DOE F 1325.8

United States Government **Department of Energy**

memorandum

Carlsbad Field Office
Carlsbad, New Mexico 88221

DATE: NOV 0 1 2007

REPLY TO ATTN OF: CBFO:OSO:RF:KJB:07-0565:UFC4700

SUBJECT: Evaluation of WIPP Ventilation Systems in Response to Defense Nuclear Facilities Safety Board Recommendation 2004-2, Final Reports

TO: James M. Owendoff, Chief Operations Officer for Environmental Management

In response to a memorandum for distribution dated March 30, 2007, from Inés Triay to DOE Field Managers, the Carlsbad Field Office (CBFO) has prepared final reports in accordance with *DNFSB 2004-2 Ventilation System Evaluation Guidance* (VSEG) to support the Office of Environmental Management's (EM) response to Recommendation 2004-2. The attachments are final reports that include the requested information for the Waste Isolation Pilot Plant (WIPP) ventilation systems. The specific systems are listed below:

- Surface Waste Handling Building (WHB) Confinement Ventilation System (CVS) Supporting Contact-Handled (CH) Waste Disposal Operations – System Designation CH CVS 411 HV01,
- Surface WHB CVS Supporting Remote-Handled (RH) Waste Disposal Operations – System Designation RH CVS 411 HV02,
- Underground Ventilation CVS Supporting CH Waste Disposal Operations – System Designation CH UG CVS VU01
- Underground Ventilation CVS Supporting RH Waste Disposal Operations – System Designation RH UG CVS VU01.

WIPP Site evaluation teams utilized the VSEG Independent Review Panel (IRP) functional classification criteria for system evaluations. Also, evaluations were performed utilizing the WIPP CH waste disposal operations documented safety analysis (DSA), *DOE/WIPP-95-2065, Revision 10, November 2006,* and the RH waste disposal operations DSA, *DOE/WIPP-06-3174, Revision 0, March 2006.*

The tables included in each attached final report identify how the VSEG evaluation criteria are met for the four listed WIPP Site CVSs. The system evaluations contained in the reports do not identify any "gaps" between the installed systems' functional design and performance expectations.

If you have any questions or comments regarding this material, please contact me at (505) 234-7300 or Mr. Vernon Daub at (505) 234-7208.

David C. Moody
Manager

Attachments

cc w/attachments:

V. Daub, CBFO	*ED
G. Basabilvazo, CBFO	ED
G. Scott, CBFO	ED
R. Farrell, CBFO	ED
D. Galbraith, CBFO	ED
M. Oliver, CBFO	ED
F. Sharif, WTS	ED
D. Busche, WTS	ED
R. Elmore, WTS	ED
CBFO M & RC	

*ED denotes Electronic Distribution

DOE Waste Isolation Pilot Plant

Contact Handled Surface Confinement Ventilation System 411 HV01

Ventilation System Evaluation

Revision 0, October 25, 2007

Review and Approval Page

Site Lead:

Richard Farrell	___Signature on File_____	Date: ___________

Evaluation Team Members:

Curtis A. Chester	___Signature on File_____	Date: ___________
Randy D. Elmore	___Signature on File_____	Date: ___________
John J. Garcia	___Signature on File_____	Date: ___________

DOE Field Office Manager:

Dave Moody	___Signature on File_____	Date: ___________

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Definitions

Safety Class.

Safety Class (SC) systems structures and components (SSCs) are those whose preventive or mitigative function is necessary to keep radiological material exposure to the public below the off-site evaluation guideline, which is 25 rem (roentgen equivalent man) total effective dose equivalent. The dose estimates to be compared to it are those received by a hypothetical maximally exposed off-site individual at the site boundary.

Safety Significant.

SSCs not designated as SC, but whose preventive or mitigative function is a major contributor to defense in depth (DiD) and/or worker safety as determined from hazards analysis. Safety Significant (SS) SSC designations based on worker safety are limited to those whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposure to workers.

Waste Isolation Pilot Plant (WIPP) procedure WP 09-CN3023, *WIPP Functional Classification for Design*, Rev. 7 identifies greater than 100 rem to the worker as the consequence for requiring consideration for functionally classifying an SSC as SS.

Abbreviations and Acronyms

CH – Contact Handled

Ci – Curie

CMR – Central Monitoring Room

CMS – Central Monitoring System

CVS – Confinement Ventilation System

DBE – Design Basis Earth Quake

DBT – Design Basis Tornado

DiD – Defense in Depth

DSA – Documented Safety Analysis

EG – Evaluation Guideline (25 rem TEDE to the maximally-exposed offsite individual as defined in DOE-STD-3009-94)

FET – Facility Evaluation Team as defined in the VSEG

HEPA – High Efficiency Particulate Air

IRP – Independent Review Panel as defined in the VSEG

PDD – Pressure Differential Damper

PE-Ci – Plutonium Equivalent Curies

PISA – Potentially Inadequate Safety Analysis

Pu-239 – Plutonium 239

rem – roentgen equivalent man

RH – Remote Handled

SC – Safety Class

SS – Safety Significant

SSCs – Systems, Structures and Components

SWB – Standard Waste Box

TEDE – Total Effective Dose Equivalent

TDOP – Ten Drum Over Pack

VSEG – Department of Energy, Deliverables 8.5.4 and 8.7 of Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems*

WIPP – Waste Isolation Pilot Plant

Executive Summary:

The Waste Isolation Pilot Plant (WIPP) site is a low level repository for radioactive waste. Waste is characterized and shipped to WIPP in packages for disposal in the repository. The container that the waste is packaged in prior to loading into transportation containers (road casks) provides primary containment. There is no planned normal operation at WIPP that allow for waste to be present external to the waste package container primary containment. The waste container packages that are used for disposal are removed from the transportation containers (road casks) in the Waste Handling Building (WHB). From the time the packages are removed until they are placed in the repository, the packages are contained within facilities and structures with active confinement ventilation systems.

Contact Handled (CH) surface waste handling operations are performed in the CH portion of the WHB. The CH Confinement Ventilation System (CVS) 411 HV01 provides the active CVS for the CH surface waste handling operations. This system is not credited in the site Documented Safety Analysis (DSA) analyzed accident scenarios to control hazardous release. The evaluated CVS performs a Defense in Depth (DiD) function for the WIPP site. WIPP is a Hazard Category 2 facility. The facility evaluation team (FET) used the independent review panel (IRP) directed functional classification criteria for Safety Significant (SS). Based on the evaluation criteria, the system evaluation did not reveal any “gaps” in the installed system’s functional design or performance expectations. The installed system’s functional design and performance expectations is commensurate with the identified site mission of receiving prepackaged and characterized waste and emplacing the waste in the waste container packages in which the waste is received on site. During the evaluation of the systems functional design and performance expectations against the evaluation criteria and the facility DSA, there was no discovery of a potentially inadequate safety analysis (PISA).

Introduction

Facility Overview

The WIPP is located in Eddy County in southeastern New Mexico. The WIPP is located in an area of low population density with no industrial, commercial, institutional, recreational or residential structures within the WIPP Site Boundary.

The WIPP is designed to receive and handle 500,000 cubic feet per year (ft^3/yr) (14,160 cubic meters per year [m^3/yr]) CH waste and 10,000 ft3/yr (283 m^3/yr) RH waste. The WIPP facility is designed to have a disposal capacity for TRU waste of 6.2 million ft^3 (175,600 m^3). The WIPP facility has sufficient capacity to handle the 250,000 ft^3 (7,080 m^3) of RH waste. The WIPP is divided into surface structures, shafts, and subsurface structures

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The WIPP surface structures accommodate the personnel, equipment, and support services required for the receipt, preparation, and transfer of waste from the surface to the underground. The primary surface operations at the WIPP are conducted in the WHB, which is divided into the CH waste handling area, the RH waste handling area, and support areas. The CH waste handling area includes the entrance airlocks, CH bay, a shielded storage room, and CH support facilities. Vertical shafts, including the waste shaft, the salt handling shaft, the exhaust shaft, and the air intake shaft, extend from the surface to the underground horizon. The waste shaft is located between the CH and RH areas in the WHB.

The WIPP underground consists of the waste disposal area, construction area, north area, and the waste shaft station area. The CH and RH waste disposal area is a 100 acre area on a horizon located 2,150 feet beneath the surface in a deep, bedded salt formation.

CH waste is disposed of in the rooms and panel entries of each room. CH waste arrives to the WIPP in drum assemblies, SWBs, or TDOPs. Drum assemblies and SWBs are stacked three high, and may be intermixed within rows and columns. TDOPs are placed on the bottom row. Four-packs of 85-gallon drums and three-packs of 100-gallon drums are placed on top of assemblies of the same type or placed on the top row for stability.

The hazard classification category was determined in accordance with DOE-STD-1027-92. The material at risk for the determination of the categorization was defined as the maximum radiological contents of a single 55-gallon drum of CH waste at 80 plutonium-239 equivalent curies (PE-Ci). Since this inventory exceeds the Hazard Category 2 minimum threshold of 56 Ci for Pu-239, the WIPP is categorized as a Hazard Category 2 facility.

Confinement Ventilation Strategy

The WIPP CVS are designed to provide confinement barriers utilizing high efficiency particulate air (HEPA) filtration to limit releases of airborne radioactive contaminants. Exhaust stacks are designed with elevated discharges and fresh air supply intakes located away from the exhaust vents. The ventilation systems provide pressure differentials that are maintained between building interior zones and the outside environment. The WHB ventilation systems continuously filter the exhaust air from waste handling areas to reduce the potential for release of radioactive effluents to the environment. Airlocks for ventilation differential pressure control are electrically interlocked and are provided in the following locations:

- At entrances to potentially contaminated areas to maintain a static barrier
- Between areas of large pressure differences to provide a pressure transition and to eliminate high air velocity
- Between areas where pressure differentials must be maintained
- To minimize air movement from the WHB to the waste shaft

The ventilation systems include monitoring of the following operating parameters:

- Pressure drop across each pre-filter and HEPA filter bank
- Air flow rates at selected points
- Pressure differentials surrounding areas of high potential for contamination levels

Each supply air handling unit consists of filters, cooling coils, heating elements, fans with associated duct work, and controls to condition the supply air maintaining the design temperature during winter and summer. Fan operating status, filter bank pressure drops, and static pressure differentials can be monitored locally or in the CMR. Conditions that alarm in the CMR are excess filter pressure drop and loss of air flow. Instruments and system components are accessible for, and will be subject to, periodic testing and inspection during normal plant operation.

The WHB supply and exhaust fans are designed and interlocked to maintain building pressure negative with respect to atmospheric pressure and maintain the design air flow pattern. During normal operation, if the operating exhaust/supply fan fail, the corresponding supply/exhaust fan is stopped. The standby train is started automatically and can also be started manually.

The Station C effluent sampling system continuously samples the air discharged from the WHB exhaust vent downstream of HEPA filtration. Tornado dampers, constructed to withstand the design basis earthquake (DBE) and Design basis tornado (DBT), are installed in all heating ventilation and air conditioning inlet and exhaust openings in the WHB. In the event of a tornado, the WHB tornado dampers will automatically close to prevent the outward rush of air caused by a rapid drop in atmospheric pressure. Damper closure mitigates damage to HEPA filters from a potential high differential pressure.

The WHB exhaust fans and controls can be supplied by backup power in the event that normal power is interrupted. In case of an off-site power failure, the capability exists to selectively switch one exhaust fan to the backup power system.

The filtration system consists of prefilters and HEPA filters sized in accordance with design air flows utilizing industry standards for maximum efficiency. All nuclear grade HEPA filter banks are tested for conformance with ASME N510 (SDD HV00, Heating, Ventilation and Air Conditioning System).

The CH surface CVS equipment was installed in the WHB facility in the mid 1980's. Between 1998 and 2000, the pneumatic control system was replaced with a microprocessor based distributive control system. Constant volume terminal units were installed in the supply system to enhance the stability of the space pressure. The original design information is still maintained and available via site records.

Currently an air recirculation modification is in progress. This is not considered a major modification. Duct and dampers have been installed to allow air within specific zones to be recirculated. The related control system is not yet functional and is awaiting a window of opportunity for deployment. The recirculation modification is being installed in accordance with DOE-HDBK-1169-2003 guidance and recommendations. The recirculation modification has been evaluated and will not negatively impact system confinement capabilities or ALARA practices.

Major Modifications

The facility is not currently undergoing any major modifications that affect the ventilation system or its operation. There are future plans under consideration to make facility modifications to allow the shipment of larger volume rectangular waste containers. This facility modification will have very limited impact to the installed configuration of the CH surface CVS and even less impact on the features and operation of the CVS.

Functional Classification Assessment

The WIPP procedure WP 09-CN3023, WIPP Functional Classification for Design, is the site procedure used for functional classification.

Existing Classification

Based on site procedures the CH surface CVS of this evaluation is classified as a balance of plant system providing a DiD function. This CVS is not credited in the site DSA for providing a safety class or safety significant function.

Evaluation

The FET used the proceduralized site process, WP 09-CN3023, to evaluate the existing site functional classification of the CVS evaluated. Additionally, the FET reviewed the site procedure for compliance with DOE regulations and drivers to assess that the site procedure provides adequate assessment of functional classification for site systems.

The CH surface CVS was found to have the proper existing functional classification per WP 09-CN3023.

The procedure, WP 09-CN3023, was found to be inline with the DOE-STD-3009-94 guidance for functional classification. The FET did discover one typographical error in the procedure. The error is being corrected.

Summary

The existing facility functional classification is commensurate with the identified site mission of receiving prepackaged and characterized waste and emplacing the waste in the packages in which it was received, in the site repository.

System Evaluation

Identification of Gaps

The FET identified there were no gaps between the *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems* (VSEG) evaluation criteria and the installed system's functional design or performance expectations.

The FET used the IRP directed SS performance criteria for the evaluation in accordance with the guidance in section 5.1 of the VSEG. Section 5.1 identifies that all hazard category 2 nuclear facilities that do not challenge or exceed the evaluation guideline (EG) will utilize SS performance criteria as identified in Table 5-1 of the VSEG.

The evaluation verified all the VSEG established performance criteria for SS CVS systems were adequately met by the CVS. The criteria established to be mandatory for this evaluation were:

a. Materials of Construction should be appropriate for normal, abnormal and accident conditions.

b. Confinement ventilation systems shall have appropriate filtration to minimize release.
c. Provide system status instrumentation and/or alarms.
d. Interlock supply and exhaust fans to prevent positive pressure differential.
e. Post accident indication of filter break-through.
f. Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.
g. Control components should fail safe.
h. Administrative controls should be in place to protect confinement ventilation systems from barrier threatening events.
i. Design supports periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically.
j. Filter service life program should be established.
k. Failure of one component (equipment or control) shall not affect continuous operation.
l. Backup electrical power shall be provided to all critical instruments and equipment to operate and monitor the CVS.

The above listed criteria are required for the system to adequately provide mitigative DiD performance.

All other IRP established VSEG performance criteria, identified in Table 5-1 of the VSEG, were non-mandatory. The non-mandatory criteria were identified within the VSEG to be “applicable as required” or “credited by the facility DSA”. The facility DSA does not credit the CH surface CVS to prevent or control hazardous release in the accident analyses.

Gap Evaluation

The FET identified there were no gaps between the VSEG evaluation criteria and the installed system’s functional design or performance expectations, whether mandatory or non-mandatory.

Modifications and Upgrades

There are no required modifications or upgrade to the CH surface CVS since there are no gaps between the established performance criteria and the install as system’s functional design or performance expectations.

Conclusion

The FET performed an evaluation of the CH surface CVS. The result of the evaluation was a determination that the system’s installed design and performance expectations met the evaluation performance criteria established by the VSEG IRP for a Hazard Category 2 facility. There were no significant findings or proposed corrective actions as a result of this evaluation.

The FET did identify the opportunity to improve pressure differential damper (PDD) control characteristics and component reliability by the installation of additional controllers at specific PDDs. The identified item is not a mandated change and is recognized as opportunity for enhancement to be scheduled and processed based on site priorities.

References

ASME N510 — American Society of Mechanical Engineers, 1989, *Standard for Testing of Nuclear Air Cleaning Systems*, (formerly ANSI N510-1975, ANSI/ASME N510-1989)

CH DSA — DOE/WIPP-95-2065, REVISION 10, NOVEMBER 2006, Waste Isolation Pilot Plant Contact Handled (CH) Waste Documented Safety Analysis, with approved page changes CH-2007-01 and CH-2007-02, August 27, 2007

DOE-STD-3009-94 — DOE Standard Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses, with Change Notice No. 2, April 2002

DOE-STD-1027-92 — DOE Standard, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, with Change Notice No. 1, September 1997

DOE HDBK-1169-2003 — DOE Handbook, Nuclear Air Cleaning Handbook

RH DSA — DOE/WIPP-06-3174, REVISION 0, MARCH 2006, Waste Isolation Pilot Plant Remote Handled (RH) Waste Documented Safety Analysis, with page changes approved through August 28, 2007

SDD HV00 — U.S. Department of Energy, Waste Isolation Pilot Plant, Heating, Ventilation and Air Conditioning System, System Design Description (SDD), Rev. 10

WP 09-CN3023 — *WIPP Functional Classification for Design*, Rev. 7

Attachments

Facility Evaluation Team composition and biographical sketches

Attachment 1 – FET members' Personnel Profiles

Data Collection Table and supporting attachments

Attachment 2 – Data Collection Table

Table 4-3

Attachment 3 - Supporting Attachments

CH Surface CVS 411 HV01, Table 5-1 Ventilation System Performance Criteria and Evaluation Response

Summary Schedules for implementing upgrades

Not applicable – no identified "gaps" or required upgrades

Completed supporting evaluations and documentation

Not applicable.

Attachment 1

Field Evaluation Team Personal Profiles **Page**

Attachment 1

Personal Profile: **Richard F. Farrell**
Position: **Nuclear Safety Specialist**
U. S. DOE Carlsbad Field Office
(505) 234-8318

Summary:

1. Environmental, Safety, and Health (E,S&H) professional with over 30 years of diversified experience in nuclear and industrial safety, health physics, environmental/effluent monitoring, regulatory compliance related to state-of-the-art nuclear facilities, and mining and mineral extraction/ metallurgical processing.
2. Managed the development of the Waste Isolation Pilot Plant (WIPP) documented safety analysis (DSA) for contact-handled and remote-handled transuranic (CH/RH-TRU) waste disposal operations. Developed and the Department of Energy's (DOE) safety evaluation reports (SER) or approval bases associated with the WIPP safety basis.
3. Developed and managed the Radioactive Source Materials License compliance programs for a NRC licensed facility (an operating uranium mill/mine) including: radiological and industrial safety, ALARA, quality assurance, occupational health, and underground mine ventilation engineering and monitoring.

Experience:

U. S. Department of Energy; September 2007 - Present
Nuclear Safety Specialist Carlsbad Field Office (CBFO) Responsibilities include oversight and integration of CBFO/WIPP radiological and nuclear safety, occupational health, and nuclear safety management.
Safety Officer CBFO; August 2000 – September 2007 Responsibilities include oversight and integration of CBFO/WIPP industrial, radiological and nuclear safety, and occupational health.

