

**Independent Oversight Review of
Preparedness for
Severe Natural Phenomena Events at the
Paducah Site**



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Acronyms

AC	Alternating Current
ALOHA	Areal Locations of Hazardous Atmospheres
BDBE	Beyond Design Basis Event
BNA	Baseline Needs Assessment
BWCS	Babcock & Wilcox Conversion Services, LLC
CAAS	Criticality Accident Alarm System
CFR	Code of Federal Regulations
CRD	Contractor Requirements Document
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
DUF6	Depleted Uranium Hexafluoride
EAL	Emergency Action Level
EAP	Emergency Action Plan
EAS	Emergency Alert System
ED	Emergency Director
EMG	Emergency Management Guide
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EPHA	Emergency Planning Hazards Assessment
ERAP	Emergency Readiness Assurance Plan
ERG	Emergency Response Guidebook
ERO	Emergency Response Organization
FBI	Federal Bureau of Investigation
FMT	Field Monitoring Team
GETS	Government Emergency Telecommunications Service
HAZMAT	Hazardous Material
HF	Hydrogen Fluoride
HSS	Office of Health, Safety and Security
HVAC	Heating, Ventilation, and Air Conditioning
IC	Incident Commander
kW	Kilowatt
LATA-KY	Los Alamos Technical Associates-Kentucky, LLC
m	Meter
MCI	Mass Casualty Incident
MOA	Memorandum of Agreement
NARAC	National Atmospheric Release Advisory Center
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NNSA	National Nuclear Security Administration
NPE	Natural Phenomena Event
NRC	Nuclear Regulatory Commission
OFI	Opportunity for Improvement
OSC	On-Scene Coordinator
PA	Public Address
PAC	Protective Action Criteria
PAR	Protective Action Recommendation
PC	Performance Category
PGDP	Paducah Gaseous Diffusion Plant
PPE	Personal Protective Equipment
PPPO	Portsmouth/Paducah Project Office

PSS	Plant Shift Superintendent
PWS	Public Warning System
RAP	Radiological Assistance Program
REAC/TS	Radiation Emergency Assistance Center/Training Site
SCBA	Self-Contained Breathing Apparatus
SST	Swift & Staley, Inc.
TAG	Technical Assessment Group
TEL	Threshold for Early Lethality
UF ₆	Uranium Hexafluoride
UPS	Uninterruptible Power Supply
USAR	Urban Search and Rescue
USEC	United States Enrichment Corporation
VHF	Very High Frequency
WPS	Wireless Priority Service

Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Paducah Site

1.0 PURPOSE

The Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent review of the U.S. Department of Energy (DOE) Paducah site's preparedness for severe natural phenomena events (NPEs). The HSS Office of Safety and Emergency Management Evaluations performed this review to evaluate the processes for identifying emergency response capabilities and maintaining them in a state of readiness in case of a severe NPE.

This report discusses the scope, background, methodology, results, and conclusions of the review, and identifies three findings and several opportunities for improvement (OFIs).

2.0 SCOPE

The scope of this review involves those aspects of the emergency management program that relate to emergency preparedness for a severe NPE. The primary areas of interest are the identification of needed facility response capabilities and their state of readiness. DOE leases the Paducah Gaseous Diffusion Plant (PGDP) enrichment operations facilities to the United States Enrichment Corporation (USEC), which is regulated by the Nuclear Regulatory Commission (NRC). As such, the USEC PGDP is exempted from the requirements of DOE Order 151.1C, *Comprehensive Emergency Management System*.

