

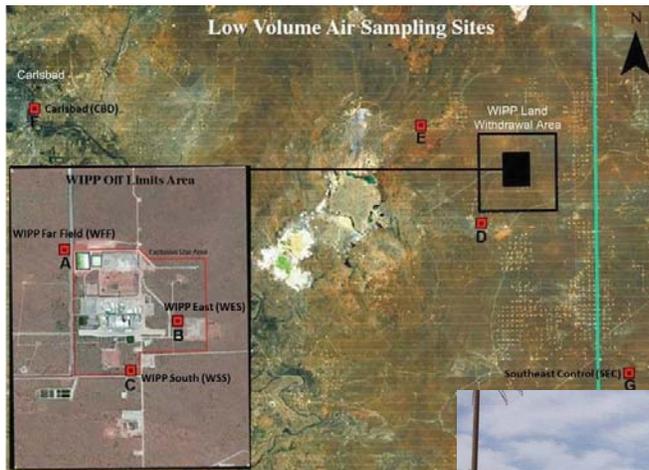


# U.S. Department of Energy Office of Environmental Management

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## Accident Investigation Report

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## Phase 1

### Radiological Release Event at the Waste Isolation Pilot Plant on February 14, 2014

April 2014



## Disclaimer

Phase 1 of this accident investigation report is an independent product of the Accident Investigation Board appointed by Matthew Moury, Deputy Assistant Secretary, Safety, Security, and Quality Programs, U.S. Department of Energy, Office of Environmental Management. The Board was appointed to perform an Accident Investigation and to prepare an investigation report in accordance with Department of Energy Order 225.1B, *Accident Investigations*.

The discussion of the facts as determined by the Board and the views expressed in the report do not assume and are not intended to establish the existence of any duty at law on the part of the U.S. Government, its employees or agents, contractors, their employees or agents, or subcontractors at any tier, or any other party.

This Phase 1 report neither determines nor implies liability.

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## Release Authorization

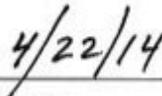
On March 4, 2014, an Accident Investigation Board was appointed to investigate a radiological release event at the U.S. Department of Energy, Waste Isolation Pilot Plant site near Carlsbad, New Mexico, that occurred on February 14, 2014. The Board's responsibilities have been completed with respect to Phase 1 of this investigation. The analysis and the identification of the contributing causes, the root cause and the Judgments of Need resulting from this investigation were performed in accordance with DOE Order 225.1B, *Accident Investigations*.

The Phase 1 report of the Accident Investigation Board has been accepted and the authorization to release this Phase 1 report for general distribution has been granted.



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James Hutton  
Acting Deputy Assistant Secretary  
Safety, Security, and Quality Programs  
Office of Environmental Management



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Date



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## Acronyms

ABSTA	Authorization Basis Senior Technical Advisor
AEOC	Alternate Emergency Control Center
AC	Administrative Control
ALARA	As Low as Reasonably Achievable
ASME	American Society of Mechanical Engineers
CAR	Corrective Action Report
CAS	Contractor Assurance System
CBFO	Carlsbad Field Office
CFM	Cubic Feet Per Minute
CH	Contact Handled
CHAMPS	Computerized History and Maintenance Planning System
CMR	Central Monitoring Room
CMRO	Central Monitoring Room Operator
CMS	Central Monitoring System
CON	Conclusion
CONOPS	Conduct of Operations
CTAC	Carlsbad Technical Assistance Contractor (Portage)
DBA	Design Basis Accident
DF	Design Feature
DOE	U.S. Department of Energy
dP	Differential Pressure
DPTA	diethylenetriamine pentaacetate
DPM	Disintegrations per Minute
DNFSB	Defense Nuclear Facilities Safety Board
DSA	Documented Safety Analysis
EAL	Emergency Action Level
EMCBC	DOE-EM Office of Environmental Management Consolidated Business Center
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ERO	Emergency Response Organization
EXO	Enriched Xenon Observatory
FR	Facility Representative
FSM	Facility Shift Manager
GCAP	Ground Control Annual Plan
HEPA	High-Efficiency Particulate Air

HSS	DOE Office of Health, Safety and Security
HQ	Headquarters
IC	Incident Commander
ICS	Incident Command System
IEP	Integrated Evaluation Plan
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ITS	Important to Safety
JON	Judgments of Need
JIC	Joint Information Center
LCO	Limiting Condition for Operations
M&O	Management and Operations
MACCS	MELCOR Accident Consequence Code Systems
NRB	Nuclear Review Board
NWP	Nuclear Waste Partnership LLC
MSHA	Mine Safety and Health Administration
MST	Mountain Standard Time
NaI	Sodium Iodide
OE	Operational Emergency
OH/IS	Occupational Health/Industrial Safety
ORPS	Occurrence Reporting and Processing System
PA	Public Address
PAC	Programmatic Administrative Control
PE-Ci	plutonium <sup>239/240</sup> equivalent curies
PISA	Potential Inadequacy in the Safety Analysis
QA	Quality Assurance
QAP	Quality Assurance Program
QAPD	Quality Assurance Program Document
RH	Remote Handled
RCDM	Radiological Control and Dosimetry Manager
RCM	Radiological Control Manager
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
REMS	Radiological Effluent Monitoring System
RPP	Radiation Protection Program
SAC	Specific Administrative Control

SC	Safety Class
SCFM	Standard Cubic Feet Per Minute
SER	Safety Evaluation Report
SigCat	Significance Category
SLA	Service Level Agreement
SME	Subject Matter Expert
SMP	Safety Management Program
SS	Safety Significant
SSC	Structures, Systems, and Components
STA	Senior Technical Advisor
TIM	Training Implementation Matrix
TQP	Technical Qualification Program
TRU	Transuranic
TRUPACT	Transuranic Package Transporter
TSR	Technical Safety Requirement
U/G	Underground
USGS	United States Geologic Service
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
UVS	Underground Ventilation System
WIPP	Waste Isolation Pilot Plant
WTS	Washington TRU Solutions, LLC

## Executive Summary

At approximately 2314 Mountain Standard Time (MST) on Friday, February 14, 2014, there was an incident in the underground repository at the Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, which resulted in the release of americium and plutonium from one or more transuranic<sup>1</sup> (TRU) waste containers into the environment. The WIPP is a deep geologic repository, mined out of a thick bed of salt, for the disposal of defense TRU waste generated primarily from the cleanup of DOE sites. The release was detected by an underground (U/G) continuous air monitor (CAM) and then directed through high-efficiency particulate air (HEPA) filter banks located in the surface exhaust building. However, a measurable portion bypassed the HEPA filters via design leakage through two ventilation system dampers and was discharged directly to the environment from an exhaust duct. No personnel were determined to have received external contamination; however, 21 individuals were identified through bioassay to have initially tested positive for low level amounts of internal contamination as of March 28, 2014. Trace amounts of americium and plutonium were detected off-site.