U. S. Department of Energy; September 1992 - August 2000
Radiological Safety Manager Carlsbad Area Office (CAO) Responsibilities include oversight and management of CAO/WIPP radiological safety/control programs (10 CFR Part 835) and nuclear safety management (10 CFR Part 830).

Westinghouse Electric Corporation; April 1990 - September 1992
Senior Engineer at the Waste Isolation Pilot Plant Responsibilities include the management of interface activities with oversight and auditing groups, evaluation of applicable regulations and DOE orders, and support of audits of waste generator sites with regard to waste acceptance criteria.

Homestake Mining Company; 1977 - April 1990
(Nuclear Regulatory Licensed Uranium Milling and Mining)
Environmental Safety and Health Department On-Site Manage; 1983 - April 1990
Responsible for radiation safety/health programs as the radiation safety officer (RSO) for the Nuclear Regulatory Commission (NRC) licensed facility. Responsibilities included department administration, industrial safety/health, emergency management, RCRA compliance and hazardous waste management, CERCLA remediation and monitoring activities, occupational health and regulatory compliance.

Radiation Protection Administrator; 1980 - 1983 Responsibilities included management of the health physics, oand hazardous waste activities, training, environmental and effluent monitoring, and regulatory compliance. Served as the RSO for a NRC licensed facility.
Radiological Safety/Environmental Engineer; 1977 - 1980 Responsibilities included evaluation of radiological safety, health physics assessment, monitoring data, and the development of monitoring and emission control programs to assure compliance with occupational and environmental regulations.

Education:

B.S. - Chemistry major - biology minor, Northern Arizona University, 1975.
Twelve (12) semester hours of graduate level chemistry class work, and six (6) semester hours of graduate level radioactive waste management; University of New Mexico; 1981 and 1992, respectively.
Strong background in applied mathematics and statistics equivalent to a minor area of study [twenty (20) semester hours], Brigham Young University; 1993 - 1996.

Attachment 1

Personal Profile: **Curtis A. Chester**
Position: **Engineering Manager**
Integrated Waste Handling Engineering
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Chester is the Washington TRU Solutions manager of the Integrated Waste Handling Engineering (IWHE) group. IWHE is responsible for the technical ownership of all equipment used in the waste handling process, both Contact Handled and Remote Handled. Mr. Chester's staff consists of 17 engineers engaged in oversight of systems that include such diverse applications of engineering as robotics in waste processing, radiological monitoring systems, pumping and distributions systems for fire suppression, industrial material handling systems, facility structural integrity (including seismic and tornado loading) and confinement ventilation. The IWHE group is tasked with monitoring, maintaining, designing and planning the implementation of regulatory requirements associated with aspects of safety, environmental and radiological requirements for the site waste handling process. As manager of the IWHE group, Mr. Chester is responsible for administration of the proper oversight, review and approval of the actions implemented by the group.

Mr. Chester has participated in two successful Operational Readiness Reviews while at WIPP and was the lead engineer in the successful completion of the Remote Handled readiness review completed in January of 2007 including the system Start-up Testing and the system Line Management Assessment. Mr. Chester's experience and accomplishments in mechanical design, shop fabrication, procurement, engineering application of quality control and application of industrial process control make him uniquely suited for management of the IWHE group.

Professional History:

Manager / Integrated Waste Handling Engineering (1998 to present)
WGI/ Washington TRU solutions Carlsbad, New Mexico
Management of personnel employed in the development and implementation of strategies, resource allocations, baselines, and project execution plans for package handling equipment, system upgrades, and processes supporting the disposal of Defense Nuclear Waste. Successes and competence have been identified with a continuous progression of assignments from support engineer to engineering staff management.

Project Engineer / Staff Consultant (1993 to 1997)
Duke Engineering & Services Carlsbad, New Mexico
Provide design, analysis, and project management services to engineering and maintenance staff at the Waste Isolation Pilot Plant (WIPP).

Product Integrity Engineer/ Lead Manufacturing Engineer (1990 to 1993)
Martin Marietta Corporation Albuquerque, New Mexico
Develop and maintain process flow instructions and configuration management for multiple process lines. Conduct engineering analysis on mechanical structures and assemblies. Develop and implement quality, cost effective manufacturing practices regarding station layouts, sequence of operations, and tooling requirements.

Staff Engineer (1989-1990, 1993)

Attachment 1

Pharmacia SP Albuquerque, New Mexico
Perform engineering analysis on equipment. Develop equipment enhancements. Design and prototype special devices.

Education:

B.S. in Mechanical Engineering, **UNM Albuquerque, NM,** 1989

Publications:

"Final Results of the WIPP RH TRU Facility Shielding Analysis". 2002
"Exhaust Shaft Hydraulic Assessment Data Report". 1996
"Room Q Data Report: Test Borehole Data From December 7, 1993, through July 7, 1995". 1995

Attachment 1

Personal Profile: **Randy D. Elmore**
Position: **Cognizant System Engineer**
Confinement Ventilation Systems
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Elmore is an engineer with over twenty years of experience with HVAC systems used for environmental, commercial and industrial applications including medical isolation suites, industrial clean room and laboratory and confinement ventilation systems. Experience includes the design, installation, start-up and oversight of isolation environments established through both positive and negative pressure differentials. Design activities have included not only air and equipment side but pneumatic, electronic and microprocessor design, programming, and start-up. Ancillary experiences and skills include cost estimation, project management, budgeting and system and personnel management.

Professional History:

Washington TRU Solutions, LLC. Carlsbad, New Mexico, 2001 – present:

Simplex Time Recorder, Inc., Lubbock, Texas, West Texas Marketing and Management Representative, 1998 to 2000

CSG (Compliance Services Group), Lubbock, Texas, Project Manager, 1996 to 1998

Con-Tech (Control Technologies), Lubbock, Texas, Co-Founder and Principal, 1992 to 1996

David G. Halley & Co., Inc., Lubbock, Texas, Sales Engineer / Stockholder, 1986 to 1992

Texas Instruments, Abilene, Texas, Project Engineer, 1985 to 1986

Williams, Tippet, and Associates, Inc., Abilene, Texas, Design Engineer, 1984 to 1985

Shell Pipeline Corp., Hamlin, Texas, Roustabout / Relief Technician, 1980 to 1982

Education:

B.S. in Mechanical Engineering, **Texas Tech University,** 1984 (Magna Cum Laude)

Professional Organizations:

Academy of Mechanical Engineers, Texas Tech University (Faculty Advisory Council, inducted April 2004)

Attachment 1

Personal Profile: **John J. Garcia**
Position: **Senior Manager**
Deputy Engineering Manager
Washington TRU Solutions LLC
WIPP Site

Summary

Proven executive level manager experienced in strategic planning, Program Management, Operations and Engineering management and business/product development of state-of-the-art nuclear facilities. Twenty-five plus years of progressive management experience. Proven ability to build new organizations, reorganize troubled organizations and expand into additional markets. Innovative problem solver and effective communicator adept in delivering superior customer service and developing new business.

Professional Experience:

Washington TRU Solutions, LLC, Carlsbad, NM – 6/1988 to Present

Deputy Engineering Manager (01/05 to Present)

- Management responsibility for implementation/improvement/maintenance of the site engineering and Nuclear Safety Programs.

Safety, Health, Security and Technical Support (02/03 to 01/05)

- Responsible for establishing and maintaining facility safety and health programs. Accomplished over 2 million work hours without a lost workday.
- Responsible for approximately 60 + employees and budget of 10 million.

Deputy Assistant General Manager Operations and Chief Engineer (02/01 to 02/03)

- Responsible for all site engineering issues listed under Engineering Manager
- Deputy Assistant General Manager Operations responsible for 400+ employees and budget of $80 Million.

Engineering Manager (Westinghouse Waste Isolation Division – 1995 to 2001)

- Responsible for 100+ employees and annual budget of $22 million.
- Assisted General Manager in establishing strategic direction and policy for the division.

- Managed an integrated, multi-disciplined infrastructure including business systems, multi-disciplined engineering functions, facility construction and configuration management processes.
- Maintained Nuclear Regulatory Commission package compliance and maintenance, generator site interface, transportation planning and tracking, Waste Acceptance Criteria requirements generation, and designed and maintained the WIPP Waste Information System for the National TRU (Transuranic Waste) Program.

Successive Engineering Management Positions including Manager, Program Management (1988-1995)

- Responsible for 35+ employees and budgets in excess of $12 million in preparation for start-up of the facility.
- Managed the division's budgeting and scheduling work scope.
- Integrated program details to establish current year budgets and five year planning.
- Tracked division performance and provided division support for program planning of major DOE or division initiatives.

Westinghouse Hanford Company, Hanford, WA – 1972 to1988

Engineering Positions of increasing responsibility leading to Manager, Waste Package, Repository and Seals Analysis Section

- Directed activities of 18 engineers and scientists and a budget of $4.5 million.
- Oversaw performance of critical engineering analyses and development of computer code to support design verification for the section.
- Designed software analytical packages for evaluating geotechnical, mechanical, hydrological, and thermal performance of the facility.

Education

B. S. - Mechanical Engineering, University of Texas, El Paso

Additional Master's Level Engineering courses

National Institute for Learning: "The Project Management Certificate Course"

Fluent in English and Spanish

Confinement Ventilation Documented Safety Analysis Information											
Facility: CH Surface CVS 411 HV01			Hazard Category 2					Performance Expectation			
Bounding Accidents	Type Confinement		Doses Bounding unmitigated / mitigated	Confinement Ventilation System Classification			Function DSA 4.3.x.1 or 4.4.x.1	Functional Requirements	Performance Requirements	Compensatory Measures
	Active	Passive		SC	SS	DID				
(1-Fire) N/A	**X**		23.2 / N/A			**X**	N/A			Performance of Facility Evaluation did not revea any vulnerability . No Compensatory Measures required.
(2 -Explosion) N/A	**X**		> 25 rem / Prevented			**X**	N/A			Performance of Facility Evaluation did not revea any vulnerability . No Compensatory Measures required.
(3 _Loss of Containment / Confinement) N/A	**X**		3.1 / N/A			**X**	N/A			Performance of Facility Evaluation did not revea any vulnerability . No Compensatory Measures required.
(4 -Direct Radiological / Chemical Exposure)	**N/A**		N/A			N/A	N/A			None Identified Based on Risk
(5 -Nuclear Criticality)	**N/A**		N/A			N/A	N/A			Not credible for the WIPP due to WAC requirements/restrictions and established waste handling procedures/processes.
(6 -External Hazards) N/A	**X**		N/A			**X**	N/A			Frequency of an aircraft crash iinto the WHB is Beyond Extremely Unlikely
(7 -Natural Phenomena) N/A	**X**		23.2 rem / prevented			**X**	N/A			Performance of Facility Evaluation did not revea any vulnerability . No Compensatory Measures required.

The identified Confinement Ventilation System provides Defense in Depth to accidents assoicated with operational and natural phenomenon events that could affect CH waste.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH Surface CVS 411 HV01**				IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
1	Pressure Differentials should be maintained between zones and atmosphere	Applies	Number of zones as credited by accident analysis to control hazardous release; demonstrate by use considering potential in-leakage	DOE-HDBK-1169 (2.2.9), ASHRAE Design Guide	The CVS is not credited in any analyzed accident scenario to control hazardous release. The CH ventilation is designed with different confinement zones established with cascading space pressure set points ,respective to atmosphere, established to control flow from areas of lower contamination to areas of higher contamination in accordance with guidance as established in DOE-HDBK-1169-2003, Chapter 2. Since all containers shipped to WIPP are certified to be free of external contamination and there is no plan to open the containers at WIPP, the DSA does not credit the confinement ventilation system for the prevention of release in any accident scenario.
2	Materials of Construction should be appropriate for normal, abnormal and accident conditions	Applies		DOE-HDBK-1169 (2.2.5), ASME AG-1	Provisions for accident and abnormal conditions have been considered in the construction of the CVS. Fans ducts and dampers are constructed of galvanized steel which is adequate based on the constituents that can reasonably be expected to exist in the air stream. The HEPA filter housings are fabricated of Stainless Steel to minimize the potential of corrosion on filter/housing interface surfaces and to aid in contamination clean-up should an accidental release occur. There is no reasonable expectation of corrosive fumes, spontaneous combustion, or explosion during processing. Waste is shipped to WIPP in sealed containers with regulated constituents regulated by the Waste Acceptance Criteria (WAC).
3	Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain integrity	Applies	As required by accident analysis to prevent accident release	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	The DSA does not credit the CVS in any prevention of accidental release. The system is designed to withstand anticipated normal, abnormal and accident conditions and maintain integrity. Explosions that would cause overpressure of the CVS is not a credible scenario based on the site processes and in place administrative controls (primarily the WAC). Fire propagation from a source to the filters is not a credible scenario based on the amount of combustibles present in the building, the non combustible materials of construction of the building and the non-combustible materials of construction of the CVS components (combustibles protected by the administratively controlled combustible loading program). Both Design Base Earthquake and Tornado considerations have been accounted for in the construction and operation of the WHB.
4	Confinement ventilation systems shall have appropriate filtration to minimize release	Applies	Address: 1) Type of filter (e.g., HEPA, sand, sintered metal); 2) Filter Sizing (flow capacity and pressure drop); 3) Decontamination Factor vs. accident analysis assumptions	ASME AG-1, DOE HDBK-1169 (2.2.1)	Filter quantity and size has been selected based on maximum flow rate through the HEPA media of 5 ft/min. The decontamination factor is of no consequence to the DSA since CVS is not credited for any accident scenarios. The waste handling process is relatively clean with minimal air borne particulate generated. Equipment is electrically powered and there are no machining or chemical process used that would generate significant amounts of particulate or gases. The single stage of prefilters is appropriate to prolong the life to the HEPA filters.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH Surface CVS 411 HV01**				IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
5	Provide system status instrumentation and/or alarms	Applies	Address key information to ensure system operability (e.g., system delta-P, filter pressure drop)	ASME AG-1, DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	The HEPA filter housings are fitted with pressure monitoring capability for each HEPA filter bank with both local and remote readout. Remote alarms indicate a pressure drop that exceeds set point (alarm function is provided in the Central Monitoring Room (CMR)). WIPP has implemented a very conservative pressure drop limit of 5 inches w.g. for HEPA filter dp. Additional instrumentation provides local and remote indication of air flow with remote alarm in the CMR.
6	Interlock supply and exhaust fans to prevent positive pressure differential	Applies		DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	Automated controls provide for interlock between the Supply Air units and the associated Exhaust Air Fans. On the loss of an exhaust fan, the associated supply air fan is shut down. Redundant exhaust air fan and supply air unit is automatically started when the lead ventilation set is "shut-down".
7	Post accident indication of filter break-through	Applies	Instrumentation supports post-accident planning and response	TECH-34	Local and remote indication of HEPA filter differential pressures and proof of air flow provide indication of filter status for post-accident planning and response.
8	Reliability of control system to maintain confinement function under normal, abnormal and accident conditions	Applies	Address, for example, impacts of potential common mode failures from events that would require active confinement function.	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	The confinement ventilation system is comprised of two completely separate "trains" of equipment providing supply air flow, exhaust air flow and confinement filtration (supply fan, exhaust fan and HEPA filter unit). Each "train" is controlled through independent controls and instrumentation. Automated controls can be manually overridden at the local control panel. Common equipment such as space supply flow control and space pressure control via variable exhaust are designed to fail safe providing active confinement ventilation.
9	Control components should fail safe	Applies		DOE-HDBK-1169 (2.4)	Automated controls are designed to fail safe. Pressure Differential Dampers fail open. Local supply flow controls fail in the last controlled position. Exhaust system failure stops associated supply air. Failure of one "train" causes the automatic start of the back-up "train". Train controls can be manually overridden.
10	Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement	Applies	As required by the accident analysis for existing facilities, must address protection of fiber media	DOE-HDBK-1169 (10.1), DOE-STD-1066	The DSA does not credit the HEPA filtration in the prevention of the release of hazardous materials. Fire propagation from a source to the filters is not a credible scenario based on the non combustible materials of construction of the building, the non-combustible materials of construction of the CVS components and the amount of combustibles present in the building (building loading of combustibles protected by the administratively controlled combustible loading program).
11	Confinement ventilation systems should not propagate the spread of fire	Applies	As required by the accident analysis for existing facilities, Address fire barriers, fire damper arrangements	DOE-HDBK-1169 (10.1), DOE-STD-1066	The building zones, the construction of the building and the site processes are such that fire dampers and fire suppression within the HEPA filter units is not required. Fans ducts and dampers are constructed of galvanized steel which is adequate based on the constituents that can reasonably be expected to exist in the air stream. Filters and filter housing are constructed of materials such as to not propagate the spread of a fire.