Three additional contractors at the DOE Paducah site conduct operations that are regulated by DOE and are required to comply with DOE Order 151.1C contractor requirements document (CRD). These contractors and their areas of responsibility are:

- Babcock & Wilcox Conversion Services, LLC (BWCS) – operation of the depleted uranium hexafluoride (DUF6) project to convert the DOE DUF6 inventory to uranium oxide and the disposition of hydrogen fluoride (HF)
- Swift & Staley, Inc. (SST) – infrastructure services
- Los Alamos Technical Associates-Kentucky, LLC (LATA-KY) – waste disposition, facilities disposition, and environmental remediation

The DOE Paducah site facilities covered by this review include:

- Emergency response command centers
- DUF6 process buildings
- Hazardous and Low-Level Waste Storage Facility, building C-746-Q

The scope of this review included portions of the following emergency management program elements outlined in DOE Order 151.1C:

- Technical planning basis
- Plans and procedures
- Emergency response organization (ERO)
- Emergency facilities and equipment
- Offsite response interfaces

The scope of the review is consistent with Objectives 1 through 4 of HSS Criteria, Review, and Approach Document 45-51, *Emergency Management Program Inspection Criteria, Approach, and Lines of Inquiry, Targeted Review of Site Preparedness for Severe NPEs*. As stated in the *Plan for the Independent Oversight Review of the Site Preparedness for Severe NPEs at the Paducah Gaseous Diffusion Plant*, dated October 2012, the purpose of the review was to determine whether:

- 1) The site analyzes plausible scenarios representing severe NPEs to determine capabilities needed for an effective emergency response
- 2) The site has a means for determining quickly whether an event results in the loss of a significant quantity of hazardous material (HAZMAT) and is beyond the site's capability to respond
- 3) The site's emergency response capabilities are in a state of readiness to perform the required emergency response functions during plausible NPEs
- 4) The site's planning is adequate for obtaining and integrating offsite response assets for events beyond the site's response capability

3.0 BACKGROUND

Numerous examples of severe NPEs and other catastrophic events, such as earthquakes, tornadoes, floods, wildland fires, and manmade disasters, have emphasized the need to adequately plan and prepare for a large-scale event that could degrade or overwhelm a site's emergency response capability. Emergency planners at DOE/National Nuclear Security Administration (DOE/NNSA) sites determine needed site emergency response capabilities based on site-specific attributes, such as types and forms of HAZMAT, demographics, and geography, using a variety of deterministic analyses. The primary means for determining needed response capabilities are the emergency planning hazards assessments (EPHAs). The analyses contained in the EPHAs should describe a spectrum of events that represent plausible HAZMAT release scenarios, such as operator errors, mechanical failures, fires, and explosions from unintentional or intentional initiators.

The facility-specific documented safety analysis (DSA) report contains scenarios used by personnel to reduce risk from operations to acceptable levels; these scenarios are referred to as design basis events. When establishing a facility design, DSAs do not analyze events that are more severe than the parameters defined for the design basis event. Such "beyond design basis events" (BDBEs) include severe NPEs that represent the upper end of the consequence spectrum for which DOE/NNSA facilities are required to prepare, in accordance with DOE Order 151.1C.

To prepare for a BDBE, emergency response staff must plan a means to provide for immediately protecting personnel, mitigating the consequences of a potential HAZMAT release, and establishing appropriate short-term recovery actions. Preparations include designating alternate emergency response facilities, having redundant and diverse communications systems if an event renders the primary facilities and equipment unavailable, and maintaining other specific planning and response capabilities needed for a comprehensive emergency management program.

Some response capabilities that emergency planners may identify as necessary for the most severe and low-probability events would be a financial burden to maintain on site or could be rendered unavailable if such an event occurred. Therefore, emergency planners must pre-determine a means to acquire these necessary capabilities for use in the site's response to operational emergencies.

The Paducah site is located on 3,400 acres owned by DOE in rural western Kentucky, 15 miles west of Paducah, Kentucky near the Ohio and Mississippi rivers. The entire DOE reservation is public exclusion

property, consisting of primarily agricultural and forested land. A large area of the reservation is leased to the Kentucky Department of Fish and Wildlife. The Manager of the Portsmouth/Paducah Project Office (PPPO) reports to DOE's Office of Environmental Management and has line management responsibility for the Paducah site, in coordination with DOE Oak Ridge Office, which is the USEC lease administrator.

There are approximately 115 buildings on the DOE reservation, including six major process buildings, a series of switchyards, storage areas, cooling towers, a steam plant, a water treatment plant, a sewage disposal plant, a pollution abatement facility, service and maintenance buildings, and facilities for administration, medical, fire and security. The site is transitioning from primarily enrichment operations to shared missions with environmental cleanup, waste management, depleted uranium conversion, deactivation and decommissioning, re-industrialization, and long-term stewardship. The current end-state completion baseline date for Paducah is 2030.