This accident meets the criteria in Appendix A to DOE Order (O) 225.1B, *Accident Investigations*. On February 27, 2014, Matthew Moury, Deputy Assistant Secretary for Safety, Security, and Quality Programs, U.S. Department of Energy, Office of Environmental Management, formally appointed an Accident Investigation Board (the Board) to investigate the radiological release in accordance with DOE Order 225.1B. The appointment letter was modified on March 4.

The Board began the investigation on March 3, 2014, completed Phase 1 of the investigation on March 28, 2014, and submitted the report to James Hutton, Acting Deputy Assistant Secretary for Safety, Security, and Quality Programs, U.S. Department of Energy, Office of Environmental Management on April 1, 2014. This report covers the Board's conclusions for the release of TRU from the U/G to the environment, which is considered to be Phase 1 of the investigation. Based upon the evidence gathered in this accident investigation, the Board concluded that the unfiltered above-ground release identified in Phase 1 of the investigation was preventable.

The Board concludes that a thorough and conservatively considered hazard analysis, coupled with a robust, tested and well maintained HEPA filter capable exhaust ventilation system could have prevented the unfiltered above ground release that occurred on February 14, 2014.

Originally, a large release from the underground that would have required crediting the HEPA filtered ventilation system to mitigate was not assumed to occur. Dating back to 2005, the safety basis documents designated the U/G confinement ventilation system (CVS) as a Safety Significant (SS) system based on directing airflow away from facility workers emplacing waste. However, the above ground systems including the exhaust High Efficiency Particulate Air (HEPA) filtration and bypass isolation valves were not credited because the safety controls at the

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<sup>1</sup> Transuranic waste (TRU) means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for (A) high-level radioactive waste; (B) waste that the DOE Secretary has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation required by the disposal regulations; or (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with part 61 of title 10, Code of Federal Regulations. [Public Law 102-579 (1992)]

time consisted of a credited Technical Safety Requirement (TSR) control that required weekly ground control inspections to ensure changing conditions were promptly identified, evaluated and addressed. When the existing Contact-Handled (CH) and Remote-Handled (RH) TRU safety basis documents were combined in September of 2008, the new Documented Safety Analysis (DSA) reduced the classification of the U/G CVS to “Balance of Plant,” meaning that it was no longer credited for worker protection from accidents identified in the DSA. Among the bounding accidents identified in this version of the DSA was a roof fall accident in an active panel (Event 030-CH/RH-UG), which resulted in an anticipated frequency with low consequences to facility workers, high consequences to co-located workers (100 meter receptor), and moderate consequences to public.

The primary safety basis control established for the roof fall accident was related to the ground control program. As a result, the release from a roof fall accident was assumed to be adequately prevented by the ground control program, and only relatively smaller releases in the U/G from events such as waste handling accidents were judged to be credible. The ground control program preventive controls were determined to be sufficient, and safety related mitigative controls for the larger releases in the U/G were not deemed necessary. As a result, the HEPA ventilation system and its associated bypass isolation dampers were not designated as credited safety related equipment. Because the isolation dampers were not nuclear safety system credited, the damper design was not required to meet requirements in the nuclear industry ventilation code, ASME AG-1-2012, *Code on Nuclear Air and Gas Treatment*. This decision resulted in the HEPA bypass isolation damper configuration not being equally efficient to the HEPA filters or suitable as a containment boundary, and resulted in the unfiltered release to the environment. The nuclear safety basis is more thoroughly discussed in Chapter 3, Nuclear Safety Program.

The U/G ventilation system originally consisted of three 860 series fans, each rated at 60,000 cfm, capable of providing normal unfiltered airflow to support early mining operations. The system also provided the capability to realign airflow through two banks of HEPA filters using a single 860 series fan to provide the rated airflow for waste emplacement activities. However, in order to align for filtration, two bypass isolation dampers that represent a pathway of unfiltered exhaust into the environment must be closed. These isolation dampers have a design leak rate of up to 1000 cfm. The radiological event that occurred on February 14 with the leakage past the isolation dampers was less than the National Emission Standards for Hazardous Air Pollutants (NESHAP) guidelines for the public and below the limits established by DOE and WIPP for site workers.

As mining activities were increased, the existing fans were no longer able to provide the necessary airflow to support the additional fossil fueled vehicle emissions. Two larger 700 series fans each rated at 260,000 cfm were installed, later followed by a third, that discharged upstream of the 860 series fans and significantly improved air flow capabilities. The ability to use the 860 fans to supplement unfiltered airflow was maintained for flexibility, although the addition of the new fans represented an opportunity to evaluate and improve the overall efficiency of the HEPA filtered system by eliminating the bypass dampers, which would have prevented the unfiltered release. However, since these systems were not credited as safety related, modifications were not subjected to the same level of scrutiny as would have occurred for modifications to credited safety systems. Additionally, there was significant degradation in the material condition of several ventilation system components identified that were not being aggressively pursued.

Since the HEPA ventilation system was not designated as a credited safety system, the CAMs in the U/G whose purpose is to detect a release in the U/G and cause an automatic switch of the ventilation system to filtration mode, were also not credited. The U/G ventilation system is more thoroughly discussed in Chapter 7, NWP Maintenance Program, Chapter 8, Radiation Protection Program and Chapter 9, Underground Ventilation.

The Board also determined that weaknesses in oversight by the contractor, CBFO, Headquarters, and outside organizations missed opportunities to identify inadequacies in the safety basis, as well as the configuration management and maintenance of the U/G ventilation system at WIPP. For example, the accident involving the roof fall in an active panel was removed in error from the latest revision to the DSA. This change was not identified by CBFO during their review, and therefore, the basis for the change was not provided in the DSA or DOE’s Safety Evaluation report (SER). Oversight is more thoroughly discussed in Chapter 11, NWP Contractor Assurance System and Chapter 12, DOE Programs and Oversight.