	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
	Table 5-1 Ventilation System Performance Criteria **Facility: CH Surface CVS 411 HV01**			IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS	
12	Confinement ventilation systems should safely withstand earthquakes	Applies	If the active CVS is not credited in a seismic accident condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any seismic impact on the CVS will be based on the current functional requirements in the DSA	ASME AG-1 AA, DOE O420.1B, DOE-HDBK-1169 (9.2)	The elements of the CVS credited during a seismic event are the seismic/tornado dampers. These dampers are designed and installed in a manner to protect ventilation penetrations of the building envelope during a seismic event (close on seismic event). The closing of the dampers provides for the maintenance of the secondary confinement boundary provided by the building envelope during a seismic event.
13	Confinement ventilation system should safely withstand tornado depressurization	Applies	If the active CVS is not credited in a tornado condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any tornado impact on the CVS will be based on the current functional requirements in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The elements of the CVS credited during a tornado event are the seismic/tornado dampers. These dampers are designed and installed in a manner to protect ventilation penetrations of the building envelope during a tornado event (close on event). The closing of the dampers provides for the prevention of the rapid depressurization, caused by a tornado, from damaging the confinement barrier provided by the HEPA filters. Rapid depressurization of the exhaust system could cause the filters to be "sucked" through the housing if not properly protected. The tornado dampers are designed to provide that protection.
14	Confinement ventilation system should safely withstand design wind effects on system performance	Applies	If the CVS is not credited in a wind condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any wind impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The DSA does not credit the confinement ventilation system in the event of high winds. The CVS supply, exhaust and filtration systems are housed within the Waste Handling Building and therefore protected from the effects of reasonably assumed high wind events.
15	Confinement ventilation system should withstand other NP events considered credible in the DSA where the CVS is credited	Applies	If the CVS is not credited for this event, there is no need to evaluate that performance and/or design attribute for the CVS. Any impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	There are no other natural phenomenon events identified in the DSA which credit the CVS to prevent the release of hazardous materials.
16	Administrative controls should be established to protect confinement ventilation systems from barrier threatening events	Applies	Ensure appropriately thought out response to external threat is defined (e.g., pre-fire plan)	DOE O420.1B	The DSA describes measures that are implemented to protect the facility and structures from credible barrier threatening events at the facility level. The CVS systems are not specifically identified, however the administrative controls that are instituted to protect the facility provide CVS protection.
17	Design supports the periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically	Applies	Ability to test for leakage per intent of N510	DOE-HDBK-1169 (2.3.8), ASME AG-1, ASME N510	WIPP utilizes a computerized history and maintenance planning system (CHAMPS) to track the performance and periodicity of confinement ventilation inspections and testing. System walk-downs are performed annually and aerosol penetration tests (in accordance with the intent of N510) are conducted on an annual basis per CHAMPS generated work orders.
18	Instrumentation required to support system operability is calibrated	Applies	Credited instrumentation should have specified calibration/surveillance requirements. Non-safety instrumentation should be calibrated as necessary to support system functionality.	DOE-HDBK-1169 (2.3.8)	No CVS instrumentation is credited in the DSA in the prevention of the release of hazardous materials in any accident scenario. WIPP utilizes the CHAMPS system and periodic maintenance work orders to generate and track the periodic calibration of instrumentation required to support the CVS operability.
19	Integrated system performance testing is specified and performed	Applies	required responses assumed in the accident analysis must be periodically confirmed including any time constraints	DOE-HDBK-1169 (2.3.8)	There are no CVS required responses in any DSA analyzed accident scenario.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH Surface CVS 411 HV01**				IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
20	Filter service life program should be established	Applies	Filter life (shelf life, service life, total life) expectancy should be determined. Consider filter environment, maximum delta-P, radiological loading, age, and potential chemical exposure.	DOE-STD-1169 (3.1 and Appendix C)	WIPP has instituted a filter service life program. Filters are being changed out to assure filters are no more than 10 years old. There is no significant source for potential chemical exposure, radiological exposure or other damaging environmental impacts to the filter media, housings or seals. WIPP has set a differential pressure limit of 5 inches water gauge across the filters. Filters are changed on age or filter pressure drop (which ever occurs first). Because the process and environment are so clean, WIPP has historically changed filters on age long before pressure drop became an issue.
21	Failure of one component (equipment or control) shall not affect continuous operation	Does Not Apply	Address potential failures (example failures-fan, back-up power supply, switchgear)	DOE O420.1B, Facility Safety, Chapter I, Sec. 3.b(8)	Although not applicable, continuous operation is supported through redundant equipment and fail safe configuration of common mode equipment. There is no single point failure in the CVS that will preclude continuous operation.
22	Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the CVS	Does Not Apply		DOE-HDBK-1169 (2.2.7)	Not applicable - see below
23	Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system	Applies		DOE-HDBK-1169 (2.2.7)	The confinement ventilation system is powered through switch gear such that on a loss of availability of commercial power, the CVS, system critical instrumentation and associated monitoring equipment can be powered from the site diesel generators.
24	Address any specific functional requirements for the CVS (beyond the scope of those above) credited in the DSA	Applies		10 CFR 830, Subpart B	There are no additional CVS requirements credited by the DSA that have not been previously covered.

DOE Waste Isolation Pilot Plant

Contact Handled Underground Confinement Ventilation System VU01

Ventilation System Evaluation

Revision 0, October 25, 2007

Review and Approval Page

Site Lead:

Richard Farrell	___Signature on File_____	Date: ___________

Evaluation Team Members:

Curtis A. Chester	___Signature on File_____	Date: ___________
Randy D. Elmore	___Signature on File_____	Date: ___________
John J. Garcia	___Signature on File_____	Date: ___________

DOE Field Office Manager:

Dave Moody	___Signature on File_____	Date: ___________

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Definitions

Safety Class.

Safety Class (SC) systems structures and components (SSCs) are those whose preventive or mitigative function is necessary to keep radiological material exposure to the public below the off-site evaluation guideline, which is 25 rem (roentgen equivalent man) total effective dose equivalent. The dose estimates to be compared to it are those received by a hypothetical maximally exposed off-site individual at the site boundary.

Safety Significant.

SSCs not designated as SC, but whose preventive or mitigative function is a major contributor to defense in depth (DiD) and/or worker safety as determined from hazards analysis. Safety Significant (SS) SSC designations based on worker safety are limited to those whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposure to workers.

Waste Isolation Pilot Plant (WIPP) procedure WP 09-CN3023, *WIPP Functional Classification for Design*, Rev. 7 identifies greater than 100 rem to the worker as the consequence for requiring consideration for functionally classifying an SSC as SS.

Abbreviations and Acronyms

ALARA – As Low as Reasonably Achievable

CH – Contact Handled

Ci – Curie

CMR – Central Monitoring Room

CMS – Central Monitoring System

CVS – Confinement Ventilation System

DBE – Design Basis Earth Quake

DBT – Design Basis Tornado

DiD – Defense in Depth

DSA – Documented Safety Analysis

EG – Evaluation Guideline (25 rem TEDE to the maximally-exposed offsite individual as defined in DOE-STD-3009-94)

FET – Facility Evaluation Team as defined in the VSEG

HEPA – High Efficiency Particulate Air

IRP – Independent Review Panel as defined in the VSEG

PDD – Pressure Differential Damper

PE-Ci – Plutonium Equivalent Curies

PISA – Potentially Inadequate Safety Analysis

Pu-239 – Plutonium 239

rem – roentgen equivalent man

RH – Remote Handled

SC – Safety Class

SS – Safety Significant

SSCs – Systems, Structures and Components

SWB – Standard Waste Box

TEDE – Total Effective Dose Equivalent

TDOP – Ten Drum Over Pack

UG – Underground

VSEG – Department of Energy, Deliverables 8.5.4 and 8.7 of Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems*

WIPP – Waste Isolation Pilot Plant

Executive Summary:

The Waste Isolation Pilot Plant (WIPP) site is a low level repository for radioactive waste. Waste is characterized and shipped to WIPP in packages for disposal in the repository. The container that the waste is packaged in prior to loading into transportation containers (road casks) provides primary containment. There is no planned normal operation at WIPP that allows for waste to be present external to the waste package container primary containment. The waste container packages that are used for disposal are removed from the transportation containers (road casks) in the Waste Handling Building (WHB). From the time the packages are removed until they are placed in the repository, the packages are contained within facilities and structures with active confinement ventilation systems.

The field evaluation team (FET) used the independent review panel (IRP) directed functional classification criteria for safety significant (SS). Based on the evaluation criteria, the confinement ventilation system (CVS) evaluation did not reveal any “gaps” in the installed system’s functional design or performance expectations. The installed system’s functional design and performance expectations is commensurate with the identified site mission of receiving prepackaged and characterized waste and emplacing the waste in the waste container packages in which the waste is received on site. During the evaluation of the systems functional design and performance expectations against the evaluation criteria and the facility Documented Safety Analysis (DSA), there was no discovery of a potentially inadequate safety analysis (PISA).

Introduction

Facility Overview

The WIPP is located in Eddy County in southeastern New Mexico. The WIPP is located in an area of low population density with no industrial, commercial, institutional, recreational or residential structures within the WIPP Site Boundary.

The WIPP is designed to receive and handle 500,000 cubic feet per year (ft^3/yr) (14,160 cubic meters per year [m^3/yr]) Contact Handled (CH) waste and 10,000 ft3/yr (283 m^3/yr) Remote Handled (RH) waste. The WIPP facility is designed to have a disposal capacity for TRU waste of 6.2 million ft^3 (175,600 m^3). The WIPP facility has sufficient capacity to handle the 250,000 ft^3 (7,080 m^3) of RH waste. The WIPP is divided into surface structures, shafts, and subsurface structures.

The WIPP surface structures accommodate the personnel, equipment, and support services required for the receipt, preparation, and transfer of waste from the surface to the underground (UG). Vertical shafts, including the waste shaft, the salt handling shaft, the exhaust shaft, and the air intake shaft, extend from the surface to the UG horizon. The waste shaft is located between the CH and RH areas in the WHB.

The WIPP UG consists of the waste disposal area, construction area, north area, and the waste shaft station area. The CH and RH waste disposal area is a 100 acre area on a horizon located 2,150 feet beneath the surface in a deep, bedded salt formation.

CH waste is disposed of in the rooms and panel entries of each room. CH waste arrives to the WIPP in drum assemblies, Standard Waste Boxes (SWBs), or Ten Drum Over-packs (TDOPs). Drum assemblies and SWBs are stacked three high, and may be intermixed within rows and columns. TDOPs are placed on the bottom row. Four-packs of 85-gallon drums and three-packs of 100-gallon drums are placed on top of assemblies of the same type or placed on the top row for stability.

The hazard classification category was determined in accordance with DOE-STD-1027-92. The material at risk for the determination of the categorization was defined as the maximum radiological contents of a single 55-gallon drum of CH waste at 80 plutonium-239 equivalent curies (PE-Ci). Since this inventory exceeds the Hazard Category 2 minimum threshold of 56 Ci for Pu-239, the WIPP is categorized as a Hazard Category 2 facility.

Confinement Ventilation Strategy

The UG ventilation system serves the WIPP UG to provide acceptable working conditions and a life-sustaining environment during normal operations and off normal events including waste handling accidents. All equipment and components of the CH UG CVS are located on the surface and provide ventilation to the UG through the mine exhaust shaft. In the event of a breach of waste containers, the UG ventilation system provides air flow away from the worker. Upon the detection of air borne radioactivity or the notification of a radiation control event, the ventilation system is either automatically or can be manually switched to provide high efficiency particulate air (HEPA) filtration of the mine exhaust.

The UG ventilation system is designed as an exhausting system that maintains the working environment below atmospheric pressure. The UG mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. UG ventilation is divided into four separate flow paths supporting the waste disposal area, the construction area, north area, and the waste shaft station. All four air circuits combine near the exhaust shaft, which acts as the common discharge from the underground. A pressure differential is maintained between the construction circuit and the waste disposal circuit to ensure that any leakage is towards the disposal circuit. The pressure differential is produced by the surface exhaust fans in conjunction with the underground air regulators. Pressure differentials across selected bulkheads between ventilation circuits are monitored from the Central Monitoring Room (CMR).

The UG ventilation system consists of six centrifugal exhaust fans (three main fans in the normal flow path and three smaller fans in the filtration flow path), two identical HEPA filter assemblies arranged in parallel, isolation and back draft dampers, a filter bypass arrangement, and associated ductwork. The main fans are used during normal operation to provide a nominal underground flow. During filtration operations only one filtration fan is in service and all other main and filtration fans are stopped and isolated. Any one of the three filtration fans is capable of delivering 100 percent of the design flow rate with the HEPA filters at their maximum pressure drop. The UG ventilation system is operated as follows:

- Normal Mode - During normal operation, five different levels of ventilation can be established to provide five different air flow quantities.
- Filtration Mode - This mode mitigates the consequences of a waste handling accident releasing radioactive contamination to the environment by providing a HEPA filtered air exhaust path from the underground and also reducing the air flow.

Filtration is activated automatically on a high radiation signal from one of the continuous air monitors in the exhaust of the active disposal room, or manually by the CMR operator, through the central monitoring system (CMS), when notified of a waste handling event underground. The operating status of the exhaust fans are displayed in the CMR and provisions to switch to filtration are provided. An alarm for excessive pressure drop across the filters is actuated at a predetermined level. Filter differential pressure is displayed locally and in the CMR. Instruments and system components are accessible for periodic testing and inspection during normal plant operation.

Under normal operating conditions, the ventilation system functions continuously. The UG ventilation system filtration fans can be connected to the backup power supply, one at a time, in the event that normal power is lost. Air is routed through the individual disposal rooms within a panel using UG bulkheads and air regulators.

Each HEPA filter assembly that serves the UG is equipped with two banks of prefilters and two banks of HEPA filters. All nuclear grade HEPA filter banks are tested for conformance with ASME N510.

The system was installed in stages starting in the mid 1980s. Originally the smaller exhaust filtration fans were installed. Two of the larger main fans were installed in the early 1990s with the third main fan installed in 1996 – 1997. The original design information is maintained and available at WIPP.

Major Modifications

The facility is not currently undergoing any major modifications that affect the ventilation system or its operation.

Functional Classification Assessment

The WIPP procedure WP 09-CN3023, WIPP Functional Classification for Design, is the site procedure used for functional classification.

Existing Classification

Based on site procedures the CH UG CVS of this evaluation is classified as a SS system. This CVS is credited in the site DSA for preventing prompt, significant radiological or chemical exposure to workers.

Evaluation

The FET used the proceduralized site process, WP 09-CN3023, to evaluate the existing site functional classification of the CVS evaluated. Additionally, the FET reviewed the site procedure for compliance with DOE regulations and drivers to assess that the site procedure provides adequate assessment of functional classification for site systems.

The CH UG CVS was found to have the proper existing functional classification per WP 09-CN3023.

The procedure, WP 09-CN3023, was found to be inline with the DOE-STD-3009-94 guidance for functional classification. The FET did discover one typographical error in the procedure. The typographical error is being corrected.

Summary

The existing facility CH UG CVS functional classification is appropriate. The system provides ventilation required for industrial safety issues and directs airflow away from the workers in various DSA analyzed accident scenarios.

System Evaluation

Identification of Gaps

The FET identified there were no gaps between the *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems* (VSEG) evaluation criteria and the installed system's functional design or performance expectations.

The FET used the IRP directed SS performance criteria for the evaluation in accordance with the guidance in section 5.1 of the document from the VSEG. Section 5.1 identifies that all hazard category 2 nuclear facilities that do not challenge or exceed the evaluation guideline (EG) will utilize SS performance criteria as identified in Table 5-1 of the VSEG.

The evaluation verified all the VSEG established performance criteria for SS CVS systems were adequately met by the CVS. The criteria established to be mandatory for this evaluation were:

a. Materials of Construction should be appropriate for normal, abnormal and accident conditions.
b. Confinement ventilation systems shall have appropriate filtration to minimize release.
c. Provide system status instrumentation and/or alarms.
d. Post accident indication of filter break-through.
e. Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.
f. Control components should fail safe.
g. Administrative controls should be in place to protect confinement ventilation systems from barrier threatening events.
h. Design supports periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically.
i. Filter service life program should be established.
j. Failure of one component (equipment or control) shall not affect continuous operation.
k. Backup electrical power shall be provided to all critical instruments and equipment to operate and monitor the CVS.

The above listed criteria are required for the system to adequately provide the DSA credited safety significant system function.

All other IRP established VSEG performance criteria, identified in Table 5-1 of the VSEG, were determined non-mandatory. The non-mandatory criteria were identified within the VSEG to be "applicable as required" or "credited by the facility DSA". The facility DSA does not credit the CH UG CVS to prevent or control hazardous release in the accident analyses.

Gap Evaluation

The FET identified there were no gaps between the VSEG evaluation criteria and the installed system's functional design or performance expectations, whether mandatory or non-mandatory.

Modifications and Upgrades

There are no required modifications or upgrade to the CH UG CVS since there are no gaps between the established performance criteria and the installed system's functional design or performance expectations.

Conclusion

The FET performed an evaluation of the CH UG CVS. The result of the evaluation was a determination that the system's installed design and performance expectations met the evaluation performance criteria established by the VSEG IRP for a Hazard Category 2 facility. There were no findings or proposed corrective actions as a result of this evaluation.

While there are no modifications or upgrades required, the system equipment is subject to a corrosive environment. There are corrosion and salt accumulations issues that will require attention for the life of the facility. These issues are being managed and continue to be managed through proper maintenance and equipment refurbishment.

References

ASME N510 — American Society of Mechanical Engineers, 1989, *Standard for Testing of Nuclear Air Cleaning Systems*, (formerly ANSI N510-1975, ANSI/ASME N510-1989)

CH DSA — DOE/WIPP-95-2065, REVISION 10, NOVEMBER 2006, Waste Isolation Pilot Plant Contact Handled (CH) Waste Documented Safety Analysis, with approved page changes CH-2007-01 and CH-2007-02, August 27, 2007

DOE-STD-3009-94 — DOE Standard Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses, with Change Notice No. 2, April 2002

DOE-STD-1027-92	DOE Standard, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, with Change Notice No. 1, September 1997
DOE HDBK-1169-2003	DOE Handbook, Nuclear Air Cleaning Handbook
RH DSA	DOE/WIPP-06-3174, REVISION 0, MARCH 2006, Waste Isolation Pilot Plant Remote Handled (RH) Waste Documented Safety Analysis, with page changes approved through August 28, 2007
SDD VU00	U.S. Department of Energy, Waste Isolation Pilot Plant, Underground Ventilation System Design Description, Rev. 12
WP 09-CN3023	*WIPP Functional Classification for Design*, Rev. 7

Attachments

Facility Evaluation Team composition and biographical sketches

Attachment 1 – FET members’ Personnel Profiles

Data Collection Table and supporting attachments

Attachment 2 – Data Collection Table

Table 4-3

Attachment 3 - Supporting Attachments

CH Underground CVS VU01, Table 5-1 Ventilation System Performance Criteria and Evaluation Response

Summary Schedules for implementing upgrades

Not applicable – no identified “gaps” or required upgrades

Completed supporting evaluations and documentation

Not applicable.

Attachment 1

Field Evaluation Team Personal Profiles **Page**

Attachment 1

Personal Profile: **Richard F. Farrell**
Position: **Nuclear Safety Specialist**
U. S. DOE Carlsbad Field Office
(505) 234-8318

<u>Summary</u>:

1. Environmental, Safety, and Health (E,S&H) professional with over 30 years of diversified experience in nuclear and industrial safety, health physics, environmental/effluent monitoring, regulatory compliance related to state-of-the-art nuclear facilities, and mining and mineral extraction/ metallurgical processing.
2. Managed the development of the Waste Isolation Pilot Plant (WIPP) documented safety analysis (DSA) for contact-handled and remote-handled transuranic (CH/RH-TRU) waste disposal operations. Developed and the Department of Energy's (DOE) safety evaluation reports (SER) or approval bases associated with the WIPP safety basis.
3. Developed and managed the Radioactive Source Materials License compliance programs for a NRC licensed facility (an operating uranium mill/mine) including: radiological and industrial safety, ALARA, quality assurance, occupational health, and underground mine ventilation engineering and monitoring.

<u>Experience</u>:

U. S. Department of Energy; September 2007 - Present
Nuclear Safety Specialist Carlsbad Field Office (CBFO) Responsibilities include oversight and integration of CBFO/WIPP radiological and nuclear safety, occupational health, and nuclear safety management.
Safety Officer CBFO; August 2000 – September 2007 Responsibilities include oversight and integration of CBFO/WIPP industrial, radiological and nuclear safety, and occupational health.

U. S. Department of Energy; September 1992 - August 2000
Radiological Safety Manager Carlsbad Area Office (CAO) Responsibilities include oversight and management of CAO/WIPP radiological safety/control programs (10 CFR Part 835) and nuclear safety management (10 CFR Part 830).

Westinghouse Electric Corporation; April 1990 - September 1992
Senior Engineer at the Waste Isolation Pilot Plant Responsibilities include the management of interface activities with oversight and auditing groups, evaluation of applicable regulations and DOE orders, and support of audits of waste generator sites with regard to waste acceptance criteria.