For incidents at the Paducah site, USEC is the lead organization responsible for managing the overall direction and control of emergency response in accordance with NRC rules and regulations. BWCS, SST, and LATA-KY are responsible for overall compliance with the emergency management program elements of DOE Order 151.1C not covered under the USEC emergency plan. These contractors also complete some requirements of the order independent of USEC, including:

- Emergency Readiness Assurance Plan (ERAP)
- Hazards surveys
- EPHAs
- Emergency plan implementing procedures
- Emergency Action Plans (EAPs)
- Training and drill programs

Independent Oversight has observed that across the DOE complex, facilities can operate with minimal interaction with other collocated facilities while conducting their day-to-day operations; however, as stated in DOE Order 151.1C, the emergency management program is a sitewide program that requires both the participation of all onsite organizations/facilities and coordinated and comprehensive planning and implementation to be effective. The DOE order also specifies that leased facilities must integrate activities into the DOE/NNSA sitewide emergency management program. The safety of workers at the Paducah site and the public nearby is heavily reliant on these separate programs being able to effectively integrate and coordinate their operations during an event.

4.0 METHODOLOGY

Independent Oversight evaluated the processes for identifying emergency response capabilities and maintaining them in a state of readiness in case of a severe NPE. DOE Order 151.1C identifies the functional emergency response requirements for a DOE site/facility, and the emergency management guides (EMGs) associated with DOE Order 151.1C provide guidance for implementing these requirements. The order and associated guides were used to determine whether DOE requirements and expectations are met. Independent Oversight also referenced applicable DOE, Federal, state, and local requirements when determining compliance with the DOE order.

The USEC enrichment facility is leased from DOE and regulated by the NRC. It is therefore exempt from the requirements of DOE Order 151.1C; however, the facility must comply with 10 Code of Federal Regulations (CFR) 76.91, *Emergency Planning*, and the *Emergency Planning and Community Right-to-*

Know Act of 1986, Title III, Public Law 99-499 for the chemicals utilized. In the absence of information to the contrary, Independent Oversight assumed that USEC is compliant with these requirements. Since the NRC accident categorization/classification process differs from that of DOE, a request was granted for both the leased and non-leased facilities and contractors to be exempt from the DOE classification requirements and to use the NRC accident classification requirement, which specifies two classifications of emergencies: “Alert” and “Site Area Emergency.”

SST generally provides infrastructure services and must comply with the DOE operational emergency base program requirements. Based on the findings of their hazards survey, BWCS and LATA-KY have developed EPHAs that define the provisions of their operational emergency HAZMAT programs. These more extensive programs are required to be commensurate with the identified hazards and to integrate the requirements included in the CRD of DOE Order 151.1C into a comprehensive emergency management system.

USEC is the lead organization responsible for managing the overall direction and control of emergency response for incidents at the Paducah site. These emergency response activities are specified in a memorandum of understanding and work authorization, and generally include fire protection, emergency response, emergency management, Incident Commander (IC), and Plant Shift Superintendent (PSS) services, as well as providing protective action recommendations (PARs) and initiating protective actions. USEC also provides some limited administrative functions, such as conducting an annual exercise, developing sitewide drill summary information, and negotiating letters of agreement with offsite organizations. Several sitewide emergency management programmatic elements and requirements that are specified in DOE Order 151.1C are not addressed in the USEC work authorization or have not been assigned to the DOE contractors. Before and during data collection, Independent Oversight requested numerous documents from the contractors. USEC provided most, but not all, of the documents that Independent Oversight requested. Most significantly, the USEC equivalent of a hazards assessment needed corporate approval to be viewed by Independent Oversight. This approval had not been obtained before the end of data collection, and PPPO did not provide a copy to Independent Oversight.