Inability of the Board to access to the U/G following the incident also prohibited definitive determination of the physical cause of the waste container(s) breach/failure. Nuclear Waste Partnership LLC (NWP) and the DOE Carlsbad Field Office (CBFO) will be implementing a detailed recovery plan to systematically reenter the U/G and make an absolute determination as to cause. The Board presumes either the penetration of a waste container or multiple containers by a roof bolt, or partial collapse of the back (roof) and/or ribs (walls) caused the breach and release of contamination. This will be investigated in Phase 2. Phase 2 of the Board investigation will occur after reentry into the U/G and a cause of the release within the U/G is able to be determined.

### Accident Description

On Friday, February 14, 2014, at approximately 2314, a “HI HI” radiation alarm was received in the Central Monitoring Room (CMR) at the DOE WIPP facility approximately 27 miles east of Carlsbad, New Mexico. The alarm was triggered from a CAM (Figure ES-1) in the U/G which was monitoring airborne radioactivity levels in air exhausting from Panel 7, an active waste panel where TRU waste was being emplaced for disposal.

The underground ventilation system (UVS) automatically switched to HEPA filtration mode when the airborne radiation alarmed the CAM and the 860 fan vortex damper was manually opened and adjusted to achieve designated airflow. This directed contaminated air from the U/G up through



**Figure ES-1: RADOS Continuous Air Monitor**

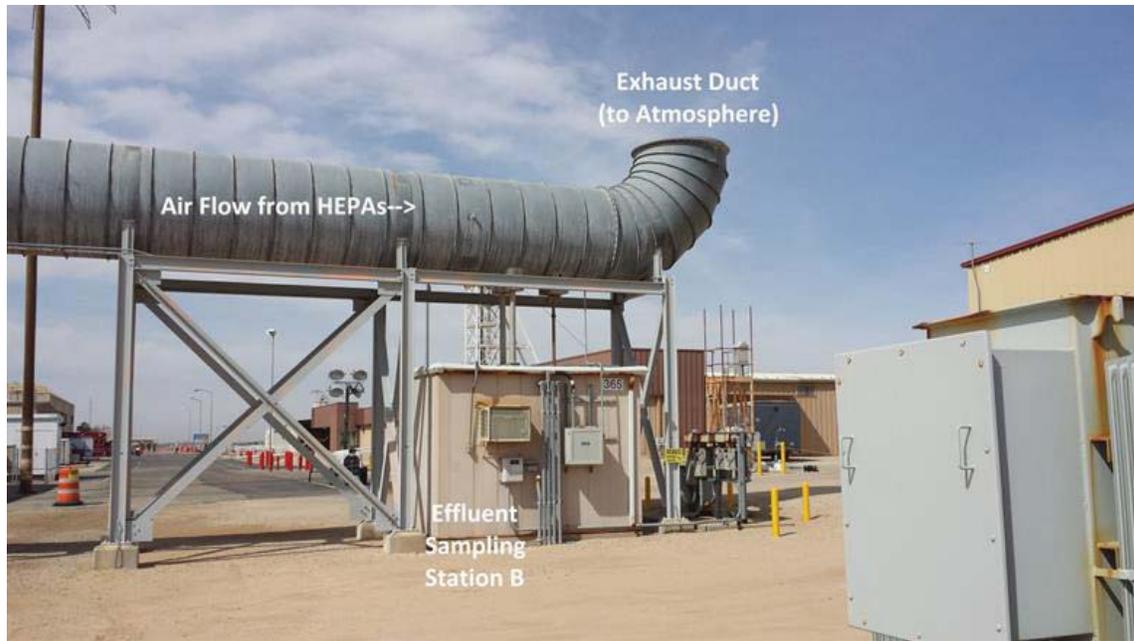
the U/G exhaust shaft, through the HEPA filter banks, and then to the environment from an exhaust duct. There were no employees working in the U/G at the time, but 11 personnel were working on the surface. After receiving the alarm, the Central Monitoring Room Operator (CMRO) notified the Operations and Radiological Control Manager (RCM also known as the Radiological Controls and Dosimetry Manager) and the DOE Facility Representative (FR), who responded to the site early the next morning. At 2342, the CMRO logged, “Disabled U/G CAM-151,” which was the only in-service CAM in the U/G, due to a malfunction indication, suspected due to filter plugging. Ventilation continued to run in filtration mode through the HEPA filters, and Radiological Control Technicians (RCTs) collected filters from upstream and downstream effluent sample stations for radiological counting. There were no other CAMs in the U/G or on the surface monitoring the exhaust. The Board determined that there should have been additional CAMs operating. However, the CAMs currently in U/G active disposal panels possess the lowest functional safety classification, Balance of Plant, and can be taken out of service without prior DOE or NWP Nuclear Safety approval, leaving no real-time monitoring capability.

On Saturday, February 15, 2014, the filters were counted at 0715; the RCM reported 4.4 million disintegrations per minute (dpm) alpha contamination on the filters from the effluent sample station upstream from the HEPA filters (Station A) (Figure ES-2). Preliminary data indicated the presence of TRU materials.



**Figure ES-2: Exhaust Air Shaft and Effluent Sample Station A**

Results from analysis of filters from the effluent sample station downstream of the HEPA filters (Station B) and at the discharge point to the atmosphere (Figure ES-3) were reported at 0915 and indicated 28,000 dpm alpha and 5,900 dpm beta contamination. This was the first indication that there was a release of contamination downstream of the HEPA filters to the environment.



**Figure ES-3: Station B and Exhaust Duct**

On-site personnel were directed to shelter-in-place at 0934. On-site and off-site surveys were initiated and portable air samplers were installed in selected site areas. A total of 153 people were working on the surface that day, including the backshift personnel and those on-site during the morning and afternoon. No personnel were working in the U/G. The Operations Assistance Team (OAT), Alternate Emergency Operations Center (AEOC) and Joint Information Center (JIC) were activated and at 1449 the AEOC at the CBFO facility in Carlsbad was declared operational.

At 1557, it was reported that site surveys were negative for radiological contamination and at 1612 preliminary analysis of the initial Station A and Station B filters indicated the presence of plutonium<sup>239/240</sup> (Pu) and americium<sup>241</sup> (Am). The UVS was still in HEPA filtration mode with no on-site or off-site contamination above background detected at that time. The site parking lot and vehicles were surveyed and found clean at 1557. At 1635, the shelter-in-place order was lifted and non-essential personnel were systematically released, building by building, via surveyed and controlled egress routes. Before they exited the guard gate, personnel underwent whole body radiological surveys (frisk). Radiological data from site surveys, effluent monitoring, portable air samplers and low volume off-site sampling continued to be collected with no indication of a detectable release to the environment. Site access was then restricted to essential personnel only.