Homestake Mining Company; 1977 - April 1990
(Nuclear Regulatory Licensed Uranium Milling and Mining)
Environmental Safety and Health Department On-Site Manage; 1983 - April 1990
Responsible for radiation safety/health programs as the radiation safety officer (RSO) for the Nuclear Regulatory Commission (NRC) licensed facility. Responsibilities included department administration, industrial safety/health, emergency management, RCRA compliance and hazardous waste management, CERCLA remediation and monitoring activities, occupational health and regulatory compliance.

Attachment 1

Radiation Protection Administrator; 1980 - 1983 Responsibilities included management of the health physics, oand hazardous waste activities, training, environmental and effluent monitoring, and regulatory compliance. Served as the RSO for a NRC licensed facility.
Radiological Safety/Environmental Engineer; 1977 - 1980 Responsibilities included evaluation of radiological safety, health physics assessment, monitoring data, and the development of monitoring and emission control programs to assure compliance with occupational and environmental regulations.

Education:

B.S. - Chemistry major - biology minor, Northern Arizona University, 1975.
Twelve (12) semester hours of graduate level chemistry class work, and six (6) semester hours of graduate level radioactive waste management; University of New Mexico; 1981 and 1992, respectively.
Strong background in applied mathematics and statistics equivalent to a minor area of study [twenty (20) semester hours], Brigham Young University; 1993 - 1996.

Attachment 1

Personal Profile: **Curtis A. Chester**
Position: **Engineering Manager**
Integrated Waste Handling Engineering
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Chester is the Washington TRU Solutions manager of the Integrated Waste Handling Engineering (IWHE) group. IWHE is responsible for the technical ownership of all equipment used in the waste handling process, both Contact Handled and Remote Handled. Mr. Chester's staff consists of 17 engineers engaged in oversight of systems that include such diverse applications of engineering as robotics in waste processing, radiological monitoring systems, pumping and distributions systems for fire suppression, industrial material handling systems, facility structural integrity (including seismic and tornado loading) and confinement ventilation. The IWHE group is tasked with monitoring, maintaining, designing and planning the implementation of regulatory requirements associated with aspects of safety, environmental and radiological requirements for the site waste handling process. As manager of the IWHE group, Mr. Chester is responsible for administration of the proper oversight, review and approval of the actions implemented by the group.

Mr. Chester has participated in two successful Operational Readiness Reviews while at WIPP and was the lead engineer in the successful completion of the Remote Handled readiness review completed in January of 2007 including the system Start-up Testing and the system Line Management Assessment. Mr. Chester's experience and accomplishments in mechanical design, shop fabrication, procurement, engineering application of quality control and application of industrial process control make him uniquely suited for management of the IWHE group.

Professional History:

Manager / Integrated Waste Handling Engineering (1998 to present)
<u>WGI/ Washington TRU solutions</u> Carlsbad, New Mexico
Management of personnel employed in the development and implementation of strategies, resource allocations, baselines, and project execution plans for package handling equipment, system upgrades, and processes supporting the disposal of Defense Nuclear Waste. Successes and competence have been identified with a continuous progression of assignments from support engineer to engineering staff management.

Project Engineer / Staff Consultant (1993 to 1997)
<u>Duke Engineering & Services</u> Carlsbad, New Mexico
Provide design, analysis, and project management services to engineering and maintenance staff at the Waste Isolation Pilot Plant (WIPP).

Product Integrity Engineer/ Lead Manufacturing Engineer (1990 to 1993)
<u>Martin Marietta Corporation</u> Albuquerque, New Mexico
Develop and maintain process flow instructions and configuration management for multiple process lines. Conduct engineering analysis on mechanical structures and assemblies. Develop and implement quality, cost effective manufacturing practices regarding station layouts, sequence of operations, and tooling requirements.

Staff Engineer (1989-1990, 1993)

Attachment 1

Pharmacia SP Albuquerque, New Mexico
Perform engineering analysis on equipment. Develop equipment enhancements. Design and prototype special devices.

Education:

B.S. in Mechanical Engineering, **UNM Albuquerque, NM,** 1989

Publications:

"Final Results of the WIPP RH TRU Facility Shielding Analysis". 2002
"Exhaust Shaft Hydraulic Assessment Data Report". 1996
"Room Q Data Report: Test Borehole Data From December 7, 1993, through July 7, 1995". 1995

Attachment 1

Personal Profile: **Randy D. Elmore**
Position: **Cognizant System Engineer**
Confinement Ventilation Systems
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Elmore is an engineer with over twenty years of experience with HVAC systems used for environmental, commercial and industrial applications including medical isolation suites, industrial clean room and laboratory and confinement ventilation systems. Experience includes the design, installation, start-up and oversight of isolation environments established through both positive and negative pressure differentials. Design activities have included not only air and equipment side but pneumatic, electronic and microprocessor design, programming, and start-up. Ancillary experiences and skills include cost estimation, project management, budgeting and system and personnel management.

Professional History:

Washington TRU Solutions, LLC. Carlsbad, New Mexico, 2001 – present:

Simplex Time Recorder, Inc., Lubbock, Texas, West Texas Marketing and Management Representative, 1998 to 2000

CSG (Compliance Services Group), Lubbock, Texas, Project Manager, 1996 to 1998

Con-Tech (Control Technologies), Lubbock, Texas, Co-Founder and Principal, 1992 to 1996

David G. Halley & Co., Inc., Lubbock, Texas, Sales Engineer / Stockholder, 1986 to 1992

Texas Instruments, Abilene, Texas, Project Engineer, 1985 to 1986

Williams, Tippet, and Associates, Inc., Abilene, Texas, Design Engineer, 1984 to 1985

Shell Pipeline Corp., Hamlin, Texas, Roustabout / Relief Technician, 1980 to 1982

Education:

B.S. in Mechanical Engineering, **Texas Tech University,** 1984 (Magna Cum Laude)

Professional Organizations:

Academy of Mechanical Engineers, Texas Tech University (Faculty Advisory Council, inducted April 2004)

Attachment 1

Personal Profile: **John J. Garcia**
Position: **Senior Manager**
Deputy Engineering Manager
Washington TRU Solutions LLC
WIPP Site

Summary

Proven executive level manager experienced in strategic planning, Program Management, Operations and Engineering management and business/product development of state-of-the-art nuclear facilities. Twenty-five plus years of progressive management experience. Proven ability to build new organizations, reorganize troubled organizations and expand into additional markets. Innovative problem solver and effective communicator adept in delivering superior customer service and developing new business.

Professional Experience:

Washington TRU Solutions, LLC, Carlsbad, NM – 6/1988 to Present

Deputy Engineering Manager (01/05 to Present)

- Management responsibility for implementation/improvement/maintenance of the site engineering and Nuclear Safety Programs.

Safety, Health, Security and Technical Support (02/03 to 01/05)

- Responsible for establishing and maintaining facility safety and health programs. Accomplished over 2 million work hours without a lost workday.
- Responsible for approximately 60 + employees and budget of 10 million.

Deputy Assistant General Manager Operations and Chief Engineer (02/01 to 02/03)

- Responsible for all site engineering issues listed under Engineering Manager
- Deputy Assistant General Manager Operations responsible for 400+ employees and budget of $80 Million.

Engineering Manager (Westinghouse Waste Isolation Division – 1995 to 2001)

- Responsible for 100+ employees and annual budget of $22 million.
- Assisted General Manager in establishing strategic direction and policy for the division.

- Managed an integrated, multi-disciplined infrastructure including business systems, multi-disciplined engineering functions, facility construction and configuration management processes.
- Maintained Nuclear Regulatory Commission package compliance and maintenance, generator site interface, transportation planning and tracking, Waste Acceptance Criteria requirements generation, and designed and maintained the WIPP Waste Information System for the National TRU (Transuranic Waste) Program.

Successive Engineering Management Positions including Manager, Program Management (1988-1995)

- Responsible for 35+ employees and budgets in excess of $12 million in preparation for start-up of the facility.
- Managed the division’s budgeting and scheduling work scope.
- Integrated program details to establish current year budgets and five year planning.
- Tracked division performance and provided division support for program planning of major DOE or division initiatives.

Westinghouse Hanford Company, Hanford, WA – 1972 to1988

Engineering Positions of increasing responsibility leading to Manager, Waste Package, Repository and Seals Analysis Section

- Directed activities of 18 engineers and scientists and a budget of $4.5 million.
- Oversaw performance of critical engineering analyses and development of computer code to support design verification for the section.
- Designed software analytical packages for evaluating geotechnical, mechanical, hydrological, and thermal performance of the facility.

Education

B. S. - Mechanical Engineering, University of Texas, El Paso

Additional Master’s Level Engineering courses

National Institute for Learning: “The Project Management Certificate Course”

Fluent in English and Spanish

Confinement Ventilation Documented Safety Analysis Information											
Facility: CH U/G VU01			Hazard Category 2					Performance Expectation			
Bounding Accidents	Type Confinement		Doses Bounding unmitigated / mitigated	Confinement Ventilation System Classification			Function	Functional Requirements	Performance Requirements	Compensatory Measures	
	Active	Passive		SC	SS	DID					
(1-Fire) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	Fires are prevented by equipment fire suppression systems and Administrative Controls listed in Section 3.4.2.2.5 of the CH DSA. Similar credits are identified in the RH DSA.	
(2 -Explosion) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.	
(3 _Loss of Containment / Confinement) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.	
(4 -Direct Radiological / Chemical Exposure)	**N/A**		N/A				N/A	N/A		None Identified Based on Risk	
(5 -Nuclear Criticality)	**N/A**		N/A				N/A	N/A		Not credible for the WIPP due to WAC requirements/restrictions and established waste handling procedures/processes.	
(6 -External Hazards) N/A	**X**		N/A				N/A	N/A		Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.	
(7 -Natural Phenomena) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.	

The identified Confinement Ventilation System provides Defense in Depth to accidents assoicated with operational and natural phenomenon events that could affect CH waste.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH U/G CVS VU01**			IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS	
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
1	Pressure Differentials should be maintained between zones and atmosphere	Applies	Number of zones as credited by accident analysis to control hazardous release; demonstrate by use considering potential in-leakage	DOE-HDBK-1169 (2.2.9), ASHRAE Design Guide	Pressure differentials are validated by measured flow rate. Flow rate validated with each change of ventilation control setting. Flow rates are verified no less than once per shift
2	Materials of Construction should be appropriate for normal, abnormal and accident conditions	Applies		DOE-HDBK-1169 (2.2.5), ASME AG-1	The Mine drifts themselves serve as the underground air flow conduits. The 8 gauge surface duct, structural supports and fans are adequately constructed.
3	Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain integrity	Applies	As required by accident analysis to prevent accident release	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	WIPP ground control measures assures adequate underground integrity. There is no accident scenario that will impact the system integrity except for natural phenomenon (NP). The only DSA identified accident scenarios that can effect the surface fans and ducts of the CVS are NP and are addressed in the following.
4	Confinement ventilation systems shall have appropriate filtration to minimize release	Applies	Address: 1) Type of filter (e.g., HEPA, sand, sintered metal); 2) Filter Sizing (flow capacity and pressure drop); 3) Decontamination Factor vs. accident analysis assumptions	ASME AG-1, DOE HDBK-1169 (2.2.1)	WIPP underground filtration is provided by two 7 wide by 3 high HEPA filter housing (24"x24" filters). Each housing is rated for 30,000 cfm. The air flow is reduced to 60,000 cfm during filtration. Mine exhaust air flow is not normally directed through the filters. This allows the filters to be kept clean and dry.
5	Provide system status instrumentation and/or alarms	Applies	Address key information to ensure system operability (e.g., system delta-P, filter pressure drop)	ASME AG-1, DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	The HEPA filter housings are fitted with pressure monitoring capability for each HEPA filter bank with both local and remote readout. Remote alarms indicate a pressure drop that exceeds set point (alarm function is provided in the Central Monitoring Room (CMR)). WIPP has implemented a very conservative pressure drop limit of 5 inches w.g. for HEPA filter dp. Additional instrumentation provides local and remote indication of air flow with remote alarm in the CMR.
6	Interlock supply and exhaust fans to prevent positive pressure differential	Applies		DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	The underground ventilation system is a draw through ventilation system without supply fans. Natural ventilation pressure (NVP) can cause very slight ventilation pressures differentials at certain points in the mine. However, NVP is not an issue in the emplacement room or the waste face. The emplacement room and the waste face are the areas of concern from the credited DSA perspective.
7	Post accident indication of filter break-through	Applies	Instrumentation supports post-accident planning and response	TECH-34	Local and remote indication of HEPA filter differential pressures and proof of air flow provide indication of filter status for post-accident planning and response.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH U/G CVS VU01**			IRP assigned Performance Criteria For Evaluation: Safety Significant	Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
8	Reliability of control system to maintain confinement function under normal, abnormal and accident conditions	Applies	Address, for example, impacts of potential common mode failures from events that would require active confinement function.	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	The confinement ventilation system is comprised of three separate exhaust fans for normal (700 fans) and three separate fans for filtration (860 fans) air flow. The 700 and 860 fans can be ran in multiple configurations. Each fan has its own control system. The two filter housings that are employed during filtration events are parallel. Common isolation dampers have manual override capability and dual dampers to provide system redundancy to reduce the risk to site operations due to equipment outages. The extensive equipment redundancy provides for high availability of equipment to support operations thus providing reliable operation in normal, accident and abnormal operations.
9	Control components should fail safe	Applies		DOE-HDBK-1169 (2.4)	Isolation dampers are configured to fail safe providing underground confinement of any release of materials from the repository should a release occur during the event of equipment failure. The failure of any other CVS control component will not affect the system integrity.
10	Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement	Applies	As required by the accident analysis for existing facilities, must address protection of fiber media	DOE-HDBK-1169 (10.1), DOE-STD-1066	There is no accident analysis associated with fire events that would render the filter media ineffective for confinement. The filter media is approximately one-half mile from the repository area where credible fire events could take place. The HEPA filters are housed inside a all metal filter housing in a building of non-combustible construction without significant sources of ignition or fire source material in the immediate vicinity.
11	Confinement ventilation systems should not propagate the spread of fire	Applies	As required by the accident analysis for existing facilities, Address fire barriers, fire damper arrangements	DOE-HDBK-1169 (10.1), DOE-STD-1066	The filters and housing are of non-combustible construction. While the ventilation flow can support the sustaining of a fire in the underground, the air flow is required to support evacuation. The structure of the mine (chloride salt and clay) is non-combustible and the greatest hazard to the workers in a fire event is smoke. Ventilation flow and evacuation procedures for the mine are established to minimize the hazard to the workers. Ventilation flow can be controlled from the surface. The Facility Shift Manager (or designee) is responsible for emergency response operations which are established to provide the safest operational configuration in protection of the public, the workers and the environment.
12	Confinement ventilation systems should safely withstand earthquakes	Applies	If the active CVS is not credited in a seismic accident condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any seismic impact on the CVS will be based on the current functional requirements in the DSA	ASME AG-1 AA, DOE O420.1B, DOE-HDBK-1169 (9.2)	The system is not credited in the DSA to prevent the release of industrially or radiologically hazardous materials in the event of an earthquake.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH U/G CVS VU01**			IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS	
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
13	Confinement ventilation system should safely withstand tornado depressurization	Applies	If the active CVS is not credited in a tornado condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any tornado impact on the CVS will be based on the current functional requirements in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The system is not credited in the DSA to prevent the release of industrially or radiologically hazardous materials in the event of a tornado.
14	Confinement ventilation system should safely withstand design wind effects on system performance	Applies	If the CVS is not credited in a wind condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any wind impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The system is not credited in the DSA to prevent the release of industrially or radiologically hazardous materials in the event of a high wind condition.
15	Confinement ventilation system should withstand other NP events considered credible in the DSA where the CVS is credited	Applies	If the CVS is not credited for this event, there is no need to evaluate that performance and/or design attribute for the CVS. Any impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	There are no other natural phenomenon events identified in the DSA which credit the CVS to prevent the release of hazardous materials.
16	Administrative controls should be established to protect confinement ventilation systems from barrier threatening events	Applies	Ensure appropriately thought out response to external threat is defined (e.g., pre-fire plan)	DOE O420.1B	The DSA describes measures that are implemented to protect the facility and structures from credible barrier threatening events at the facility level. The CVS systems are not specifically identified, however the administrative controls that are instituted to protect the facility provide CVS protection.
17	Design supports the periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically	Applies	Ability to test for leakage per intent of N510	DOE-HDBK-1169 (2.3.8), ASME AG-1, ASME N510	WIPP utilizes a computerized history and maintenance planning system (CHAMPS) to track the performance and periodicity of confinement ventilation inspections and testing. System walk-downs are performed annually and aerosol penetration tests (in accordance with the intent of N510) are conducted on an annual basis per CHAMPS generated work orders.
18	Instrumentation required to support system operability is calibrated	Applies	Credited instrumentation should have specified calibration/surveillance requirements. Non-safety instrumentation should be calibrated as necessary to support system functionality.	DOE-HDBK-1169 (2.3.8)	No CVS instrumentation is credited in the DSA in the prevention of the release of hazardous materials in any accident scenario. WIPP utilizes the CHAMPS system and periodic maintenance work orders to generate and track the periodic calibration of instrumentation required to support the CVS operability. The shift-to-filtration operation of the CVS is checked quarterly.

	Table 5-1 Ventilation System Performance Criteria **Facility: CH U/G CVS VU01**			IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS	
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
19	Integrated system performance testing is specified and performed	Applies	required responses assumed in the accident analysis must be periodically confirmed including any time constraints	DOE-HDBK-1169 (2.3.8)	There are no CVS required responses in any DSA analyzed accident scenario. The shift-to-filtration operation of the CVS is checked quarterly.
20	Filter service life program should be established	Applies	Filter life (shelf life, service life, total life) expectancy should be determined. Consider filter environment, maximum delta-P, radiological loading, age, and potential chemical exposure.	DOE-STD-1169 (3.1 and Appendix C)	WIPP has instituted a filter service life program. Filters are being changed out to assure filters are no more than 10 years old. There is no significant source for potential chemical exposure, radiological exposure or other damaging environmental impacts to the filter media, housings or seals. WIPP has set a differential pressure limit of 5 inches water gauge across the filters. Filters are changed on age or filter pressure drop (which ever occurs first). Because the process and environment is so clean, WIPP has historically changed filters on age long before pressure drop became an issue.
21	Failure of one component (equipment or control) shall not affect continuous operation	Does Not Apply	Address potential failures (example failures- fan, back-up power supply, switchgear)	DOE O420.1B, Facility Safety, Chapter I, Sec. 3.b(8)	Although not applicable, equipment redundancy (fans) and manual control operation of both fans and dampers allow for continued operation with any single point failure. The fans used for HEPA filtration can be powered from site generators on a loss of commercially available power.
22	Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the CVS	Does Not Apply		DOE-HDBK-1169 (2.2.7)	Not applicable.
23	Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system	Applies		DOE-HDBK-1169 (2.2.7)	The fans used for HEPA filtration, system critical instrumentation and associated monitoring equipment can be powered from site generators on a loss of commercially available power.
24	Address any specific functional requirements for the CVS (beyond the scope of those above) credited in the DSA	Applies		10 CFR 830, Subpart B	There are no additional CVS requirements credited by the DSA that have not been previously covered.