This Independent Oversight review was accomplished by reviewing the documentation that establishes and governs the Paducah site emergency management program processes, such as emergency plans, procedures, safety basis documents, program implementing checklists, records of program activities, and memoranda of agreement (MOAs); interviewing key personnel; and performing walkdowns of facilities and equipment.

5.0 RESULTS

The following sections discuss the observations made by Independent Oversight during this review, keyed to the objectives in HSS Criteria, Review, and Approach Document 45-51.

5.1 Objective 1: Scenario Analysis

The site analyzes plausible scenarios representing severe NPEs to determine the capabilities needed for an effective emergency response.

Independent Oversight reviewed the process guides that BWCS and LATA-KY use to develop their hazards surveys and EPHAs, as well as the hazards surveys, EPHAs, and DSAs for the DUF6 and C-746-Q facilities. SST does not use or store HAZMAT; therefore, Independent Oversight did not review their technical planning basis documents. The hazards surveys and EPHAs were reviewed to determine the accuracy and adequacy of analyses conducted for severe NPEs. Further, the EPHAs were reviewed to

determine whether the documents identified the needed emergency response capabilities for severe NPEs and served as the basis for event classification and pre-planned protective actions. The DSAs were reviewed to assess their consistency with the various DSAs and EPHAs of the BDBEs that were identified and analyzed. As noted, Independent Oversight formally requested a copy of the USEC hazards assessment for review, but was unable to do so as PPPO did not have a copy and the USEC corporate office did not grant the release of the document. (See Section 5.2, **Finding F-1**.)

Independent Oversight determined that LATA-KY appropriately analyzed a plausible scenario representing a severe NPE but did not factor the results into the determination of assistance capabilities needed in the emergency operations center (EOC). Independent Oversight also determined that BWCS has not consistently analyzed plausible scenarios representing severe NPEs in the DUF6 facility EPHA.

DOE Order 151.1C requires development of a hazards survey to examine the features and characteristics of the facilities and activities, and to identify generic emergency events and conditions, including NPEs such as earthquakes and tornadoes, and the potential impacts of such emergencies. This order also requires that if the hazards survey identifies specific HAZMAT in quantities that, if released, could result in an operational emergency by causing an airborne health hazard, then the potential release of these materials will require further analysis in an EPHA. DOE Guide 151.1-2, *Technical Planning Basis Emergency Management Guide (EMG)*, provides direction in selecting dispersion models that should be used to support development of the EPHA. Additionally, DOE Guide 151.1-2 recommends that analyses in the EPHA calculate the consequences at specific receptors of interest (i.e., facility boundary, onsite receptor locations, site boundary, and offsite locations of interest) and calculate the maximum distances at which consequences exceed the applicable protective action criteria (PAC) used to develop default initial protective actions.

LATA-KY and BWCS have procedures for developing and maintaining their respective hazards surveys, EPHAs, and emergency action levels (EALs) that adequately incorporate the requirements of DOE Order 151.1C and follow the guidance of DOE Guide 151.1-2. The LATA-KY and BWCS procedures appropriately establish the roles, responsibilities, and administrative and management requirements for preparing, reviewing, approving, and maintaining the hazards surveys, EPHAs, and associated EALs. The procedures also identify the NPEs of earthquake, tornadoes, and wildfire as potential initiating events.

The Paducah site has an approved waiver from DOE requirements that allows the site contractors to implement a two-level emergency classification system: alert and site area emergency. An alert emergency classification at the Paducah site encompasses the alert and site area emergencies defined in DOE Order 151.1C and a Paducah site area emergency is a DOE general emergency

LATA-KY and BWCS have developed hazards surveys in accordance with their respective procedures that appropriately incorporate the provisions of DOE Order 151.1C and DOE Guide 151.1-2. The hazards surveys adequately identify HAZMAT exceeding screening quantities that could become an airborne hazard at the respective buildings due to a severe NPE. LATA-KY and BWCS considered flooding in their hazards surveys as a release mechanism, but justifiably did not analyze flooding in the EPHAs because the Paducah site is in a level plateau region above the Ohio River floodplain.