The emergency event was terminated at 1917 on February 16, when the JIC and AEOC were deactivated. Bioassay was subsequently performed on approximately 150 personnel to determine if there was any intake of airborne contamination from the event. As of March 28, 2014, 21 personnel were found to have positive bioassay results.

On February 19, radiological results from the Carlsbad Environmental Monitoring and Research Center (CEMRC) high volume air sampling station located approximately 0.6 miles northwest of

the site on the WIPP access road were reported. CEMRC is affiliated with New Mexico State University and provides independent monitoring of the WIPP facility. The filter that was counted had been installed at the station prior to the event, on Tuesday, February 11, and was removed on Sunday, February 16. The levels detected at this sampling station indicated a small release of radioactive particles from the WIPP site.

On February 24, DOE reported additional environmental monitoring data from samples collected by WIPP radiological and environmental personnel on February 17 and 18 at numerous locations on and around the site. These results also indicated slightly elevated levels of airborne radioactive concentrations consistent with the waste disposed of at WIPP. These concentrations were well below a level of public or environmental hazard.

On March 6, two ventilation system dampers that were known to have design leakage, and allowed a portion of the radioactive material to bypass the HEPA filters were sealed with a high-density foaming material.

On March 7 and 8, radiological and air quality instruments were lowered into the U/G to check for airborne radioactivity and to determine air quality. The preliminary sample results indicated no detectable radioactive contamination in the air or on the air quality instruments.

On March 18, new air sample data were reported via a DOE press release and indicated a very small radiation release occurred on March 11, but with no expected health impact to the workers, public and environment. A series of workforce and public meetings were held following the February 14 radiological event to communicate what was known about the incident, provide monitoring results, and to provide status on recovery planning. These actions are ongoing, and site access continues to be limited to essential personnel only. Manned entry into the U/G to collect samples and assess conditions is being planned but has not yet been authorized.

### **Direct, Root, and Contributing Causes**

**Direct Cause** – the immediate events or conditions that caused the accident.

The Board identified the direct cause of this accident to be the breach of at least one TRU waste container in the U/G which resulted in airborne radioactivity escaping to the environment downstream of the HEPA filters. Due to restrictions on access to the U/G following the event, the exact mechanism of container failure, e.g., back or rib fall, puncture by a failed roof bolt, off-gassing, etc., is unknown at this time and must be determined once access to the U/G is restored. This will be investigated in Phase 2.

**Root Cause** – causal factors that, if corrected, would prevent recurrence of the same or similar accidents.

The Board identified the root cause of Phase 1 of the investigation of the release of radioactive material from underground to the environment to be NWP's and CBFO's management failure to fully understand, characterize, and control the radiological hazard. The cumulative effect of inadequacies in ventilation system design and operability compounded by degradation of key safety management programs and safety culture resulted in the release of radioactive material

from the underground to the environment, and the delayed/ineffective recognition and response to the release.

With regard to ventilation system design and operability: the filtration portion of the ventilation system has two HEPA filter bypass isolation dampers that provide a pathway of unfiltered exhaust into the environment. These isolation dampers are not suitable as a containment boundary and reduce the overall efficiency of the HEPA filter system. This is discussed further in Chapter 9, Underground Ventilation. This condition was never identified by the contractor, CBFO, or Headquarters in any of the revisions and updates to the WIPP safety basis documentation.

**Contributing Causes** – events or conditions that collectively with other causes increased the likelihood or severity of an accident but that individually did not cause the accident. For the purposes of this investigation, contributing causes include those related to the cause of the radiological release to the environment as well as those related to the subsequent response.

The Board identified eight contributing causes to the radiological release to the environment investigated in Phase 1, or resultant response:

1. Implementation of the NWP Conduct of Operations Program is not fully compliant with DOE O 422.1, *Conduct of Operations*, and impacted the identification of abnormal conditions and timely response.
2. NWP does not have an effective Radiation Protection Program in accordance with 10 Code of Federal Regulations (CFR) 835, *Occupational Radiation Protection*, including but not limited to radiological control technician training, qualification and requalification, equipment and instrumentation, and audits.
3. NWP does not have an effective maintenance program. The condition of critical equipment and components, including continuous air monitors, ventilation dampers, fans, sensors, and the primary system status display were degraded to the point where the cumulative impact on overall operational readiness and safety was not recognized or understood.
4. NWP does not have an effective Nuclear Safety Program in accordance with 10 CFR 830 Subpart B, *Safety Basis Requirements*. There has been a reduction in the conservatism in the Documented Safety Analysis (DSA) hazard/accident analysis and corresponding Technical Safety Requirement (TSR) controls over time, commencing with EM Headquarters delegation of safety basis approval authority (SBAA) in late 2009. For example, 15 of 22 design basis accidents were removed from the latest revision without any clear justification, including the elimination of a roof/rib fall event in an open waste panel. Several other examples are provided in Chapter 3, Nuclear Safety Program. In addition, the DSA and TSRs contain errors, there is a lack of DSA linkage to supporting hazard analysis information, and there is confusion over the back fall accident description in a closed versus open panel.
5. NWP implementation of DOE O 151.1C, *Comprehensive Emergency Management System*, was ineffective. Personnel did not adequately recognize, categorize, or classify the emergency and did not implement adequate protective actions in a timely manner.

6. The current site safety culture does not fully embrace and implement the principles of DOE Guide (G) 450.4-1C, *Integrated Safety Management Guide*. There is a lack of a questioning attitude, reluctance to bring up and document issues, and an acceptance and normalization of degraded equipment and conditions. This is supported by the 2012 Safety Conscious Work Environment (SCWE) survey results which indicated a reluctance to report issues to management, indicating a chilled work environment. Execution of the NWP Contractor Assurance System (CAS) in accordance with DOE O 226.1B, *Implementation of Department of Energy Oversight Policy*, was ineffective. Execution of the CAS did not identify precursors to this event or the unacceptable conditions and behaviors documented in this Phase 1 report.
7. Execution of CBFO oversight in accordance with DOE O 226.1B was ineffective. CBFO failed to establish and implement adequate line management oversight programs and processes and hold personnel accountable.
8. DOE Headquarters (HQ) line management oversight was ineffective. DOE HQ failed to ensure that CBFO was held accountable for correcting repeated identified issues involving radiological protection, nuclear safety, Integrated Safety Management (ISM), maintenance, emergency management, work planning, and control and oversight.