DOE Waste Isolation Pilot Plant

Remote Handled Surface Confinement Ventilation System 411 HV02

Ventilation System Evaluation

Revision 0, October 25, 2007

Review and Approval Page

Site Lead:

Richard Farrell ___Signature on File_____ Date: ___________

Evaluation Team Members:

Curtis A. Chester ___Signature on File_____ Date: ___________

Randy D. Elmore ___Signature on File_____ Date: ___________

John J. Garcia ___Signature on File_____ Date: ___________

DOE Field Office Manager:

Dave Moody ___Signature on File_____ Date: ___________

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Definitions

Safety Class.

Safety Class (SC) systems structures and components (SSCs) are those whose preventive or mitigative function is necessary to keep radiological material exposure to the public below the off-site evaluation guideline, which is 25 rem (roentgen equivalent man) total effective dose equivalent. The dose estimates to be compared to it are those received by a hypothetical maximally exposed off-site individual at the site boundary.

Safety Significant.

SSCs not designated as SC, but whose preventive or mitigative function is a major contributor to defense in depth (DiD) and/or worker safety as determined from hazards analysis. Safety Significant (SS) SSC designations based on worker safety are limited to those whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposure to workers.

Waste Isolation Pilot Plant (WIPP) procedure WP 09-CN3023, *WIPP Functional Classification for Design*, Rev. 7 identifies greater than 100 rem to the worker as the consequence for requiring consideration for functionally classifying an SSC as SS.

Abbreviations and Acronyms

ALARA – As Low as Reasonably Achievable

CH – Contact Handled

Ci – Curie

CMR – Central Monitoring Room

CMS – Central Monitoring System

CVS – Confinement Ventilation System

DBE – Design Basis Earth Quake

DBT – Design Basis Tornado

DiD – Defense in Depth

DSA – Documented Safety Analysis

EG – Evaluation Guideline (25 rem TEDE to the maximally-exposed offsite individual as defined in DOE-STD-3009-94)

FET – Facility Evaluation Team as defined in the VSEG

HEPA – High Efficiency Particulate Air

IRP – Independent Review Panel as defined in the VSEG

PDD – Pressure Differential Damper

PE-Ci – Plutonium Equivalent Curies

PISA – Potentially Inadequate Safety Analysis

Pu-239 – Plutonium 239

rem – roentgen equivalent man

RH – Remote Handled

SC – Safety Class

SS – Safety Significant

SSCs – Systems, Structures and Components

TEDE – Total Effective Dose Equivalent

VSEG – Department of Energy, Deliverables 8.5.4 and 8.7 of Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems*

WIPP – Waste Isolation Pilot Plant

Executive Summary:

The Waste Isolation Pilot Plant (WIPP) site is a low level repository for radioactive waste. Waste is characterized and shipped to WIPP in packages for disposal in the repository. The container that the waste is packaged in prior to loading into transportation containers (road casks) provides primary containment. There is no planned normal operation at WIPP that allow for waste to be present external to the waste package container primary containment. The waste container packages that are used for disposal are removed from the transportation containers (road casks) in the Waste Handling Building (WHB). From the time the packages are removed until they are placed in the repository, the packages are contained within facilities and structures with active confinement ventilation systems.

Remote Handled (RH) surface waste handling operations are performed in the RH portion of the WHB. The Remote Handled Confinement Ventilation System (CVS) 411 HV02 provides the active CVS for the RH surface waste handling operations. This system is not credited in the site Documented Safety Analysis (DSA) analyzed accident scenario to control hazardous release. The evaluated CVS performs a defense-in-depth (DiD) function for the WIPP site. WIPP is a Hazard Category 2 facility. The facility evaluation team (FET) used the independent review panel (IRP) directed functional classification criteria for SS. Based on the evaluation criteria, the system evaluation did not reveal any “gaps” in the installed system’s functional design or performance expectations. The installed system’s functional design and performance expectations is commensurate with the identified site mission of receiving prepackaged and characterized waste and emplacing the waste in the waste container packages in which the waste is received on site. During the evaluation of the systems functional design and performance expectations against the evaluation criteria and the facility DSA, there was no discovery of a potentially inadequate safety analysis (PISA).

Introduction

Facility Overview

The WIPP is located in Eddy County in southeastern New Mexico. The WIPP is located in an area of low population density with no industrial, commercial, institutional, recreational or residential structures within the WIPP Site Boundary.

The WIPP is designed to receive and handle 500,000 cubic feet per year (ft^3/yr) (14,160 cubic meters per year [m^3/yr]) CH waste and 10,000 ft3/yr (283 m^3/yr) RH waste. The WIPP facility is designed to have a disposal capacity for TRU waste of 6.2 million ft^3 (175,600 m^3). The WIPP facility has sufficient capacity to

handle the 250,000 ft^3 (7,080 m^3) of RH waste. The WIPP is divided into surface structures, shafts, and subsurface structures
.

The WIPP surface structures accommodate the personnel, equipment, and support services required for the receipt, preparation, and transfer of waste from the surface to the underground. The primary surface operations at the WIPP are conducted in the WHB, which is divided into the CH waste handling area, the RH waste handling area, and support areas.

Vertical shafts, including the waste shaft, the salt handling shaft, the exhaust shaft, and the air intake shaft, extend from the surface to the underground horizon. The waste shaft is located between the CH and RH areas in the WHB.

The WIPP underground consists of the waste disposal area, construction area, north area, and the waste shaft station area. The CH and RH waste disposal area is a 100 acre area on a horizon located 2,150 feet beneath the surface in a deep, bedded salt formation.

RH waste is shipped to the site in one of two types of road casks. Waste canisters are shipped in 72-B casks. Drums of waste are shipped in 10-160B casks. Waste canisters shipped in 72-B casks are nominally 10 feet long and 26 inches in diameter. Drums of waste received in 10-160B casks, are over-packed into a steel facility canisters in the Hot Cell. Facility canisters are nominally 10 feet long and 28 inches in diameter. Canisters of RH waste are emplaced in the bore holes drilled in the walls of the disposal rooms.

The hazard classification category was determined in accordance with DOE-STD-1027-92. The material at risk for the determination of the categorization was defined as the maximum radiological contents of a single 55-gallon drum of CH waste at 80 plutonium-239 equivalent curies (PE-Ci). Since this inventory exceeds the Hazard Category 2 minimum threshold of 56 Ci for Pu-239, the WIPP is categorized as a Hazard Category 2 facility.

Confinement Ventilation Strategy

The WIPP CVS are designed to provide confinement barriers utilizing high efficiency particulate air (HEPA) filtration to limit releases of airborne radioactive contaminants. Exhaust stacks are designed with elevated discharges and fresh air supply intakes located away from the exhaust vents. The RH portion of the WHB has two ventilation systems, one for the RH bay and the other for the hot cell complex. Each system maintains pressure differential between areas of low potential for airborne radioactive material and those of higher potential. The RH bay ventilation system has HEPA filters located in the WHB mechanical equipment room, while the hot cell complex ventilation system HEPA filters are located in a room adjacent to the lower hot cell. The hot cell ventilation system ensures that the upper hot cell remains at a lower static pressure than other RH areas of the WHB. The ventilation supply and exhaust systems for each WHB subsystem supply air to the rooms of the areas served. Each supply air handling unit consists of filters, cooling coils, heating elements, fans with associated duct work, and controls to condition the supply air maintaining the design temperature during winter and summer. Fan operating status, filter bank pressure drops, and static pressure differentials can be monitored locally and in the central monitoring room (CMR). Excess filter pressure drop and loss of flow alarm in the CMR. Instruments and system components are accessible for, and will be subject to, periodic testing and inspection during normal plant operation.

The WHB ventilation systems continuously filter the exhaust air from waste handling areas to reduce the potential for release of radioactive effluents to the environment. Airlocks for ventilation differential pressure control are electrically interlocked and are provided in the following locations:

- Between areas of large pressure differences to provide a pressure transition and to eliminate high air velocity
- Between areas where pressure differentials must be maintained
- To minimize air movement from the WHB to the waste shaft

The ventilation systems include monitoring of the following operating parameters:

- Pressure drop across each pre-filter and HEPA filter bank
- Air flow rates at selected points
- Pressure differentials surrounding areas of high potential for contamination levels

The WHB supply and exhaust fans are designed and interlocked to maintain building pressure negative with respect to atmospheric pressure and maintain the design air flow pattern. During normal operation, if the operating exhaust/supply fan fail, the corresponding supply/exhaust fan is stopped. The standby train is started automatically and can also be started manually.

The WHB exhaust fans and controls can be supplied by backup power in the event that normal power is interrupted. In case of an off-site power failure, the capability exists to selectively switch one exhaust fan to the backup power system.

The Station C effluent sampling system continuously samples the air discharged from the WHB exhaust vent downstream of HEPA filtration. Tornado dampers, constructed to withstand the design basis earthquake (DBE) and design basis tornado (DBT), are installed in all heating ventilation and air conditioning inlet and exhaust openings in the WHB. In the event of a tornado, the WHB tornado dampers will automatically close to prevent the outward rush of air caused by a rapid drop in atmospheric pressure. Damper closure mitigates damage to HEPA filters from a potential high differential pressure.

The filtration system consists of prefilters and HEPA filters sized in accordance with design air flows utilizing industry standards for maximum efficiency. All nuclear grade HEPA filter banks are tested for conformance with ASME N510.

The RH surface CVS equipment was installed in the WHB facility in the mid 1980's. Between 2000 and 2002, the pneumatic control system was replaced with a microprocessor based distributive control system. Constant volume terminal units were installed in the supply system to enhance the stability of the space pressure. The original design information is still maintained and available via site records.

Currently an air recirculation modification is in progress. This is not a major modification. Duct and dampers have been installed to allow air within specific zones to be recirculated. The related control system is not yet functional and is awaiting a window of opportunity for deployment. The recirculation modification is being installed in accordance with DOE-HDBK-1169-2003 guidance and recommendations. The recirculation modification will not negatively impact system confinement capabilities or As Low as Reasonably Achievable (ALARA) principals. The Hot Cell exhaust will not be recirculated.

Major Modifications

The facility is not currently undergoing any major modifications that affect the ventilation system or its operation.

Functional Classification Assessment

The WIPP procedure WP 09-CN3023, WIPP Functional Classification for Design, is the site procedure used for functional classification.

Existing Classification

Based on site procedures the RH surface CVS of this evaluation is classified as a balance of plant system providing a DiD function. This CVS is not credited in the facility DSA for providing a safety class or safety significant function.

Evaluation

The FET used the proceduralized site process, WP 09-CN3023, to evaluate the existing site functional classification of the CVS evaluated. Additionally, the FET reviewed the site procedure for compliance with DOE regulations and drivers to assess that the site procedure provides adequate assessment of functional classification for site systems.

The procedure, WP 09-CN3023, was found to be inline with the DOE-STD-3009-94 guidance for functional classification. The FET did discover one typographical error in the procedure. The error is being corrected.

Summary

The existing facility functional classification is commensurate with the identified site mission of receiving prepackaged and characterized waste and emplacing the waste in the packages in which it was received, in the site repository.

System Evaluation

Identification of Gaps

The FET identified there were no gaps between the *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems* (VSEG) evaluation criteria and the installed system's functional design or performance expectations.

The FET used the IRP directed SS performance criteria for the evaluation in accordance with the guidance in section 5.1 of the VSEG. Section 5.1 identifies that all hazard category 2 nuclear facilities that do not challenge or exceed the evaluation guideline (EG) will utilize SS performance criteria as identified in Table 5-1 of the VSEG.

The evaluation verified all the VSEG established performance criteria for SS CVS systems were adequately met by the CVS. The criteria established to be mandatory for this evaluation were:

a. Materials of Construction should be appropriate for normal, abnormal and accident conditions.
b. Confinement ventilation systems shall have appropriate filtration to minimize release.
c. Provide system status instrumentation and/or alarms.

d. Interlock supply and exhaust fans to prevent positive pressure differential.
e. Post accident indication of filter break-through.
f. Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.
g. Control components should fail safe.
h. Administrative controls should be in place to protect confinement ventilation systems from barrier threatening events.
i. Design supports periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically.
j. Filter service life program should be established.
k. Failure of one component (equipment or control) shall not affect continuous operation.
l. Backup electrical power shall be provided to all critical instruments and equipment to operate and monitor the CVS.

The above listed criteria are required for the system to adequately provide mitigative DiD performance.

All other IRP established VSEG performance criteria, identified in Table 5-1 of the VSEG, were non-mandatory. The non-mandatory criteria were identified within the VSEG to be "applicable as required" or "credited by the facility DSA". The facility DSA does not credit the RH surface CVS to prevent or control hazardous release in the accident analyses.

Gap Evaluation

The FET identified there were no gaps between the VSEG evaluation criteria and the installed system's functional design or performance expectations, whether mandatory or non-mandatory.

Modifications and Upgrades

There are no required modifications or upgrade to the RH surface CVS as there are no gaps between the established performance criteria and the installed system's functional design or performance expectations.

Conclusion

The FET performed an evaluation of the RH surface CVS. The result of the evaluation was a determination that the system's installed design and performance expectations met the evaluation performance criteria established by the VSEG IRP for a Hazard Category 2 facility. There were no findings or proposed corrective actions as a result of this evaluation.

The FET did identify the opportunity to enhance pressure differential damper (PDD) control component reliability by the installation of additional controllers at specific PDDs. The identified item is not a mandated change and is recognized as an opportunity for enhancement to be processed and scheduled based on site priorities.

References

ASME N510 — American Society of Mechanical Engineers, 1989, *Standard for Testing of Nuclear Air Cleaning Systems*, (formerly ANSI N510-1975, ANSI/ASME N510-1989)

CH DSA — DOE/WIPP-95-2065, REVISION 10, NOVEMBER 2006, Waste Isolation Pilot Plant Contact Handled (CH) Waste Documented Safety Analysis, with approved page changes CH-2007-01 and CH-2007-02, August 27, 2007

DOE-STD-3009-94 — DOE Standard Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses, with Change Notice No. 2, April 2002

DOE-STD-1027-92 — DOE Standard, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports, with Change Notice No. 1, September 1997

DOE HDBK-1169-2003 — DOE Handbook, Nuclear Air Cleaning Handbook

RH DSA — DOE/WIPP-06-3174, REVISION 0, MARCH 2006, Waste Isolation Pilot Plant Remote Handled (RH) Waste Documented Safety Analysis, with page changes approved through August 28, 2007

SDD HV00 — U.S. Department of Energy, Waste Isolation Pilot Plant, Heating, Ventilation and Air Conditioning System, System Design Description (SDD), Rev. 10

WP 09-CN3023 — *WIPP Functional Classification for Design*, Rev. 7

Attachments

Facility Evaluation Team composition and biographical sketches

Attachment 1 – FET members' Personnel Profiles

Data Collection Table and supporting attachments

Attachment 2 – Data Collection Table

Table 4-3

Attachment 3 - Supporting Attachments

RH Surface CVS 411 HV02, Table 5-1 Ventilation System Performance Criteria and Evaluation Response

Summary Schedules for implementing upgrades

Not applicable – no identified "gaps" or required upgrades

Completed supporting evaluations and documentation

Not applicable.

Attachment 1

Field Evaluation Team Personal Profiles **Page**

Attachment 1

Personal Profile: **Richard F. Farrell**
Position: **Nuclear Safety Specialist**
U. S. DOE Carlsbad Field Office
(505) 234-8318

Summary:

1. Environmental, Safety, and Health (E,S&H) professional with over 30 years of diversified experience in nuclear and industrial safety, health physics, environmental/effluent monitoring, regulatory compliance related to state-of-the-art nuclear facilities, and mining and mineral extraction/ metallurgical processing.
2. Managed the development of the Waste Isolation Pilot Plant (WIPP) documented safety analysis (DSA) for contact-handled and remote-handled transuranic (CH/RH-TRU) waste disposal operations. Developed and the Department of Energy's (DOE) safety evaluation reports (SER) or approval bases associated with the WIPP safety basis.
3. Developed and managed the Radioactive Source Materials License compliance programs for a NRC licensed facility (an operating uranium mill/mine) including: radiological and industrial safety, ALARA, quality assurance, occupational health, and underground mine ventilation engineering and monitoring.

Experience:

U. S. Department of Energy; September 2007 - Present
Nuclear Safety Specialist Carlsbad Field Office (CBFO) Responsibilities include oversight and integration of CBFO/WIPP radiological and nuclear safety, occupational health, and nuclear safety management.
Safety Officer CBFO; August 2000 – September 2007 Responsibilities include oversight and integration of CBFO/WIPP industrial, radiological and nuclear safety, and occupational health.

U. S. Department of Energy; September 1992 - August 2000
Radiological Safety Manager Carlsbad Area Office (CAO) Responsibilities include oversight and management of CAO/WIPP radiological safety/control programs (10 CFR Part 835) and nuclear safety management (10 CFR Part 830).

Westinghouse Electric Corporation; April 1990 - September 1992
Senior Engineer at the Waste Isolation Pilot Plant Responsibilities include the management of interface activities with oversight and auditing groups, evaluation of applicable regulations and DOE orders, and support of audits of waste generator sites with regard to waste acceptance criteria.

Homestake Mining Company; 1977 - April 1990
(Nuclear Regulatory Licensed Uranium Milling and Mining)
Environmental Safety and Health Department On-Site Manage; 1983 - April 1990
Responsible for radiation safety/health programs as the radiation safety officer (RSO) for the Nuclear Regulatory Commission (NRC) licensed facility. Responsibilities included department administration, industrial safety/health, emergency management, RCRA compliance and hazardous waste management, CERCLA remediation and monitoring activities, occupational health and regulatory compliance.

Radiation Protection Administrator; 1980 - 1983 Responsibilities included management of the health physics, oand hazardous waste activities, training, environmental and effluent monitoring, and regulatory compliance. Served as the RSO for a NRC licensed facility.
Radiological Safety/Environmental Engineer; 1977 - 1980 Responsibilities included evaluation of radiological safety, health physics assessment, monitoring data, and the development of monitoring and emission control programs to assure compliance with occupational and environmental regulations.

Education:

B.S. - Chemistry major - biology minor, Northern Arizona University, 1975.
Twelve (12) semester hours of graduate level chemistry class work, and six (6) semester hours of graduate level radioactive waste management; University of New Mexico; 1981 and 1992, respectively.
Strong background in applied mathematics and statistics equivalent to a minor area of study [twenty (20) semester hours], Brigham Young University; 1993 - 1996.

