDIX B - INTERFACES

EM03 – Meteorological Monitoring

Primary Interface

GC00	Provides a 50 meter tower and space for the northeast station meteorological monitoring equipment in the meteorological instrument Building 472
CM00	Provides display and historical storage of the northeast meteorological station readout data.
ED00	Provides 120 volt, single phase ac power for the northeast station meteorological monitoring equipment on the 50 meter tower and in the meteorological instrument Building 472

Secondary Interface

There are no secondary interfaces.

EM04 – Seismic Monitoring

GC00	Provides space for the surface seismic monitoring electronic equipment in Building 413A and a free field station (concrete slab) near Building 413A for mounting the seismic sensors.
AU00	Provides a space for the underground (U/G) seismic monitoring electronic equipment in crosscut S-90 near E-100 and a free field station (concrete slab) in drift E-140 (between crosscuts S-90 and N-150).
CM00	Provides a surface and an U/G Seismic Recording alarm indication. Provides a surface and U/G Seismic Event alarm indication. Provides a surface and U/G Design Basis Earthquake alarm indication.
ED00	Provides 120 volts, single phase power for the seismic monitoring electronic equipment in Building 113A and in the U/G in crosscut S-90 near E-100.

Secondary Interface

HV00	The surface Seismic Switch provides relay contacts to initiate closure of the tornado dampers in the Waste Handling Building for a DBE or larger seismic event.

APPENDIX B - INTERFACES
EM05 – VOC Monitoring

AU00	Provides space for the following: • VOC-A equipment U/G at approximately E-300/S-1300 • VOC-B equipment U/G at approximately E-300/S-1950 • Disposal Room VOC equipment U/G at active waste emplacement panel
ED00	Provides 120 volt, single phase ac power for the following: • VOC-A equipment in U/G drift S-1300 • VOC-B equipment in U/G drift S-1950 • Disposal Room VOC equipment U/G at active waste emplacement panel
VU00	Provides mine ventilation flow rates and mine weather conditions for the calculation of VOC samples.

APPENDIX C – OPERATING LIMITS

EM01 – Effluent Monitoring System

The system is designated to operate in the range of ambient conditions as stated in the general requirements section for the surface structures and underground. Sample collection is designed for operation in the full exhaust air flow paths.

EM02 - Air Quality Monitoring

System Limitation

The following component ambient operating limits as specified by the manufacturer are listed in table below.

Ambient Temperature Design Limits

Components	Operating
Air Sampler	-30^0C to 75^0C

EM03 - Meteorological Monitoring

System Limitations

The component ambient operating limits as specified by the manufacturer are listed in table below.

Ambient Temperature and Humidity Equipment Design Limits

Component	Temperature	Humidity
Data Logger	-4˚ F to 122˚ F	10 -90%
Wind Speed Sensor	-40˚ F to 140˚ F	0 - 100%
Wind Direction Sensor	-40˚ F to 140˚ F	0 - 100%
Temperature Sensor	-22˚ F to 122˚ F	0 - 100%
Humidity Sensor	-40˚ F to 140˚ F	0 - 100%
Precipitation Sensor	-20˚ F to 122˚ F	0 - 100%
Pressure Sensor	-20˚ F to 122˚ F	0 - 100%
Solar Radiation Sensor	-4˚ F to 104˚ F	0 - 100%

APPENDIX C – OPERATING LIMITS

EM04 – Seismic Monitoring System

Ambient Temperature/Humidity Design Limits

Component	Temperature ˚ F	Humidity %
Triaxial Accelerometer Sensor	0 to 160	0-100
Peak Acceleration Recorder	-40 to 185	0-100
Response Spectrum Recorder	-40 to 185	0-100
Playback and Analysis Computer, Printer, and UPS	60 to 90	0-80
Record Panel	30 to 130	0-80

EM05 - VOC Monitoring

The system is designed to operate in the range of ambient conditions as stated in the general requirements section for the underground.

APPENDIX D – SYSTEM INSTRUMENTATION

EM01 – Effluent Monitoring System

The Effluent Monitoring System provides instrumentation with the following characteristics:

INSTRUMENT	RANGE	ACCURACY
Flow Control Valve	0.5 to 3.0 cfm	+/- 10%
Differential Pressure	0 to 10 in. Hg	+/- 10%

EM02 - Air Quality Monitoring System

Total suspended particulates (TSP) are routinely measured from particulate samples collected by commercially available low-volume continuous air samplers.