### **Conclusions and Judgments of Need**

Based upon the conclusions of this accident investigation, the Board concluded that the unfiltered above ground release identified in Phase 1 of the investigation was preventable. The ventilation system has High Efficiency Particulate Air (HEPA) filter bypass isolation dampers that represent a pathway of unfiltered exhaust into the environment. These isolation dampers are not suitable as a containment boundary and reduce the overall efficiency of the HEPA filter system.

Table ES-1 summarizes the Conclusions (CONs) and Judgments of Need (JONs) determined by the Board. The conclusions are derived from the analytical results performed during this accident investigation for determining what happened and why it happened. Also listed are JONs determined by the Board as managerial controls and safety measures necessary to prevent or minimize the probability or severity of a recurrence of this type of accident. Table 4-1 in the body of the report provides more detail, including the causal factors, specific conditions related to the causal factors, and associated CONs and JONs.

**Table ES-1: Conclusions and Judgments of Need**

Conclusion (CON)	Judgments of Need (JON)
<p><b>CON 1:</b> The direct cause of the transuranic mixed waste container release could not be definitively determined during Phase 1 of the investigation due to the inability for personnel to access the underground, collect information, and inspect the waste panels/rooms.</p>	<p><b>JON 1:</b> Nuclear Waste Partnership LLC (NWP) and the Carlsbad Field Office (CBFO) need to implement a detailed recovery plan to systematically reenter the underground, collect data and information, and make an absolute determination as to the mechanism of the transuranic waste release.</p> <p><b>JON 2:</b> During Phase 2, the DOE Accident Investigation Board needs to evaluate the data and information collected and provided by NWP and CBFO to determine the mechanism of release and determine the related conditions and causal factors, reach conclusions, and identify additional judgments of need.</p>
<p><b>Nuclear Safety Program</b></p>	
<p><b>CON 2:</b> There has been a reduction in conservatism in the Documented Safety Analysis hazard/accident analysis and Technical Safety Requirement safety controls within safety basis revisions occurring since 2010, i.e., <i>Documented Safety Analysis/ Technical Safety Requirement</i>, Revision 1 to Revision 4. This is not consistent with DOE-Standard (STD)-3009, <i>Preparation Guidance for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis</i> and DOE-STD-5506, <i>Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities</i>.</p>	<p><b>JON 3:</b> NWP needs to revise the hazard and accident analyses to comply with DOE-Standard-3009, <i>Preparation Guidance for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis</i> and DOE-STD-5506, <i>Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities</i>, regarding not crediting administrative controls in the unmitigated analysis. In particular, some initial assumptions/initial conditions, e.g., compliance with 30 CFR 57, <i>Safety and Health Standards Underground Metal and Nonmetal Mines</i> ground control program requirements, should be preventive or mitigative controls derived by the mitigated analysis and should be evaluated for the need for protection with Technical Safety Requirement controls.</p>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
<p><b>CON 3:</b> The Documented Safety Analysis and Technical Safety Requirement have several errors or omissions that are indicative of lack of rigorous contractor internal review and independent peer-review processes for the development of the safety basis, e.g., quality issues include Documented Safety Analysis and Technical Safety Requirement errors, lack of Documented Safety Analysis linkage to supporting hazard analysis information, confusion over back fall accident description in closed vs. open panel.</p>	<p><b>JON 4:</b> NWP needs to commission an independent assessment of the Documented Safety Analysis/Technical Safety Requirement Revision 4 through corporate assistance or other recognized external resources, and corrective actions implemented that establish appropriate hazard controls and functional classifications.</p>
<p><b>CON 4:</b> Technical Safety Requirements are not effective in ensuring facility configurations that provide contribution to defense-in-depth for radiological events. The function of the Documented Safety Analysis as articulated in 10 CFR 830, <i>Nuclear Safety Management Rule</i>, Appendix A, Section G.4 is as follows: “Technical Safety Requirements establish limits, controls and related actions necessary for the safe operation of a nuclear facility.”</p>	<p><b>JON 5:</b> NWP needs to re-evaluate the importance of the suite of available preventive and mitigative controls, e.g., continuous air monitors and underground ventilation system, in the supporting hazards analysis report and the Documented Safety Analysis, Section 3.3 hazard evaluation, and whether they should be considered as major contributors to defense in depth. This may require upgrading of some Structures, Systems, and Components functional classifications.</p>
<p><b>CON 5:</b> Since neither the CAMs nor the underground ventilation system are pedigreed, i.e., Safety Class, Safety Significant, Important to Safety Structures, Systems, and Components, their importance has not been acknowledged within the Technical Safety Requirements, e.g., no Limiting Conditions for Operation/ Surveillance Requirements.</p> <p>In addition, neither Documented Safety Analysis Safety Management Programs, (Chapter 7 Radiation Protection Program), nor the Technical Safety Requirement Programmatic Administrative Controls consider whether CAMs may provide protection for the facility worker who may be in the exhaust drift.</p>	<p><b>JON 6:</b> NWP needs to re-evaluate the classification of continuous air monitors and the underground ventilation system consistent with the outcome of the revised hazard analysis and develop Technical Safety Requirement controls consistent with that classification.</p>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
<p><b>CON 6:</b> The Technical Safety Requirement documentation is not being controlled with the rigor normally associated with a Hazard Category 2 nuclear facility.</p>	<p><b>JON 7:</b> NWP needs to revise the Technical Safety Requirements to align with changes to the Documented Safety Analysis, e.g., continuous air monitor and underground ventilation system, correct current errors in the Technical Safety Requirements, and ensure that implementing procedures clearly support consistent interpretations.</p>
<p><b>CON 7:</b> The NWP Unreviewed Safety Question Determination procedure does not clearly communicate the actions required to evaluate situations that could involve a Potential Inadequacy in the Safety Analysis. In addition, NWP’s implementation of Unreviewed Safety Question procedure requirements indicates a lack of recognition that some proposed recovery activities associated with the radiological release event were outside the analyzed safety basis. This is evident from NWP’s Unreviewed Safety Question’s evaluations or lack there-of, related to impacts on previously analyzed accidents or safety controls; identifying equipment that is important to safety; and completeness of identifying accidents of a new type not previously analyzed.</p>	<p><b>JON 8:</b> NWP needs to commission an independent assessment of the Unreviewed Safety Question process through corporate assistance or other recognized external resources, and implement corrective actions that ensure effectiveness.</p> <p><b>JON 9:</b> NWP needs to strengthen the Unreviewed Safety Question Determination procedure to clarify Potential Inadequacy in the Safety Analysis guidance, including the appropriate timeliness for entrance into the process and decision making.</p>
<p><b>CON 8:</b> There is an observed lack of robustness in the CBFO technical review of Documented Safety Analysis/Technical Safety Requirement changes/annual updates, e.g., lack of documentation of the technical basis for approval to support development of a Safety Evaluation Report. While the Safety Evaluation Reports are consistent with the format per DOE-Standard-1104, <i>Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents</i>, the conclusions do not include adequate rationale for acceptance of the proposed changes.</p>	<p><b>JON 10:</b> CBFO needs to revise Management Procedure 4.11, <i>Safety Basis Review Procedure</i>, to require adequate documentation of the technical basis supporting approval of changes to the WIPP Document Safety Analysis or Technical Safety Requirements, consistent with DOE Standard 1104, e.g., regulatory compliance, justification for initial assumptions/initial conditions, reduced conservatism of the hazards and accident analysis.</p> <p><b>JON 11:</b> CBFO and DOE HQ need to commission an independent assessment of the CBFO safety basis review and approval process and implement corrective actions that ensure effective implementation.</p>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
<p><b>CON 9:</b> CBFO has insufficient nuclear safety management/staffing since the 2010 timeframe and the retirement of Authorization Basis Senior Technical Advisor and existing Nuclear Safety Specialist staff responsible for multiple subject matter expertise.</p>	<p><b>JON 12:</b> CBFO needs to perform a critical federal staffing analysis focused on Nuclear Safety e.g., Nuclear Safety Specialist, nuclear safety qualified Senior Technical Advisor and supporting CBFO Subject Matter Experts and determine whether existing resources are adequate.</p> <p><b>JON 13:</b> CBFO and DOE HQ need to arrange for temporary DOE senior nuclear safety resources to mentor existing CBFO nuclear safety and supporting resources, and assist as necessary.</p>
<b>Emergency Management</b>	
<p><b>CON 10:</b> Compensatory measures were not put in place to mitigate issues identified immediately following the February 5, 2014, underground fire event with respect to emergency management.</p> <p><b>CON 11:</b> The emergency management program was not adequately structured and implemented such that personnel did not recognize, categorize, or classify the emergency and implement protective actions in a timely manner.</p> <p><b>CON 12:</b> The Waste Isolation Pilot Plant (WIPP) (NWP and CBFO) emergency management program is not fully compliant with DOE Order 151.1C, <i>Comprehensive Emergency Management System</i>, e.g., activation of the Emergency Operations Center, classification and categorization, emergency action levels, implementation of the Incident Command System, training, drills and exercises, etc. Weaknesses in classification, categorization, and emergency action levels were previously identified by both external review and in the response to the underground fire and the radiological release events.</p>	<p><b>JON 14:</b> NWP needs to immediately develop and implement interim compensatory measures to ensure prompt identification, categorization, classification, and response to operational emergencies, e.g., corporate reach-back, training, Senior Management Watch in the Central Monitoring Room, etc.</p> <p><b>JON 15:</b> CBFO needs to take prompt action to fully integrate trained Federal management resources into the emergency response organization and take action to bring their emergency management program into compliance with DOE Order 151.1C, <i>Comprehensive Emergency Management System</i>.</p> <p><b>JON 16:</b> NWP needs to correct their activation, notification, classification, and categorization protocols to be in full compliance with DOE Order 151.1C, <i>Comprehensive Emergency Management System</i>, Resource Conservation and Recovery Act Contingency Plan and then provide training and drills for all applicable personnel.</p> <p><b>JON 17:</b> NWP needs to revise Emergency Response Organization training to include</p>