Attachment 1

Personal Profile: **Curtis A. Chester**
Position: **Engineering Manager**
Integrated Waste Handling Engineering
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Chester is the Washington TRU Solutions manager of the Integrated Waste Handling Engineering (IWHE) group. IWHE is responsible for the technical ownership of all equipment used in the waste handling process, both Contact Handled and Remote Handled. Mr. Chester's staff consists of 17 engineers engaged in oversight of systems that include such diverse applications of engineering as robotics in waste processing, radiological monitoring systems, pumping and distributions systems for fire suppression, industrial material handling systems, facility structural integrity (including seismic and tornado loading) and confinement ventilation. The IWHE group is tasked with monitoring, maintaining, designing and planning the implementation of regulatory requirements associated with aspects of safety, environmental and radiological requirements for the site waste handling process. As manager of the IWHE group, Mr. Chester is responsible for administration of the proper oversight, review and approval of the actions implemented by the group.

Mr. Chester has participated in two successful Operational Readiness Reviews while at WIPP and was the lead engineer in the successful completion of the Remote Handled readiness review completed in January of 2007 including the system Start-up Testing and the system Line Management Assessment. Mr. Chester's experience and accomplishments in mechanical design, shop fabrication, procurement, engineering application of quality control and application of industrial process control make him uniquely suited for management of the IWHE group.

Professional History:

Manager / Integrated Waste Handling Engineering (1998 to present)
<u>WGI/ Washington TRU solutions</u> Carlsbad, New Mexico
Management of personnel employed in the development and implementation of strategies, resource allocations, baselines, and project execution plans for package handling equipment, system upgrades, and processes supporting the disposal of Defense Nuclear Waste. Successes and competence have been identified with a continuous progression of assignments from support engineer to engineering staff management.

Project Engineer / Staff Consultant (1993 to 1997)
<u>Duke Engineering & Services</u> Carlsbad, New Mexico
Provide design, analysis, and project management services to engineering and maintenance staff at the Waste Isolation Pilot Plant (WIPP).

Product Integrity Engineer/ Lead Manufacturing Engineer (1990 to 1993)
<u>Martin Marietta Corporation</u> Albuquerque, New Mexico
Develop and maintain process flow instructions and configuration management for multiple process lines. Conduct engineering analysis on mechanical structures and assemblies. Develop and implement quality, cost effective manufacturing practices regarding station layouts, sequence of operations, and tooling requirements.

Staff Engineer (1989-1990, 1993)

Attachment 1

Pharmacia SP Albuquerque, New Mexico
Perform engineering analysis on equipment. Develop equipment enhancements. Design and prototype special devices.

Education:

B.S. in Mechanical Engineering, **UNM Albuquerque, NM,** 1989

Publications:

"Final Results of the WIPP RH TRU Facility Shielding Analysis". 2002
"Exhaust Shaft Hydraulic Assessment Data Report". 1996
"Room Q Data Report: Test Borehole Data From December 7, 1993, through July 7, 1995". 1995

Attachment 1

Personal Profile: **Randy D. Elmore**
Position: **Cognizant System Engineer**
Confinement Ventilation Systems
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Elmore is an engineer with over twenty years of experience with HVAC systems used for environmental, commercial and industrial applications including medical isolation suites, industrial clean room and laboratory and confinement ventilation systems. Experience includes the design, installation, start-up and oversight of isolation environments established through both positive and negative pressure differentials. Design activities have included not only air and equipment side but pneumatic, electronic and microprocessor design, programming, and start-up. Ancillary experiences and skills include cost estimation, project management, budgeting and system and personnel management.

Professional History:

Washington TRU Solutions, LLC. Carlsbad, New Mexico, 2001 – present:

Simplex Time Recorder, Inc., Lubbock, Texas, West Texas Marketing and Management Representative, 1998 to 2000

CSG (Compliance Services Group), Lubbock, Texas, Project Manager, 1996 to 1998

Con-Tech (Control Technologies), Lubbock, Texas, Co-Founder and Principal, 1992 to 1996

David G. Halley & Co., Inc., Lubbock, Texas, Sales Engineer / Stockholder, 1986 to 1992

Texas Instruments, Abilene, Texas, Project Engineer, 1985 to 1986

Williams, Tippet, and Associates, Inc., Abilene, Texas, Design Engineer, 1984 to 1985

Shell Pipeline Corp., Hamlin, Texas, Roustabout / Relief Technician, 1980 to 1982

Education:

B.S. in Mechanical Engineering, **Texas Tech University,** 1984 (Magna Cum Laude)

Professional Organizations:

Academy of Mechanical Engineers, Texas Tech University (Faculty Advisory Council, inducted April 2004)

Attachment 1

Personal Profile: **John J. Garcia**
Position: **Senior Manager**
Deputy Engineering Manager
Washington TRU Solutions LLC
WIPP Site

Summary

Proven executive level manager experienced in strategic planning, Program Management, Operations and Engineering management and business/product development of state-of-the-art nuclear facilities. Twenty-five plus years of progressive management experience. Proven ability to build new organizations, reorganize troubled organizations and expand into additional markets. Innovative problem solver and effective communicator adept in delivering superior customer service and developing new business.

Professional Experience:

Washington TRU Solutions, LLC, Carlsbad, NM – 6/1988 to Present

Deputy Engineering Manager (01/05 to Present)

- Management responsibility for implementation/improvement/maintenance of the site engineering and Nuclear Safety Programs.

Safety, Health, Security and Technical Support (02/03 to 01/05)

- Responsible for establishing and maintaining facility safety and health programs. Accomplished over 2 million work hours without a lost workday.
- Responsible for approximately 60 + employees and budget of 10 million.

Deputy Assistant General Manager Operations and Chief Engineer (02/01 to 02/03)

- Responsible for all site engineering issues listed under Engineering Manager
- Deputy Assistant General Manager Operations responsible for 400+ employees and budget of $80 Million.

Engineering Manager (Westinghouse Waste Isolation Division – 1995 to 2001)

- Responsible for 100+ employees and annual budget of $22 million.
- Assisted General Manager in establishing strategic direction and policy for the division.

- Managed an integrated, multi-disciplined infrastructure including business systems, multi-disciplined engineering functions, facility construction and configuration management processes.
- Maintained Nuclear Regulatory Commission package compliance and maintenance, generator site interface, transportation planning and tracking, Waste Acceptance Criteria requirements generation, and designed and maintained the WIPP Waste Information System for the National TRU (Transuranic Waste) Program.

Successive Engineering Management Positions including Manager, Program Management (1988-1995)

- Responsible for 35+ employees and budgets in excess of $12 million in preparation for start-up of the facility.
- Managed the division’s budgeting and scheduling work scope.
- Integrated program details to establish current year budgets and five year planning.
- Tracked division performance and provided division support for program planning of major DOE or division initiatives.

Westinghouse Hanford Company, Hanford, WA – 1972 to1988

Engineering Positions of increasing responsibility leading to Manager, Waste Package, Repository and Seals Analysis Section

- Directed activities of 18 engineers and scientists and a budget of $4.5 million.
- Oversaw performance of critical engineering analyses and development of computer code to support design verification for the section.
- Designed software analytical packages for evaluating geotechnical, mechanical, hydrological, and thermal performance of the facility.

Education

B. S. - Mechanical Engineering, University of Texas, El Paso

Additional Master’s Level Engineering courses

National Institute for Learning: “The Project Management Certificate Course”

Fluent in English and Spanish

Confinement Ventilation Documented Safety Analysis Information											
Facility: RH Surface CVS 411 HV02			Hazard Category 2					Performance Expectation			
Bounding Accidents	Type Confinement		Doses Bounding unmitigated / mitigated	Confinement Ventilation System Classification			Function	Functional Requirements	Performance Requirements	Compensatory Measures
	Active	Passive		SC	SS	DID				
(1-Fire) N/A	**X**		> 25 rem / prevented			**X**	N/A			Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.
(2 -Explosion) N/A	**X**		> 25 rem / prevented			**X**	N/A			Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.
(3 _Loss of Containment / Confinement)	**X**		6.0 / N/A			**X**	N/A			Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.
(4 -Direct Radiological / Chemical Exposure)	**N/A**		N/A			N/A	N/A			None Identified Based on Risk
(5 -Nuclear Criticality)	**N/A**		N/A			N/A	N/A			Not credible for the WIPP due to WAC requirements/restrictions and established waste handling procedures/processes.
(6 -External Hazards) N/A	**X**		N/A			**X**	N/A			Frequency of an aircraft crash iinto the WHB is Beyond Extremely Unlikely
(7 -Natural Phenomena) N/A	**X**		> 25 rem / prevented			**X**	N/A			Performance of Facility Evaluation did not reveal any vulnerability . No Compensatory Measures required.

The identified Confinement Ventilation System provides Defense in Depth to accidents assoicated with operational and natural phenomenon events that could affect RH waste.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH Surface CVS 411 HV02**				IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
1	Pressure Differentials should be maintained between zones and atmosphere	Applies	Number of zones as credited by accident analysis to control hazardous release; demonstrate by use considering potential in-leakage	DOE-HDBK-1169 (2.2.9), ASHRAE Design Guide	The CVS is not credited in any analyzed accident scenario to control hazardous release. The RH ventilation is designed with different confinement zones established with cascading space pressure set points ,respective to atmosphere, established to control flow from areas of lower contamination to areas of higher contamination in accordance with guidance as established in DOE-HDBK-1169-2003, Chapter 2. The RH bay is held equal to atmosphere. The Hot Cell complex is held at a more negative pressure and the Upper Hot Cell is held at the most negative pressure. Since all containers shipped to WIPP are certified to be free of external contamination and there is no plan to open the containers at WIPP, the DSA does not credit the confinement ventilation system for the prevention of release in any accident scenario.
2	Materials of Construction should be appropriate for normal, abnormal and accident conditions	Applies		DOE-HDBK-1169 (2.2.5), ASME AG-1	Provisions for accident and abnormal conditions have been considered in the construction of the CVS. Fans ducts and dampers are constructed of galvanized steel which is adequate based on the constituents that can reasonably be expected to exist in the air stream. The HEPA filter housings are fabricated of Stainless Steel to minimize the potential of corrosion on filter/housing interface surfaces and to aid in contamination clean-up should an accidental release occur. There is no reasonable expectation of corrosive fumes, spontaneous combustion, or explosion during processing. Waste is shipped to WIPP in sealed containers with regulated constituents regulated by the Waste Acceptance Criteria (WAC).
3	Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain integrity	Applies	As required by accident analysis to prevent accident release	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	The DSA does not credit the CVS in any prevention of accidental release. The system is designed to withstand anticipated normal, abnormal and accident conditions and maintain integrity. Explosions that would cause overpressure of the CVS is not a credible scenario based on the site processes and in place administrative controls (primarily the WAC). Fire propagation from a source to the filters is not a credible scenario based on the amount of combustibles present in the building, the non combustible materials of construction of the building and the non-combustible materials of construction of the CVS components (combustibles protected by the administratively controlled combustible loading program). Both Design Base Earthquake and Tornado considerations have been accounted for in the construction and operation of the WHB.
4	Confinement ventilation systems shall have appropriate filtration to minimize release	Applies	Address: 1) Type of filter (e.g., HEPA, sand, sintered metal); 2) Filter Sizing (flow capacity and pressure drop); 3) Decontamination Factor vs. accident analysis assumptions	ASME AG-1, DOE HDBK-1169 (2.2.1)	Filter quantity and size has been selected based on maximum flow rate through the HEPA media of 5 ft/min. The decontamination factor is of no consequence to the DSA since CVS is not credited for any accident scenarios. The waste handling process is relatively clean with minimal air borne particulate generated. Some minimal amount of diesel particulate could possibly enter the RH Bay as the Road Cask is located in the bay for processing by the over the road tractor-trailer. All other equipment is electrically powered and there are no machining or chemical process used that would generate significant amounts of particulate or gases. The single stage of prefilters is appropriate to prolong the life to the HEPA filters.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH Surface CVS 411 HV02**			IRP assigned Performance Criteria For Evaluation: Safety Significant	Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
5	Provide system status instrumentation and/or alarms	Applies	Address key information to ensure system operability (e.g., system delta-P, filter pressure drop)	ASME AG-1, DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	The HEPA filter housings are fitted with pressure monitoring capability for each HEPA filter bank with both local and remote readout. Remote alarms indicate a pressure drop that exceeds set point (alarm function is provided in the Central Monitoring Room (CMR)). WIPP has implemented a very conservative pressure drop limit of 5 inches w.g. for HEPA filter dp. Additional instrumentation provides local and remote indication of air flow with remote alarm in the CMR.
6	Interlock supply and exhaust fans to prevent positive pressure differential	Applies		DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	Automated controls provide for interlock between the Supply Air units and the associated Exhaust Air Fans. On the loss of an exhaust fan, the associated supply air fan is shut down. Redundant exhaust air fan and supply air unit is automatically started when the lead ventilation set is "shut-down".
7	Post accident indication of filter break-through	Applies	Instrumentation supports post-accident planning and response	TECH-34	Local and remote indication of HEPA filter differential pressures and proof of air flow provide indication of filter status for post-accident planning and response.
8	Reliability of control system to maintain confinement function under normal, abnormal and accident conditions	Applies	Address, for example, impacts of potential common mode failures from events that would require active confinement function.	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	The confinement ventilation system is comprised of two completely separate "trains" of equipment providing supply air flow, exhaust air flow and confinement filtration (supply fan, exhaust fan and HEPA filter unit). Each "train" is controlled through independent controls and instrumentation. Automated controls can be manually overridden at the local control panel. Common equipment such as space supply flow control and space pressure control via variable exhaust are designed to fail safe providing active confinement ventilation.
9	Control components should fail safe	Applies		DOE-HDBK-1169 (2.4)	Automated controls are designed to fail safe. Pressure Differential Dampers fail open. Local supply flow controls fail in the last controlled position. Exhaust system failure stops associated supply air. Failure of one "train" causes the automatic start of the back-up "train". Train controls can be manually overridden.
10	Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement	Applies	As required by the accident analysis for existing facilities, must address protection of fiber media	DOE-HDBK-1169 (10.1), DOE-STD-1066	The DSA does not credit the HEPA filtration in the prevention of the release of hazardous materials. Fire propagation from a source to the filters is not a credible scenario based on the non combustible materials of construction of the building, the non-combustible materials of construction of the CVS components and the amount of combustibles present in the building (building loading of combustibles protected by the administratively controlled combustible loading program).
11	Confinement ventilation systems should not propagate the spread of fire	Applies	As required by the accident analysis for existing facilities, Address fire barriers, fire damper arrangements	DOE-HDBK-1169 (10.1), DOE-STD-1066	The building zones, the construction of the building and the site processes are such that fire dampers and fire suppression within the HEPA filter units is not required. Fans ducts and dampers are constructed of galvanized steel which is adequate based on the constituents that can reasonably be expected to exist in the air stream. Filters and filter housing are constructed of materials such as to not propagate the spread of a fire.
12	Confinement ventilation systems should safely withstand earthquakes	Applies	If the active CVS is not credited in a seismic accident condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any seismic impact on the CVS will be based on the current functional requirements in the DSA	ASME AG-1 AA, DOE O420.1B, DOE-HDBK-1169 (9.2)	The elements of the CVS credited during a seismic event are the seismic/tornado dampers. These dampers are designed and installed in a manner to protect ventilation penetrations of the building envelope during a seismic event (close on seismic event). The closing of the dampers provides for the maintenance of the secondary confinement boundary provided by the building envelope during a seismic event.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH Surface CVS 411 HV02**			IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS	
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
13	Confinement ventilation system should safely withstand tornado depressurization	Applies	If the active CVS is not credited in a tornado condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any tornado impact on the CVS will be based on the current functional requirements in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The elements of the CVS credited during a tornado event are the seismic/tornado dampers. These dampers are designed and installed in a manner to protect ventilation penetrations of the building envelope during a tornado event (close on event). The closing of the dampers provides for the prevention of the rapid depressurization, caused by a tornado, from damaging the confinement barrier provided by the HEPA filters. Rapid depressurization of the exhaust system could cause the filters to be "sucked" through the housing if not properly protected. The tornado dampers are designed to provide that protection.
14	Confinement ventilation system should safely withstand design wind effects on system performance	Applies	If the CVS is not credited in a wind condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any wind impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The DSA does not credit the confinement ventilation system in the event of high winds. The CVS exhaust and filtration systems are housed within the Waste Handling Building and therefore protected from the effects of reasonably assumed high wind events.
15	Confinement ventilation system should withstand other NP events considered credible in the DSA where the CVS is credited	Applies	If the CVS is not credited for this event, there is no need to evaluate that performance and/or design attribute for the CVS. Any impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	There are no other natural phenomenon events identified in the DSA which credit the CVS to prevent the release of hazardous materials.
16	Administrative controls should be established to protect confinement ventilation systems from barrier threatening events	Applies	Ensure appropriately thought out response to external threat is defined (e.g., pre-fire plan)	DOE O420.1B	The DSA describes measures that are implemented to protect the facility and structures from credible barrier threatening events at the facility level. The CVS systems are not specifically identified, however the administrative controls that are instituted to protect the facility provide CVS protection.
17	Design supports the periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically	Applies	Ability to test for leakage per intent of N510	DOE-HDBK-1169 (2.3.8), ASME AG-1, ASME N510	WIPP utilizes a computerized history and maintenance planning system (CHAMPS) to track the performance and periodicity of confinement ventilation inspections and testing. System walk-downs are performed annually and aerosol penetration tests (in accordance with the intent of N510) are conducted on an annual basis per CHAMPS generated work orders.
18	Instrumentation required to support system operability is calibrated	Applies	Credited instrumentation should have specified calibration/surveillance requirements. Non-safety instrumentation should be calibrated as necessary to support system functionality.	DOE-HDBK-1169 (2.3.8)	No CVS instrumentation is credited in the DSA in the prevention of the release of hazardous materials in any accident scenario. WIPP utilizes the CHAMPS system and periodic maintenance work orders to generate and track the periodic calibration of instrumentation required to support the CVS operability.
19	Integrated system performance testing is specified and performed	Applies	required responses assumed in the accident analysis must be periodically confirmed including any time constraints	DOE-HDBK-1169 (2.3.8)	There are no CVS required responses in any DSA analyzed accident scenario.