Instrument Requirements

Instrument	Set Point	Accuracy	Set Point
Aerosol Sampler	N/A	N/A	N/A

EM03 - Meteorological Monitoring System

The Meteorological Monitoring System provides monitoring instrumentation with the following characteristics:

PARAMETER	MEASURING RANGE
Ambient Air Temperature	-30 to +50˚C ± 0.5˚C
Temperature Difference	-5 to +15˚C ± 0.1˚C (relative accuracy with respect to other temperature loops)
Barometric Pressure	600 to 1100 mb ± 4 mb
Precipitation	0 to 25.5 mm ± 10% of observed (automatically resets at 25.5 mm)
Wind Speed	0 to 50 m/s ± 0.2 m/s, for speeds < 4.5 m/s ± 0.2 m/s ± 5% of observed for speeds > 4.5 m/s
Wind Direction	0 to 360 ˚ ± 5 ˚
Relative Humidity	0 to 100% RH ± 2.0% RH
Solar Radiation	0 to 1500 w/m^2 ± 5% of observed

APPENDIX D – SYSTEM INSTRUMENTATION

EM04 – Seismic Monitoring System

The Seismic Monitoring System provides monitoring instrumentation with the following characteristics:

TRIAXIAL ACCELEROMETER SENSORS	
Instrument Nos.	413A-TAS-004-001, 413A-TAS-004-002 (Station A) 534-TAS-003-001, 534-TAS-003-002 (U/G E-140)
Type	Kinemetrics, models FBA-3 & FBA 23, Triaxial Force Balance Accelerometer
Full-scale Range	± 1.0g
Natural Frequency	50 Hz
Bandwidth	Dc to 50 Hz (3 db points)
Damping	70% critical
Operating Temperature Range	0˚ F to 160˚F (-20˚ C to 70˚ C)
Output (Full-scale)	± 2.5 V into 50,000 ohms
Zero Offset	Less than 25 mV
Cross-axis Sensitivity	Less than 3% g/g
Linearity (70˚ F)	Less than 1% of full-scale
Noise (0 to 50 Hz)	Less than ± 2.5 mV
Noise (0 to 10,000 Hz)	Less than ± 2.5 V
Dynamic Range	100 db from 0.0 to 50 Hz
Temperature effect (Zero Drift & Sensitivity)	Less than 2% of full-scale
Supply voltage	-12V dc and + 12 V dc
Turn-on Time	Operational within 0.1 sec. after power applied
Calibration Check	Provision when electrical commands are applied to produce damping and natural frequency outputs
STRONG MOTION ACCELEROGRAPH RECORD AND ALARM PANELS	
Instrument Nos.	413A-SRU-004-001 (Station A) 534-SRU-003-001 (U/G S-90)
Type	Kinemetrics, Model Condor, Accelerograph
RECORDING SYSTEM CHARACTERISTICS	
Type	Condor Accelerograph with one record panel containing two triaxial 18-bit recorders and an alarm panel
Sample Rate	200 samples per second (sps) per channel
Number of Channels	Three to each recorder (total = 6)
Frequency Response	Dc 0 to 80 Hz
Resolution	18 bits
Trigger	Bandwidth 0.1 to 12.5 Hz
Pre-event Memory	Selectable
Post-event Hold	Selectable

APPENDIX D – SYSTEM INSTRUMENTATION

Storage Medium	PCMCIA Card
Capacity	16 Mbyte
Dynamic Range	108 db @ 200 sps
Seismic Recording Event Indicator	LED (Light Emitting Diode)
Seismic Recording Event Relay	DPDT rated at 5A for 28 V dc or 115 Vac
Seismic Event (OBE) Indicator	LED
Seismic Event (OBE) Relay	DPDT rated at 5A for 28 V dc or 115 Vac
Loss of DC Relay	DPDT rated at 5A for 28 V dc or 115 Vac
Loss of AC Relay	DPDT rated at 5A for 28 V dc or 115 Vac
POWER SUPPLY	Two internal 6.5 amp-hour rechargeable 12 V batteries Internal battery charger, operating from 115 V ac Power consumption, 100 mA at 12 V dc Polarity reversal protection, fuses and TransZorbs
STRONG MOTION ACCELEROGRAPH PLAYBACK SYSTEM AND UNINTERRUPTIBLE POWER SUPPLY	
Instrument Nos.	413A-SPA-004-001 (Station A) 534-SPA-003-001 (U/G S-90)
Equipment Nos.	41P-UPS03/001 (Station A) 53P-UPS03/001 (U/G S-90)
Type	Kinemetrics, Condor Playback and Analysis System and Uninterruptible Power Supply
PLAYBACK AND ANALYSIS SYSTEM	
Computer	Rack-mounted Industrial Quality PC 1 Gybtes RAM, LED Color Monitor and Retractable Alphanumeric Keyboard, and RS-232 Interface
Software	Automatic OBE/CAV, Windows XP-bases for Condor
Graphics Printer	Rack-mounted Hewlett Packard Ink Jet Printer
POWER SUPPLY	Rack-mounted Uninterruptible Power Supply, operating from 115 V AC, provides 30 minutes of 115 V AC backup power to Computer and Printer