Conclusion (CON)	Judgments of Need (JON)
	<p>more supervised hands-on training and drills to enhance the effectiveness of the Emergency Response Organization's response.</p> <p><b>JON 18:</b> NWP needs to fully integrate the Resource Conservation and Recovery Act Contingency Plan activation criteria within the site Emergency Action Levels and to train the applicable personnel to ensure implementation of the Resource Conservation and Recovery Act Contingency Plan.</p> <p><b>JON 19:</b> NWP needs to take prompt action to correct longstanding deficiencies from previous reviews.</p> <p><b>JON 20:</b> CBFO needs to ensure that NWP completes prompt action to correct longstanding deficiencies from previous reviews.</p> <p><b>JON 21:</b> NWP needs to improve the content of site-specific Emergency Action Levels to expand on the information provided in the standard Emergency Action Levels contained in DOE Order 151.1C, <i>Comprehensive Emergency Management System</i>.</p> <p><b>JON 22:</b> NWP needs to develop and implement an Incident Command System for the Emergency Operations Center/Central Monitoring Room that is compliant with DOE O 151.1C and is capable of assuming command and control for all anticipated emergencies.</p> <p><b>JON 23:</b> DOE Headquarters (HQ) needs to conduct an effectiveness review of the NWP and CBFO emergency management program implementation within six months of completion of the corrective actions for the Emergency Management Judgments of Need.</p>

Conclusion (CON)	Judgments of Need (JON)
<b>Safety Culture</b>	
<p><b>CON 13:</b> NWP and CBFO have allowed the safety culture at the WIPP project to deteriorate as evidenced by the workers feedback that they do not feel comfortable identifying issues that may adversely affect management direction, delay mission related objectives, or otherwise affect cost or schedule.</p> <p>Questioning attitudes are not welcomed by management and many issues and hazards do not appear to be readily recognized by site personnel.</p>	<p><b>JON 24:</b> NWP and CBFO need to develop and implement an effective integrated safety management system that embraces and implements the principles of DOE G 450.4-1C, <i>Integrated Safety Management Guide</i>, including but not limited to:</p> <ul style="list-style-type: none"> <li>• Demonstrated leadership in risk-informed, conservative decision making</li> <li>• Improved learning through error reporting and effective resolution of problems</li> <li>• Line management encouraging a questioning attitude without fear of reprisal and following through to resolve issues identified by the workforce</li> <li>• Reinforcing the mechanisms, e.g., WIPP Forms, “Notes to Joe,” employee concern program, differing professional opinions, and protocols for communicating issues to NWP and CBFO leadership.</li> </ul> <p><b>JON 25:</b> DOE HQ needs to engage external safety culture expertise in providing training and mentoring to NWP and CBFO management on the principles of a strong nuclear safety culture and implement any recommendations from these experts.</p>