Table 5-1 Ventilation System Performance Criteria IRP assigned Performance Criteria For Evaluation: Safety Significant

Facility: RH Surface CVS 411 HV02 Hazard Category 2 - Active CVS

	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
20	Filter service life program should be established	Applies	Filter life (shelf life, service life, total life) expectancy should be determined. Consider filter environment, maximum delta-P, radiological loading, age, and potential chemical exposure.	DOE-STD-1169 (3.1 and Appendix C)	WIPP has instituted a filter service life program. Filters are being changed out to assure filters are no more than 10 years old. There is no significant source for potential chemical exposure, radiological exposure or other damaging environmental impacts to the filter media, housings or seals. WIPP has set a differential pressure limit of 5 inches water gauge across the filters. Filters are changed on age or filter pressure drop (which ever occurs first). Because the process and environment is so clean, WIPP has historically changed filters on age long before pressure drop became an issue.
21	Failure of one component (equipment or control) shall not affect continuous operation	Does Not Apply	Address potential failures (example failures- fan, back-up power supply, switchgear)	DOE O420.1B, Facility Safety, Chapter I, Sec. 3.b(8)	Although not applicable, continuous operation is supported through redundant equipment and fail safe configuration of common mode equipment. There is no single point failure in the CVS that will preclude continuous operation.
22	Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the CVS	Does Not Apply		DOE-HDBK-1169 (2.2.7)	Not applicable - see below
23	Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system	Applies		DOE-HDBK-1169 (2.2.7)	The confinement ventilation system is powered through switch gear such that on a loss of availability of commercial power, the CVS, system critical instrumentation and associated monitoring equipment can be powered from the site diesel generators.
24	Address any specific functional requirements for the CVS (beyond the scope of those above) credited in the DSA	Applies		10 CFR 830, Subpart B	There are no additional CVS requirements credited by the DSA that have not been previously covered.

DOE Waste Isolation Pilot Plant

Remote Handled Underground Confinement Ventilation System VU01

Ventilation System Evaluation

Revision 0, October 25, 2007

Review and Approval Page

Site Lead:

Richard Farrell ___Signature on File_____ Date: ____________

Evaluation Team Members:

Curtis A. Chester ___Signature on File_____ Date: ____________

Randy D. Elmore ___Signature on File_____ Date: ____________

John J. Garcia ___Signature on File_____ Date: ____________

DOE Field Office Manager:

Dave Moody ___Signature on File_____ Date: ____________

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Definitions

Safety Class.

Safety Class (SC) systems structures and components (SSCs) are those whose preventive or mitigative function is necessary to keep radiological material exposure to the public below the off-site evaluation guideline, which is 25 rem (roentgen equivalent man) total effective dose equivalent. The dose estimates to be compared to it are those received by a hypothetical maximally exposed off-site individual at the site boundary.

Safety Significant.

SSCs not designated as SC, but whose preventive or mitigative function is a major contributor to defense in depth (DiD) and/or worker safety as determined from hazards analysis. Safety Significant (SS) SSC designations based on worker safety are limited to those whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposure to workers.

Waste Isolation Pilot Plant (WIPP) procedure WP 09-CN3023, *WIPP Functional Classification for Design*, Rev. 7 identifies greater than 100 rem to the worker as the consequence for requiring consideration for functionally classifying an SSC as SS.

Abbreviations and Acronyms

ALARA – As Low As Reasonably Achievable

CH – Contact Handled

CMR – Central Monitoring Room

CMS – Central Monitoring System

CVS – Confinement Ventilation System

DBE – Design Basis Earth Quake

DBT – Design Basis Tornado

DiD – Defense in Depth

DSA – Documented Safety Analysis

EG – Evaluation Guideline (25 rem TEDE to the maximally-exposed offsite individual as defined in DOE-STD-3009-94)

FET – Facility Evaluation Team as defined in the VSEG

HEPA – High Efficiency Particulate Air

IRP – Independent Review Panel as defined in the VSEG

PDD – Pressure Differential Damper

PISA – Potentially Inadequate Safety Analysis

RH – Remote Handled

SC – Safety Class

SET – Site Evaluation Team as defined in the VSEG

SS – Safety Significant

SSCs – Systems, Structures and Components

TEDE – Total Effective Dose Equivalent

UG – Underground

VSEG – Department of Energy, Deliverables 8.5.4 and 8.7 of Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2004-2, *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems*

WAC – Waste Acceptance Criteria

WIPP – Waste Isolation Pilot Plant

Executive Summary:

The Waste Isolation Pilot Plant (WIPP) site is a low level repository for radioactive waste. Waste is characterized and shipped to WIPP in packages for disposal in the repository. The container that the waste is packaged in prior to loading into transportation containers (road casks) provides primary containment. There is no planned normal operation at WIPP that allow for waste to be present external to the waste package container primary containment. The waste container packages that are used for disposal are removed from the transportation containers (road casks) in the Waste Handling Building (WHB). From the time the packages are removed until they are placed in the repository, the packages are contained within facilities and structures with active confinement ventilation systems.

The facility evaluation team (FET) used the independent review panel (IRP) directed functional classification criteria for SS. Based on the evaluation criteria, the system evaluation did not reveal any “gaps” in the installed system’s functional design or performance expectations. The installed system’s functional design and performance expectations is commensurate with the identified site mission of receiving prepackaged and characterized waste and emplacing the waste in the waste container packages in which the waste is received on site. During the evaluation of the systems functional design and performance expectations against the evaluation criteria and the facility Documented Safety Analysis (DSA), there was no discovery of a potentially inadequate safety analysis (PISA).

Introduction

Facility Overview

The WIPP is located in Eddy County in southeastern New Mexico. The WIPP is located in an area of low population density with no industrial, commercial, institutional, recreational or residential structures within the WIPP Site Boundary.

The WIPP is designed to receive and handle 500,000 cubic feet per year (ft^3/yr) (14,160 cubic meters per year [m^3/yr]) contact handled (CH) waste and 10,000 ft3/yr (283 m^3/yr) remote handled (RH) waste. The WIPP facility is designed to have a disposal capacity for TRU waste of 6.2 million ft^3 (175,600 m^3). The WIPP facility has sufficient capacity to handle the 250,000 ft^3 (7,080 m^3) of RH waste. The WIPP is divided into surface structures, shafts, and subsurface structures.

The WIPP surface structures accommodate the personnel, equipment, and support services required for the receipt, preparation, and transfer of waste from the surface to the underground (UG). Vertical shafts, including the waste shaft, the salt handling shaft, the exhaust shaft, and the air intake shaft, extend from the surface to the UG horizon. The waste shaft is located between the CH and RH areas in the WHB.

The WIPP UG consists of the waste disposal area, construction area, north area, and the waste shaft station area. The CH and RH waste disposal area is a 100 acre area on a horizon located 2,150 feet beneath the surface in a deep, bedded salt formation.

RH waste is shipped to the site in one of two types of road casks. Waste canisters are shipped in 72-B casks. Drums of waste are shipped in 10-160B casks. Waste canisters shipped in 72-B casks are nominally 10 feet long and 26 inches in diameter. Drums of waste received in 10-160B casks, are over-packed into a steel facility canisters in the Hot Cell. Facility canisters are nominally 10 feet long and 28 inches in diameter. Canisters of RH waste are emplaced in the bore holes drilled in the walls of the disposal rooms.

The hazard classification category was determined in accordance with DOE-STD-1027-92. The material at risk for the determination of the categorization was defined as the maximum radiological contents of a single 55-gallon drum of CH waste at 80 plutonium-239 equivalent curies (PE-Ci). Since this inventory exceeds the Hazard Category 2 minimum threshold of 56 Ci for Pu-239, the WIPP is categorized as a Hazard Category 2 facility.

Confinement Ventilation Strategy

The UG ventilation system serves the WIPP underground to provide acceptable working conditions and a life-sustaining environment during normal operations and off normal events including waste handling accidents. All equipment and components of the RH UG CVS are located on the surface and provide ventilation to the UG through the mine exhaust shaft. In the event of a breach of waste containers, the underground ventilation system provides air flow away from the worker. Upon the detection of air borne radioactivity or the notification of a radiation control event, the ventilation system is either automatically or can be manually switched to provide high efficiency particulate air (HEPA) filtration of the mine exhaust.

The UG ventilation system is designed as an exhausting system that maintains the working environment below atmospheric pressure. The UG mine ventilation is designed to supply sufficient quantities of air to all areas of the repository. UG ventilation is divided into four separate flow paths supporting the waste disposal area, the construction area, north area, and the waste shaft station. All four air circuits combine near the exhaust shaft, which acts as the common discharge from the UG. A pressure differential is maintained between the construction circuit and the waste disposal circuit to ensure that any leakage is towards the disposal circuit. The pressure differential is produced by the surface exhaust fans in conjunction with the UG air regulators. Pressure differentials across selected bulkheads between ventilation circuits are monitored from the central monitoring room (CMR).

The UG ventilation system consists of six centrifugal exhaust fans (three main fans in the normal flow path and three smaller fans in the filtration flow path), two identical HEPA filter assemblies arranged in parallel, isolation and back draft dampers, a filter bypass arrangement, and associated ductwork. The main fans are used during normal operation to provide a nominal underground flow. During filtration operations only one filtration fan is in service and all other main and filtration fans are stopped and isolated. Any one of the three filtration fans is capable of delivering 100 percent of the design flow rate with the HEPA filters at their maximum pressure drop. The UG ventilation system is operated as follows:

- Normal Mode - During normal operation, five different levels of ventilation can be established to provide five different air flow quantities.
- Filtration Mode - This mode mitigates the consequences of a waste handling accident releasing radioactive contamination to the environment by providing a HEPA filtered air exhaust path from the underground and also reducing the air flow.

Filtration is activated automatically on a high radiation signal from one of the continuous air monitors in the exhaust of the active disposal room, or manually by the CMR operator, through the central monitoring system (CMS), when notified of a waste handling event underground. The operating status of the exhaust fans are displayed in the CMR and provisions to switch to filtration are provided. An alarm for excessive pressure drop across the filters is actuated at a predetermined level. Filter differential pressure is displayed locally and in the CMR. Instruments and system components are accessible for periodic testing and inspection during normal plant operation.

Under normal operating conditions, the ventilation system functions continuously. The underground ventilation system filtration fans can be connected to the backup power supply, one at a time, in the event that normal power is lost. Air is routed through the individual disposal rooms within a panel using UG bulkheads and air regulators.

Each HEPA filter assembly that serves the UG is equipped with two banks of prefilters and two banks of HEPA filters. All nuclear grade HEPA filter banks are tested for conformance with ASME N510.

The system was installed in stages starting in the mid 1980s. Originally the smaller exhaust filtration fans were installed. Two of the larger main fans were installed in the early 1990s with the third main fan installed in 1996 – 1997. The original design information is maintained and available at the WIPP.

Major Modifications

The facility is not currently undergoing any major modifications that affect the ventilation system or its operation.

Functional Classification Assessment

The WIPP procedure WP 09-CN3023, WIPP Functional Classification for Design, is the site procedure used for functional classification.

Existing Classification

Based on site procedures the RH UG CVS of this evaluation is classified as a safety significant system. This CVS is credited in the site DSA for preventing prompt, significant radiological or chemical exposure to workers.

Evaluation

The FET used the proceduralized site process, WP 09-CN3023, to evaluate the existing site functional classification of the CVS evaluated. Additionally, the FET reviewed the site procedure for compliance with DOE regulations and drivers to assess that the site procedure provides adequate assessment of functional classification for site systems.

The RH UG CVS was found to have the proper existing functional classification per WP 09-CN3023.

The procedure, WP 09-CN3023, was found to be inline with the DOE-STD-3009-94 guidance for functional classification. The FET did discover one typographical error in the procedure. The typographical error is being corrected.

Summary

The existing facility RH UG CVS functional classification is appropriate. The system provides ventilation that provides ventilation required for industrial safety issues and directs airflow away from the workers in various DSA analyzed accident scenarios.

System Evaluation

Identification of Gaps

The FET identified there were no gaps between the *Ventilation System Evaluation Guidance for Safety-Related and Non-Safety-Related Systems* VSEG evaluation criteria and the installed system's functional design or performance expectations.

The FET used the IRP directed SS performance criteria for the evaluation in accordance with the guidance in section 5.1 of the VSEG. Section 5.1 identifies that all hazard category 2 nuclear facilities that do not challenge or exceed the evaluation guideline (EG) will utilize SS performance criteria as identified in Table 5-1 of the VSEG.

The evaluation verified all the VSEG established performance criteria for SS CVS systems were adequately met by the CVS. The criteria established to be mandatory for this evaluation were:

a. Materials of Construction should be appropriate for normal, abnormal and accident conditions.
b. Confinement ventilation systems shall have appropriate filtration to minimize release.
c. Provide system status instrumentation and/or alarms.
d. Post accident indication of filter break-through.
e. Reliability of control system to maintain confinement function under normal, abnormal and accident conditions.
f. Control components should fail safe.
g. Administrative controls should be in place to protect confinement ventilation systems from barrier threatening events.
h. Design supports periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically.
i. Filter service life program should be established.
j. Failure of one component (equipment or control) shall not affect continuous operation.
k. Backup electrical power shall be provided to all critical instruments and equipment to operate and monitor the CVS.

The above listed criteria are required for the system to adequately provide the DSA credited safety significant system function.

All other IRP established VSEG performance criteria, identified in Table 5-1 of the VSEG, were determined to not be mandatory. The non-mandatory criteria were identified within the VSEG to be "applicable as required" or "credited by the facility DSA". The facility DSA does not credit the RH UG CVS to prevent or control hazardous release in the accident analyses.

Gap Evaluation

The FET identified there were no gaps between the VSEG evaluation criteria and the installed system's functional design or performance expectations, whether mandatory or non-mandatory.

Modifications and Upgrades

There are no required modifications or upgrade to the RH UG CVS since there are no gaps between the established performance criteria and the installed system's functional design or performance expectations.

Conclusion

The FET performed an evaluation of the RH UG CVS. The result of the evaluation was a determination that the system's installed design and performance expectations met the evaluation performance criteria established by the VSEG IRP for a Hazard Category 2 facility. There were no findings or proposed corrective actions as a result of this evaluation.

While there are no modifications or upgrades required, the system equipment is subject to a corrosive environment. There are corrosion and salt accumulations issues that will require attention for the life of the facility. These issues are being managed and continue to be managed through proper maintenance and equipment refurbishment.

References

ASME N510 — American Society of Mechanical Engineers, 1989, *Standard for Testing of Nuclear Air Cleaning Systems*, (formerly ANSI N510-1975, ANSI/ASME N510-1989)

CH DSA — DOE/WIPP-95-2065, REVISION 10, NOVEMBER 2006, Waste Isolation Pilot Plant Contact Handled (CH) Waste Documented Safety Analysis, with approved page changes CH-2007-01 and CH-2007-02, August 27, 2007

DOE-STD-3009-94 — DOE Standard Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses, with Change Notice No. 2, April 2002

DOE-STD-1027-92 — DOE Standard, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23,

	Nuclear Safety Analysis Reports, with Change Notice No. 1, September 1997
DOE HDBK-1169-2003	DOE Handbook, Nuclear Air Cleaning Handbook
RH DSA	DOE/WIPP-06-3174, REVISION 0, MARCH 2006, Waste Isolation Pilot Plant Remote Handled (RH) Waste Documented Safety Analysis, with page changes approved through August 28, 2007
SDD VU00	U.S. Department of Energy, Waste Isolation Pilot Plant, Underground Ventilation System Design Description, Rev. 12
WP 09-CN3023	*WIPP Functional Classification for Design*, Rev. 7

Attachments

Facility Evaluation Team composition and biographical sketches

Attachment 1 – FET members' Personnel Profiles

Data Collection Table and supporting attachments

Attachment 2 – Data Collection Table

Table 4-3

Attachment 3 - Supporting Attachments

RH Underground CVS VU01, Table 5-1 Ventilation System Performance Criteria and Evaluation Response

Summary Schedules for implementing upgrades

Not applicable – no identified "gaps" or required upgrades

Completed supporting evaluations and documentation

Not applicable.

Attachment 1

Field Evaluation Team Personal Profiles **Page**

Attachment 1

Personal Profile: **Richard F. Farrell**
Position: **Nuclear Safety Specialist**
U. S. DOE Carlsbad Field Office
(505) 234-8318

Summary:

1. Environmental, Safety, and Health (E,S&H) professional with over 30 years of diversified experience in nuclear and industrial safety, health physics, environmental/effluent monitoring, regulatory compliance related to state-of-the-art nuclear facilities, and mining and mineral extraction/ metallurgical processing.
2. Managed the development of the Waste Isolation Pilot Plant (WIPP) documented safety analysis (DSA) for contact-handled and remote-handled transuranic (CH/RH-TRU) waste disposal operations. Developed and the Department of Energy's (DOE) safety evaluation reports (SER) or approval bases associated with the WIPP safety basis.
3. Developed and managed the Radioactive Source Materials License compliance programs for a NRC licensed facility (an operating uranium mill/mine) including: radiological and industrial safety, ALARA, quality assurance, occupational health, and underground mine ventilation engineering and monitoring.

Experience:

U. S. Department of Energy; September 2007 - Present
Nuclear Safety Specialist Carlsbad Field Office (CBFO) Responsibilities include oversight and integration of CBFO/WIPP radiological and nuclear safety, occupational health, and nuclear safety management.
Safety Officer CBFO; August 2000 – September 2007 Responsibilities include oversight and integration of CBFO/WIPP industrial, radiological and nuclear safety, and occupational health.

U. S. Department of Energy; September 1992 - August 2000
Radiological Safety Manager Carlsbad Area Office (CAO) Responsibilities include oversight and management of CAO/WIPP radiological safety/control programs (10 CFR Part 835) and nuclear safety management (10 CFR Part 830).

Westinghouse Electric Corporation; April 1990 - September 1992
Senior Engineer at the Waste Isolation Pilot Plant Responsibilities include the management of interface activities with oversight and auditing groups, evaluation of applicable regulations and DOE orders, and support of audits of waste generator sites with regard to waste acceptance criteria.

Homestake Mining Company; 1977 - April 1990
(Nuclear Regulatory Licensed Uranium Milling and Mining)
Environmental Safety and Health Department On-Site Manage; 1983 - April 1990
Responsible for radiation safety/health programs as the radiation safety officer (RSO) for the Nuclear Regulatory Commission (NRC) licensed facility. Responsibilities included department administration, industrial safety/health, emergency management, RCRA compliance and hazardous waste management, CERCLA remediation and monitoring activities, occupational health and regulatory compliance.

Radiation Protection Administrator; 1980 - 1983 Responsibilities included management of the health physics, oand hazardous waste activities, training, environmental and effluent monitoring, and regulatory compliance. Served as the RSO for a NRC licensed facility.
Radiological Safety/Environmental Engineer; 1977 - 1980 Responsibilities included evaluation of radiological safety, health physics assessment, monitoring data, and the development of monitoring and emission control programs to assure compliance with occupational and environmental regulations.

Education:

B.S. - Chemistry major - biology minor, Northern Arizona University, 1975.
Twelve (12) semester hours of graduate level chemistry class work, and six (6) semester hours of graduate level radioactive waste management; University of New Mexico; 1981 and 1992, respectively.
Strong background in applied mathematics and statistics equivalent to a minor area of study [twenty (20) semester hours], Brigham Young University; 1993 - 1996.