APPENDIX D – SYSTEM INSTRUMENTATION

INSTRUMENT REQUIREMENTS

Instrument	Range	Accuracy	Set Point
Triaxial Accelerometer Sensor	0 to 1.0 g	± 5% At Full Scale	N/A
	0 to 50.0 H_z	Changing Linearly to ± 1.5 % of Full Scale at 0.01 g.	

APPENDIX D – SYSTEM INSTRUMENTATION

EM05 – VOC Monitoring System

INSTRUMENT REQUIREMENTS

Repository and Disposal Room VOC Instrumentation					
Instrument	Range	Accuracy (1)	Operator Set Points		
Pump Pressure Gage	0-30 psig	± 1.5 psig (±5%)	20 ±2 psig		
Sample Flow	0-100 SCCM	± 5% of full scale	Sample Time (hrs)	Flow Rate Set Point (sccm)	±
			2	76.8	7.7
			4	38.4	3.8
			6	25.6	2.6
			8	19.2	1.9
			10	15.6	1.5
			12	12.8	1.3
			14	11.0	1.1
			16	9.6	1.0
			18	8.5	0.9
			20	7.7	0.8
			22	7.0	0.7
			24	6.4	0.6
Sample Vacuum/ Pressure gage	-30"Hg to 30 psig	± 1.5 psig ± 1.5 in Hg ± 5% full scale for both vacuum & pressure	N/A		

(1) Accuracy based on Bureau of Standards

APPENDIX E – ALARMS AND SETPOINTS

EM01 – Effluent Monitoring System

Stations A, B, and D have a low flow alarm for each skid when total air flow drops 10% of full scale.

EM02 – Air Quality Monitoring System

There are no setpoints, alarms, or interlocks employed in the air quality monitoring system.

Portable air monitors have various setpoints and alarms as appropriate to application of the instrument. Generally, these are determined by Industrial Hygiene.

EM03 - Meteorological Monitoring System

There are no set points, alarms, or interlocks employed in the meteorological monitoring system except for the loss of air flow alarm for the air temperature sensors and local and remote power failure alarms for loss of 115 V AC power to the meteorological panel and terminal box.

If aspirating air flow is lost on any of the three sets of air temperature sensor assemblies mounted on the 50 meter tower (2, 10, and 50 meter level) an alarm signal is sent to the CMR (system CM00). Alarm signals are also sent to the CMR on loss of 115 V AC to the meteorological panel and terminal box.

EM04 - Seismic Monitoring System

The following three adjustable setpoints and alarms are provided for surface and for U/G.

1) 0.008g : Setpoint for the Seismic Recording alarm. This initiates the recording of the triaxial seismic accelerometers and provides local and CMR alarms.

2) 0.015g : Setpoint for the Seismic Event alarm. This provides local and CMR alarms.

3) 0.10g : Setpoint for the Design Basis Earthquake alarm. This initiates tornado damper closure (surface seismic station only) and provides local and CMR alarms.

APPENDIX E – ALARMS AND SETPOINTS

EM05 – VOC Monitoring System

INSTRUMENT SETPOINTS AND ALARMS

Function	Range	Set Point			Alarm
Pump head pressure	0 to 30 psig	20±2 psig			none
Sample flow	0 to 100 SCCM	Sample Time (hrs)	Flow Rate Set Point (sccm)	±	none
		2	76.8	7.7	
		4	38.4	3.8	
		6	25.6	2.6	
		8	19.2	1.9	
		10	15.6	1.5	
		12	12.8	1.3	
		14	11.0	1.1	
		16	9.6	1.0	
		18	8.5	0.9	
		20	7.7	0.8	
		22	7.0	0.7	
		24	6.4	0.6	
Sample vacuum pressure	-30 in Hg to +30 psig	N/A			none