Conclusion (CON)	Judgments of Need (JON)
<p><b>CON 14:</b> DOE has exacerbated the safety culture problem by referring to numbers of ORPS reports and other deficiency reporting documents, rather than the significance of the events, as a measure of performance by Source Evaluation Boards during contract bid evaluations, and poor scoring on award fee determinations. Directly tying performance to the number of occurrence reports drives the contractor to non-disclosure of events in order to avoid the poor score. This practice is contrary to the Department's goals of the development and implementation of a strong safety culture across our projects.</p>	<p><b>JON 26:</b> DOE HQ needs to clearly specify the use of performance reporting results, e.g., Occurrence Reporting and Processing System and non-conformance reports in Past Performance Evaluations, to encourage conservative reporting and communication of Lessons Learned.</p>
Conduct of Operations	
<p><b>CON 15:</b> Key elements of the NWP Conduct of Operations program were ineffective in driving safe and compliant operation of a Hazard Category 2 nuclear facility.</p>	<p><b>JON 27:</b> NWP needs to strengthen execution of the Conduct of Operations program to be compliant with DOE O 422.1, <i>Conduct of Operations</i>. Specific areas of focus must include (but not limited to):</p> <ul style="list-style-type: none"> <li>• Establishing and reinforcing expectations conveyed in WP 04-CO.01, <i>Conduct of Operations</i> series procedures.</li> <li>• Initiate a mentoring program, e.g., senior supervisor watch that provides real time feedback to first and second line supervisors as to their responsibilities regarding compliant execution of operations activities.</li> <li>• Strengthen the structure, content and flow of abnormal response procedures to ensure immediate actions do not require judgment calls prior to execution.</li> <li>• Consider the addition of real time surveillance capability, e.g., video of the active waste panels/rooms.</li> <li>• Establish and execute an operational drill program that evaluates operator</li> </ul>

Conclusion (CON)	Judgments of Need (JON)
	<p>response to upset conditions.</p> <ul style="list-style-type: none"> <li>• Establish a process that heightens awareness and requires deliberate action to reduce the quantity and length of time key pieces of equipment are out of service.</li> </ul> <p><b>JON 28:</b> CBFO needs to take an active role towards improving NWP conduct of operations through implementation of a structured DOE O 226.1B, <i>Implementation of Department of Energy Oversight Policy</i>, oversight process that includes mechanisms for identifying, reporting, and transmitting issues that tracks corrective actions to effective closure. Specific areas of focus must include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Develop and conduct routine oversight of contractor implementation of the WP 04-CO.01, <i>Conduct of Operations</i> series procedures. Oversight needs to include detailed oversight plans that contain specific criteria and lines of inquiry to effectively assess compliance with DOE O 422.1.</li> <li>• Oversight of the NWP mentoring program e.g., senior supervisor watch that provides real time feedback to first and second line supervisors as to their responsibilities regarding compliant execution of operations activities in order to provide feedback on effectiveness.</li> <li>• Oversight of procedure development in order to strengthen the structure, content and flow of abnormal response procedures to ensure immediate actions do not require judgment calls prior to execution.</li> <li>• Overseeing execution of the NWP operational drill program that evaluates operator response to upset conditions.</li> </ul>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
	<ul style="list-style-type: none"> <li>Strengthen oversight of NWP processes that monitor equipment status and initiate action to correct deficiencies in order to ensure a reduction in the quantity and length of time key pieces of equipment are out of service.</li> </ul>
<b>Maintenance Program</b>	
<p><b>CON 16:</b> The current culture at NWP is such that due consideration for prioritization of maintenance of equipment is not given unless there is an immediate impact on the waste emplacement processes.</p> <p><b>CON 17:</b> Execution of the NWP engineering process has not been effective in maintaining configuration of key systems at WIPP. Specific examples include:</p> <ul style="list-style-type: none"> <li>Conversion of the 860 fan vortex damper actuator from automatic to manual operation;</li> <li>Functionality of the ventilation system in filtration including evaluation and testing of leakage via the bypass dampers; and</li> <li>The impact of salt buildup on bypass damper effectiveness.</li> </ul>	<p><b>JON 29:</b> NWP needs to take action to ensure that the maintenance process effectively considers and prioritizes repairs to achieve and maintain a high state of operational readiness.</p> <p><b>JON 30:</b> NWP needs to improve the execution of engineering processes that ensure system configuration management is maintained and that the rigor in processing proposed changes to systems is at a level that ensures system design functionality is maintained. Specific examples include:</p> <ul style="list-style-type: none"> <li>Conversion of the 860 fan vortex damper actuator from automatic to manual operation;</li> <li>Functionality of the ventilation system in filtration including evaluation and testing of leakage via the bypass dampers; and</li> <li>The impact of salt buildup on bypass damper effectiveness.</li> </ul> <p><b>JON 31:</b> CBFO needs to take a more proactive role in the configuration management and maintenance programs to ensure that the facility can meet its operational and life time expectancy.</p> <p><b>JON 32:</b> DOE HQ Office of Environmental Management and CBFO need to develop an infrastructure improvement plan within six months to identify and prioritize program-wide critical infrastructure upgrades for key systems to ensure continuation of EM's programmatic mission execution at WIPP.</p>