Attachment 1

Personal Profile: **Curtis A. Chester**
Position: **Engineering Manager**
Integrated Waste Handling Engineering
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Chester is the Washington TRU Solutions manager of the Integrated Waste Handling Engineering (IWHE) group. IWHE is responsible for the technical ownership of all equipment used in the waste handling process, both Contact Handled and Remote Handled. Mr. Chester's staff consists of 17 engineers engaged in oversight of systems that include such diverse applications of engineering as robotics in waste processing, radiological monitoring systems, pumping and distributions systems for fire suppression, industrial material handling systems, facility structural integrity (including seismic and tornado loading) and confinement ventilation. The IWHE group is tasked with monitoring, maintaining, designing and planning the implementation of regulatory requirements associated with aspects of safety, environmental and radiological requirements for the site waste handling process. As manager of the IWHE group, Mr. Chester is responsible for administration of the proper oversight, review and approval of the actions implemented by the group.

Mr. Chester has participated in two successful Operational Readiness Reviews while at WIPP and was the lead engineer in the successful completion of the Remote Handled readiness review completed in January of 2007 including the system Start-up Testing and the system Line Management Assessment. Mr. Chester's experience and accomplishments in mechanical design, shop fabrication, procurement, engineering application of quality control and application of industrial process control make him uniquely suited for management of the IWHE group.

Professional History:

Manager / Integrated Waste Handling Engineering (1998 to present)
WGI/ Washington TRU solutions Carlsbad, New Mexico
Management of personnel employed in the development and implementation of strategies, resource allocations, baselines, and project execution plans for package handling equipment, system upgrades, and processes supporting the disposal of Defense Nuclear Waste. Successes and competence have been identified with a continuous progression of assignments from support engineer to engineering staff management.

Project Engineer / Staff Consultant (1993 to 1997)
Duke Engineering & Services Carlsbad, New Mexico
Provide design, analysis, and project management services to engineering and maintenance staff at the Waste Isolation Pilot Plant (WIPP).

Product Integrity Engineer/ Lead Manufacturing Engineer (1990 to 1993)
Martin Marietta Corporation Albuquerque, New Mexico
Develop and maintain process flow instructions and configuration management for multiple process lines. Conduct engineering analysis on mechanical structures and assemblies. Develop and implement quality, cost effective manufacturing practices regarding station layouts, sequence of operations, and tooling requirements.

Staff Engineer (1989-1990, 1993)

Attachment 1

Pharmacia SP Albuquerque, New Mexico
Perform engineering analysis on equipment. Develop equipment enhancements. Design and prototype special devices.

Education:

B.S. in Mechanical Engineering, **UNM Albuquerque, NM,** 1989

Publications:

"Final Results of the WIPP RH TRU Facility Shielding Analysis". 2002
"Exhaust Shaft Hydraulic Assessment Data Report". 1996
"Room Q Data Report: Test Borehole Data From December 7, 1993, through July 7, 1995". 1995

Attachment 1

Personal Profile: **Randy D. Elmore**
Position: **Cognizant System Engineer**
Confinement Ventilation Systems
Washington TRU Solutions LLC
WIPP Site

Summary:

Mr. Elmore is an engineer with over twenty years of experience with HVAC systems used for environmental, commercial and industrial applications including medical isolation suites, industrial clean room and laboratory and confinement ventilation systems. Experience includes the design, installation, start-up and oversight of isolation environments established through both positive and negative pressure differentials. Design activities have included not only air and equipment side but pneumatic, electronic and microprocessor design, programming, and start-up. Ancillary experiences and skills include cost estimation, project management, budgeting and system and personnel management.

Professional History:

Washington TRU Solutions, LLC. Carlsbad, New Mexico, 2001 – present:

Simplex Time Recorder, Inc., Lubbock, Texas, West Texas Marketing and Management Representative, 1998 to 2000

CSG (Compliance Services Group), Lubbock, Texas, Project Manager, 1996 to 1998

Con-Tech (Control Technologies), Lubbock, Texas, Co-Founder and Principal, 1992 to 1996

David G. Halley & Co., Inc., Lubbock, Texas, Sales Engineer / Stockholder, 1986 to 1992

Texas Instruments, Abilene, Texas, Project Engineer, 1985 to 1986

Williams, Tippet, and Associates, Inc., Abilene, Texas, Design Engineer, 1984 to 1985

Shell Pipeline Corp., Hamlin, Texas, Roustabout / Relief Technician, 1980 to 1982

Education:

B.S. in Mechanical Engineering, **Texas Tech University,** 1984 (Magna Cum Laude)

Professional Organizations:

Academy of Mechanical Engineers, Texas Tech University (Faculty Advisory Council, inducted April 2004)

Attachment 1

Personal Profile: **John J. Garcia**
Position: **Senior Manager**
Deputy Engineering Manager
Washington TRU Solutions LLC
WIPP Site

Summary

Proven executive level manager experienced in strategic planning, Program Management, Operations and Engineering management and business/product development of state-of-the-art nuclear facilities. Twenty-five plus years of progressive management experience. Proven ability to build new organizations, reorganize troubled organizations and expand into additional markets. Innovative problem solver and effective communicator adept in delivering superior customer service and developing new business.

Professional Experience:

Washington TRU Solutions, LLC, Carlsbad, NM – 6/1988 to Present

Deputy Engineering Manager (01/05 to Present)

- Management responsibility for implementation/improvement/maintenance of the site engineering and Nuclear Safety Programs.

Safety, Health, Security and Technical Support (02/03 to 01/05)

- Responsible for establishing and maintaining facility safety and health programs. Accomplished over 2 million work hours without a lost workday.
- Responsible for approximately 60 + employees and budget of 10 million.

Deputy Assistant General Manager Operations and Chief Engineer (02/01 to 02/03)

- Responsible for all site engineering issues listed under Engineering Manager
- Deputy Assistant General Manager Operations responsible for 400+ employees and budget of $80 Million.

Engineering Manager (Westinghouse Waste Isolation Division – 1995 to 2001)

- Responsible for 100+ employees and annual budget of $22 million.
- Assisted General Manager in establishing strategic direction and policy for the division.

- Managed an integrated, multi-disciplined infrastructure including business systems, multi-disciplined engineering functions, facility construction and configuration management processes.
- Maintained Nuclear Regulatory Commission package compliance and maintenance, generator site interface, transportation planning and tracking, Waste Acceptance Criteria requirements generation, and designed and maintained the WIPP Waste Information System for the National TRU (Transuranic Waste) Program.

Successive Engineering Management Positions including Manager, Program Management (1988-1995)

- Responsible for 35+ employees and budgets in excess of $12 million in preparation for start-up of the facility.
- Managed the division's budgeting and scheduling work scope.
- Integrated program details to establish current year budgets and five year planning.
- Tracked division performance and provided division support for program planning of major DOE or division initiatives.

Westinghouse Hanford Company, Hanford, WA – 1972 to1988

Engineering Positions of increasing responsibility leading to Manager, Waste Package, Repository and Seals Analysis Section

- Directed activities of 18 engineers and scientists and a budget of $4.5 million.
- Oversaw performance of critical engineering analyses and development of computer code to support design verification for the section.
- Designed software analytical packages for evaluating geotechnical, mechanical, hydrological, and thermal performance of the facility.

Education

B. S. - Mechanical Engineering, University of Texas, El Paso

Additional Master's Level Engineering courses

National Institute for Learning: "The Project Management Certificate Course"

Fluent in English and Spanish

Confinement Ventilation Documented Safety Analysis Information										
Facility: RH U/G VU01			Hazard Category 2					Performance Expectation		
Bounding Accidents	Type Confinement		Doses Bounding unmitigated / mitigated	Confinement Ventilation System Classification			Function	Functional Requirements	Performance Requirements	Compensatory Measures
	Active	Passive		SC	SS	DID				
(1-Fire) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	The performance functional evaluation did not reveal any vulnerability. No compensatory measures required.
(2 -Explosion) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	The performance functional evaluation did not reveal any vulnerability. No compensatory measures required.
(3 _Loss of Containment / Confinement) N/A	**X**		> 25 rem / prevented		**X**		In-facility worker protection	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room	The TSRs require daily check of the minimum airflow in active disposal room and in the waste shaft ventilation circuit	The performance functional evaluation did not reveal any vulnerability. No compensatory measures required.
(4 -Direct Radiological / Chemical Exposure)	**N/A**		N/A				N/A	N/A		None Identified Based on Risk
(5 -Nuclear Criticality)	**N/A**		N/A				N/A	N/A		Not credible for the WIPP due to WAC requirements/restrictions and established waste handling procedures/processes.
(6 -External Hazards)	**N/A**		N/A				N/A	N/A		None Identified Based on Risk
(7 -Natural Phenomena)	**N/A**		N/A				N/A	Required to provide sufficient airflow to direct airflow away from workers during waste handling in the event of a waste container breach. Sufficient airflow must also be maintained to facilitate evacuation of underground workers in the event of underground fires. The underground ventilation system is required to provide at least 20,000 scfm at the base of the waste shaft and 42,000 scfm in the active disposal room		None Identified Based on Risk

The confinement ventilation portion of the underground ventilation system provides a defense in depth function for accidents assoicated with operational and natural phenomenon events that could effect RH waste.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH U/G CVS VU01**				IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
1	Pressure Differentials should be maintained between zones and atmosphere	Applies	Number of zones as credited by accident analysis to control hazardous release; demonstrate by use considering potential in-leakage	DOE-HDBK-1169 (2.2.9), ASHRAE Design Guide	Pressure differentials are validated by measured flow rate. Flow rate validated with each change of ventilation control setting. Flow rates are verified no less than once per shift
2	Materials of Construction should be appropriate for normal, abnormal and accident conditions	Applies		DOE-HDBK-1169 (2.2.5), ASME AG-1	The Mine drifts themselves serve as the underground air flow conduits. The 8 gauge surface duct, structural supports and fans are adequately constructed.
3	Exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain integrity	Applies	As required by accident analysis to prevent accident release	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	WIPP ground control measures assures adequate underground integrity. There is no accident scenario that will impact the system integrity except for natural phenomenon (NP). The only DSA identified accident scenarios that can effect the surface fans and ducts of the CVS are NP and are addressed in the following.
4	Confinement ventilation systems shall have appropriate filtration to minimize release	Applies	Address: 1) Type of filter (e.g., HEPA, sand, sintered metal); 2) Filter Sizing (flow capacity and pressure drop); 3) Decontamination Factor vs. accident analysis assumptions	ASME AG-1, DOE HDBK-1169 (2.2.1)	WIPP underground filtration is provided by two 7 wide by 3 high HEPA filter housing (24"x24" filters). Each housing is rated for 30,000 cfm. The air flow is reduced to 60,000 cfm during filtration. Mine exhaust air flow is not normally directed through the filters. This allows the filters to be kept clean and dry.
5	Provide system status instrumentation and/or alarms	Applies	Address key information to ensure system operability (e.g., system delta-P, filter pressure drop)	ASME AG-1, DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	The HEPA filter housings are fitted with pressure monitoring capability for each HEPA filter bank with both local and remote readout. Remote alarms indicate a pressure drop that exceeds set point (alarm function is provided in the Central Monitoring Room (CMR)). WIPP has implemented a very conservative pressure drop limit of 5 inches w.g. for HEPA filter dp. Additional instrumentation provides local and remote indication of air flow with remote alarm in the CMR.
6	Interlock supply and exhaust fans to prevent positive pressure differential	Applies		DOE-HDBK-1169, ASHRAE Design Guide (Section 4)	The underground ventilation system is a draw through ventilation system without supply fans. Natural ventilation pressure (NVP) can cause very slight ventilation pressures differentials at certain points in the mine. However, NVP is not an issue in the emplacement room or the waste face. The emplacement room and the waste face are the areas of concern from the credited DSA perspective.
7	Post accident indication of filter break-through	Applies	Instrumentation supports post-accident planning and response	TECH-34	Local and remote indication of HEPA filter differential pressures and proof of air flow provide indication of filter status for post-accident planning and response.
8	Reliability of control system to maintain confinement function under normal, abnormal and accident conditions	Applies	Address, for example, impacts of potential common mode failures from events that would require active confinement function.	DOE-HDBK-1169 (2.4), ASHRAE Design Guide	The confinement ventilation system is comprised of three separate exhaust fans for normal (700 fans) and three separate fans for filtration (860 fans) air flow. The 700 and 860 fans can be ran in multiple configurations. Each fan has its own control system. The two filter housings that are employed during filtration events are parallel. Common isolation dampers have manual override capability and dual dampers to provide system redundancy to reduce the risk to site operations due to equipment outages. The extensive equipment redundancy provides for high availability of equipment to support operations thus providing reliable operation in normal, accident and abnormal operations.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH U/G CVS VU01**		IRP assigned Performance Criteria For Evaluation: Safety Significant		Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
9	Control components should fail safe	Applies		DOE-HDBK-1169 (2.4)	Isolation dampers are configured to fail safe providing underground containment of any release of materials from the repository should a release occur during the event of equipment failure. The failure of any other CVS control component will not affect the system integrity.
10	Confinement ventilation systems should withstand credible fire events and be available to operate and maintain confinement	Applies	As required by the accident analysis for existing facilities, must address protection of fiber media	DOE-HDBK-1169 (10.1), DOE-STD-1066	There is no accident analysis associated with fire events that would render the filter media ineffective for confinement. The filter media is approximately one-half mile from the repository area where credible fire events could take place. The HEPA filters are housed inside a all metal filter housing in a building of non-combustible construction without significant sources of ignition or fire source material in the immediate vicinity.
11	Confinement ventilation systems should not propagate the spread of fire	Applies	As required by the accident analysis for existing facilities, Address fire barriers, fire damper arrangements	DOE-HDBK-1169 (10.1), DOE-STD-1066	The filters and housing are of non-combustible construction. While the ventilation flow can support the sustaining of a fire in the underground, the air flow is required to support evacuation. The structure of the mine (chloride salt and clay) is non-combustible and the greatest hazard to the workers in a fire event is smoke. Ventilation flow and evacuation procedures for the mine are established to minimize the hazard to the workers. Ventilation flow can be controlled from the surface. The Facility Shift Manager (or designee) is responsible for emergency response operations which are established to provide the safest operational configuration in protection of the public, the workers and the environment.
12	Confinement ventilation systems should safely withstand earthquakes	Applies	If the active CVS is not credited in a seismic accident condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any seismic impact on the CVS will be based on the current functional requirements in the DSA	ASME AG-1 AA, DOE O420.1B, DOE-HDBK-1169 (9.2)	The system is not credited in the DSA to prevent the release of industrially or radiologically hazardous materials in the event of an earthquake.
13	Confinement ventilation system should safely withstand tornado depressurization	Applies	If the active CVS is not credited in a tornado condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any tornado impact on the CVS will be based on the current functional requirements in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The system is not credited in the DSA to prevent the release of industrially or radiologically hazardous materials in the event of a tornado.
14	Confinement ventilation system should safely withstand design wind effects on system performance	Applies	If the CVS is not credited in a wind condition, there is no need to evaluate that performance and/or design attribute for the CVS. Any wind impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	The system is not credited in the DSA to prevent the release of industrially or radiologically hazardous materials in the event of a high wind condition.
15	Confinement ventilation system should withstand other NP events considered credible in the DSA where the CVS is credited	Applies	If the CVS is not credited for this event, there is no need to evaluate that performance and/or design attribute for the CVS. Any impact on the CVS performance will be based on the current NP analysis in the DSA	DOE O420.1B, DOE-HDBK-1169 (9.2)	There are no other natural phenomenon events identified in the DSA which credit the CVS to prevent the release of hazardous materials.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH U/G CVS VU01**			IRP assigned Performance Criteria For Evaluation: Safety Significant	Hazard Category 2 - Active CVS
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
16	Administrative controls should be established to protect confinement ventilation systems from barrier threatening events	Applies	Ensure appropriately thought out response to external threat is defined (e.g., pre-fire plan)	DOE O420.1B	The DSA describes measures that are implemented to protect the facility and structures from credible barrier threatening events at the facility level. The CVS systems are not specifically identified, however the administrative controls that are instituted to protect the facility provide CVS protection.
17	Design supports the periodic inspection and testing of filters and housing, and tests and inspections are conducted periodically	Applies	Ability to test for leakage per intent of N510	DOE-HDBK-1169 (2.3.8), ASME AG-1, ASME N510	WIPP utilizes a computerized history and maintenance planning system (CHAMPS) to track the performance and periodicity of confinement ventilation inspections and testing. System walk-downs are performed annually and aerosol penetration tests (in accordance with the intent of N510) are conducted on an annual basis per CHAMPS generated work orders.
18	Instrumentation required to support system operability is calibrated	Applies	Credited instrumentation should have specified calibration/surveillance requirements. Non-safety instrumentation should be calibrated as necessary to support system functionality.	DOE-HDBK-1169 (2.3.8)	No CVS instrumentation is credited in the DSA in the prevention of the release of hazardous materials in any accident scenario. WIPP utilizes the CHAMPS system and periodic maintenance work orders to generate and track the periodic calibration of instrumentation required to support the CVS operability. The shift-to-filtration operation of the CVS is checked quarterly.
19	Integrated system performance testing is specified and performed	Applies	required responses assumed in the accident analysis must be periodically confirmed including any time constraints	DOE-HDBK-1169 (2.3.8)	There are no CVS required responses in any DSA analyzed accident scenario. The shift-to-filtration operation of the CVS is checked quarterly.
20	Filter service life program should be established	Applies	Filter life (shelf life, service life, total life) expectancy should be determined. Consider filter environment, maximum delta-P, radiological loading, age, and potential chemical exposure.	DOE-STD-1169 (3.1 and Appendix C)	WIPP has instituted a filter service life program. Filters are being changed out to assure filters are no more than 10 years old. There is no significant source for potential chemical exposure, radiological exposure or other damaging environmental impacts to the filter media, housings or seals. WIPP has set a differential pressure limit of 5 inches water gauge across the filters. Filters are changed on age or filter pressure drop (which ever occurs first). Because the process and environment is so clean, WIPP has historically changed filters on age long before pressure drop became an issue.
21	Failure of one component (equipment or control) shall not affect continuous operation	Does Not Apply	Address potential failures (example failures- fan, back-up power supply, switchgear)	DOE O420.1B, Facility Safety, Chapter I, Sec. 3.b(8)	Although not applicable, equipment redundancy (fans) and manual control operation of both fans and dampers allow for continued operation with any single point failure. The fans used for HEPA filtration can be powered from site generators on a loss of commercially available power.
22	Automatic backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the CVS	Does Not Apply		DOE-HDBK-1169 (2.2.7)	Not applicable.
23	Backup electrical power shall be provided to all critical instruments and equipment required to operate and monitor the confinement ventilation system	Applies		DOE-HDBK-1169 (2.2.7)	The fans used for HEPA filtration, system critical instrumentation and associated monitoring equipment can be powered from site generators on a loss of commercially available power.

	Table 5-1 Ventilation System Performance Criteria **Facility: RH U/G CVS VU01**			IRP assigned Performance Criteria For Evaluation: Safety Significant Hazard Category 2 - Active CVS	
	Evaluation Criteria	Safety Sign. IRP Class	Discussion	Reference	Criteria met by
24	Address any specific functional requirements for the CVS (beyond the scope of those above) credited in the DSA	Applies		10 CFR 830, Subpart B	There are no additional CVS requirements credited by the DSA that have not been previously covered.