Conclusion (CON)	Judgments of Need (JON)
	<p>Additionally, DOE HQ Office of Environmental Management needs to coordinate an extent of condition review at other EM sites and take action based on the outcome of that review.</p>
<p><b>Radiation Protection Program</b></p>	
<p><b>CON 18:</b> NWP does not have an effective Radiation Protection Program in accordance with 10 Code of Federal Regulations (CFR) 835, <i>Occupational Radiation Protection</i>, including but not limited to radiological control technician training, qualification and requalification, equipment and instrumentation, and audits.</p>	<p><b>JON 33:</b> NWP needs to evaluate the current state of the radiological control program including the current radiological conditions and implement compensatory measures to support recovery and current activities.</p> <p><b>JON 34:</b> NWP needs to perform an extent of condition review of the training program incorporating the results of this event and implement actions to improve radiological control management, Radiological Control Technician, and rad worker proficiency in dealing with contamination, and airborne radioactive material.</p> <p><b>JON 35:</b> NWP needs to perform an extent of condition review for identified weaknesses in the radiological control program and implement corrective actions to fully implement 10 CFR 835.</p> <p><b>JON 36:</b> CBFO needs to determine the effectiveness of the radiation protection program within three months of completion of NWP's corrective actions.</p>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
<p><b>CON 19:</b> There is an inadequate technical basis for the existing ventilation and airborne monitoring systems. It is unclear that they adequately provide protection to the underground workers, the co-located worker, the public, and the environment from the transuranic mixed waste or hazardous constituents, e.g., reliability of a single CAM to initiate an automatic shift to filtration, acceptability of leakage past the bypass dampers and automatic shift to filtration that now requires manual operation of 860 fan vortex dampers.</p>	<p><b>JON 37:</b> NWP needs to develop a technical basis to implement continuous and reliable/redundant real-time air monitoring with appropriate automatic shift to filtration to protect the workers, the public and the environment. This needs to take into consideration the different ventilation modes, protection of workers in the underground, and release of contaminants to the environment. The technical basis must also consider the hazardous constituents in the transuranic mixed waste, e.g., reliability of a single CAM to initiate an automatic shift to filtration, acceptability of leakage past the bypass dampers and automatic shift to filtration that now requires manual operation of 860 fan vortex dampers.</p>
<b>NWP Contractor Assurance System</b>	
<p><b>CON 20:</b> NWP has not fully developed an integrated contractor assurance system that provides assurance that work is performed compliantly, risks are identified, and control systems are effective and efficient.</p>	<p><b>JON 38:</b> NWP needs to develop and implement a fully integrated contractor assurance system that provides DOE and NWP confidence that work is performed compliantly, risks are identified, and control systems are effective and efficient.</p>
<p><b>CON 21:</b> NWP failed to adequately establish and implement line management oversight programs and processes to meet the requirements of DOE O 226.1B, <i>Implementation of Department of Energy Oversight Policy</i>, and hold personnel accountable for implementing those programs and processes.</p> <p><b>CON 22:</b> NWP failed to identify weaknesses in conduct of operations, maintenance, radiological protection, nuclear safety, emergency management, and safety culture.</p> <p><b>CON 23:</b> NWP failed to adequately complete corrective actions from prior assessments to prevent or minimize recurrence.</p> <p><b>CON 24:</b> Comprehensive self-assessments are</p>	<p><b>JON 39:</b> NWP needs to establish and implement line management oversight programs and processes that:</p> <ul style="list-style-type: none"> <li>• Meet the requirements of DOE O 226.1B, <i>Implementation of Department of Energy Oversight Policy</i>, and hold personnel accountable for implementing those programs and processes.</li> <li>• Implement effective contractor assurance processes to emphasize conduct of operations, maintenance, radiological protection, nuclear safety, emergency management, and safety culture.</li> <li>• Implement a Contractor Assurance System to ensure that actions from prior</li> </ul>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
<p>not being performed by knowledgeable, qualified subject matter experts within the various safety management programs. Contractor Assurance System is implemented primarily through the Quality Assurance program.</p>	<p>assessments are implemented to prevent or minimize recurrence of identified deficiencies.</p> <ul style="list-style-type: none"> <li>• Include self-assessments by knowledgeable, qualified subject matter experts within the various safety management programs.</li> </ul>
<b>CBFO Oversight</b>	
<p><b>CON 25:</b> CBFO failed to adequately establish and implement line management oversight programs and processes to meet the requirements of DOE Order 226.1B, <i>Implementation of Department of Energy Oversight Policy</i>, and hold personnel accountable for implementing those programs and processes.</p> <p><b>CON 26:</b> CBFO failed to identify weaknesses in oversight processes, conduct of operations, maintenance, radiological protection, nuclear safety, emergency management, and safety culture.</p> <p><b>CON 27:</b> CBFO is lacking adequate qualified staffing in numerous areas related to line management, technical disciplines and oversight functions.</p> <p><b>CON 28:</b> CBFO failed to adequately complete corrective actions from prior assessments to prevent or minimize recurrence.</p>	<p><b>JON 40:</b> CBFO needs to establish and implement line management oversight programs and processes such that CBFO:</p> <ul style="list-style-type: none"> <li>• Verifies that NWP has developed and implemented a DOE Order 226.1B compliant Contractor Assurance System.</li> <li>• Meets the requirements of DOE Order 226.1B and hold personnel accountable for implementing those programs and processes.</li> <li>• Implements effective oversight processes to ensure emphasis on conduct of operations, maintenance, radiological protection, nuclear safety, emergency management, and safety culture.</li> </ul> <p><b>JON 41:</b> CBFO needs to develop and implement an effective issues management process to document, disposition (including extent of condition), close, track/trend issues, and ensure effectiveness of corrective actions. The process shall also ensure that actions from prior assessments are implemented to prevent or minimize recurrence of identified deficiencies.</p> <p><b>JON 42:</b> The CBFO Site Manager needs to institutionalize and communicate expectations for a strong safety culture and the identification, documentation, reporting, and correction of issues without fear of reprisal.</p> <p><b>JON 43:</b> CBFO needs to evaluate the</p>

<b>Conclusion (CON)</b>	<b>Judgments of Need (JON)</b>
	<p>current organizational structure, identify specific staffing needs related to line management, technical discipline and oversight functions, submit those staffing needs to DOE HQ, and effectively manage their resources such that qualified personnel are effectively performing those functions.</p>
<b>DOE Headquarters Oversight</b>	
<p><b>CON 29:</b> DOE HQ failed to ensure that CBFO was held accountable for correcting repeated identified issues involving radiological protection, nuclear safety, Integrated Safety Management System, maintenance, emergency management, work planning and control and oversight.</p>	<p><b>JON 44:</b> DOE HQ needs to develop and implement a process to ensure repeatedly identified issues related to the safety management programs are confirmed, closed and validated by the local DOE office in a timely manner.</p>
<p><b>CON 30:</b> DOE HQ management has failed to ensure that adequate resources, full time employees, technical expertise, travel money, adequate budget, etc., are provided to support the WIPP project.</p> <p><b>CON 31:</b> DOE HQ management and staff failed to adequately define and execute roles and responsibilities related to line management, oversight, safety and balanced priorities.</p>	<p><b>JON 45:</b> DOE HQ needs to re-evaluate priorities and allocate the resources, i.e., funding, staffing, infrastructure, etc., applied to the WIPP project to ensure those resources effectively address safety, programmatic, and operational considerations.</p> <p><b>JON 46:</b> DOE HQ needs to better define and execute their roles and responsibilities in order to improve line management ownership, oversight, safety, and resources to ensure site implementation of the radiological protection, nuclear safety, ISMS, maintenance, emergency management, work planning and control and oversight policies and requirements are consistent and effective.</p> <p><b>JON 47:</b> DOE HQ needs to perform an effectiveness review on all corrective actions completed in response to this investigation.</p>