In accordance with its EPHA development procedure, LATA-KY developed the EPHA for the C-746-Q Hazardous and Low-Level Waste Storage Facility. The NPEs analyzed in the C-746-Q EPHA (seismic, high winds, and tornadoes) are consistent with the NPEs analyzed in the DSA for building C-746-Q. LATA-KY adequately analyzed a severe NPE associated with a bounding release of 100 percent of the maximum allowable inventory of HAZMAT in building C-746-Q. The accident scenario initiator is a seismic event or other applicable NPE (high winds, tornadoes, and tornado missiles) followed by a fire.

The consequence analysis for this event identified that HF is the worst-case HAZMAT and calculated that the maximum distance from the release point to PAC (the projected dose value for initiating protective action) for HF, is 1,200 meters (m). The threshold for early lethality (TEL) – i.e., the dose at which the sensitive groups would begin to show an increase in mortality – is 818 m. PAC is a general term for the level of HAZMAT impact that, if observed or predicted, indicates that action is needed to prevent or limit exposure of people to the hazard. The maximum distance at which consequences exceed the applicable PAC is used to develop default (pre-planned) initial protective actions. Similarly, the TEL signifies a more lethal concentration and is used to define the distance from a release to which personnel should, if possible, be evacuated. Independent Oversight determined that the consequences of the severe NPE in the C-746-Q EPHA were correctly calculated.

Per the BWCS EPHA development procedure, BWCS developed the DUF6 facility EPHA. The NPEs analyzed in this EPHA (seismic, high winds, tornadoes, and tornado missiles) are consistent with the NPEs analyzed in the DSA for the DUF6 facility. BWCS appropriately analyzed a severe NPE associated with a uranium hexafluoride (UF_6) and U-238 equivalent release at the Full Cylinder Staging Area (C-1745A) in the EPHA. The accident scenario initiator is a seismic event or other applicable NPE (high winds, tornadoes, and tornado missiles) resulting in the release of ten full DUF6 cylinders. The consequence analysis for this event correctly calculated the maximum distances to PAC and TEL.

BWCS appropriately analyzed a severe NPE associated with a uranium oxide release at the Conversion Building (C-1300). The scenario appropriately determined that a seismic event or other applicable NPE (high winds, tornadoes, and tornado missiles) would result in a large loss of building containment, resulting in the release of 100 percent of the uranium oxide contained in two hoppers. The consequence analysis for this event appropriately calculated that the maximum distance from the release point to the applicable PAC is 153 m and to TEL is 33 m.

Nevertheless, BWCS did not consistently follow the EPHA development procedure in considering BDBEs relative to severe NPEs in the EPHA for use in developing EALs. Although BWCS analyzed for an NPE associated with a UF_6 and U-238 equivalent release from C-1300, they did not analyze for a severe NPE. The consequence analyses conducted for a release of UF_6 and U-238 equivalent assumed that due to the relatively low energy of the seismic event, the primary barrier (cylinder, piping) only partially fails and only the inventory in the piping between the Vaporization Room and Conversion Unit is involved. The consequence analysis for this event calculated that the applicable PAC and TEL concentrations for UF_6 and U-238 equivalent were not exceeded and do not result in an operational emergency requiring classification. However, the EPHA contains a consequence analysis for a release of UF_6 due to an extreme event (malevolent act or aircraft crash) with fire. This analysis results in the UF_6 PAC concentration being exceeded out to 9973 m and TEL concentration exceeded out to 9713 m and thus requires a site area emergency classification and initial protective actions and PARs to be implemented out to these distances. These assumptions are probably more representative of the conditions resulting from a severe NPE, and they result in protective action distances significantly greater than those currently used. (See Section 8.0, **OFI 1.**)

Additionally, BWCS analyzed for an NPE, but did not analyze for a severe NPE associated with an HF release at the HF Storage Tank Area (C-1305). The NPE accident scenario initiator is a seismic event or other applicable NPE; however, the consequence analysis for this event calculated that the PAC and TEL for HF were not exceeded and do not require classification. The EPHA contains analyses for a release of HF due to an extreme event with fire, which may be a better representation of a severe NPE. The consequence analysis for this event results in PAC being exceeded out to 9708 m and TEL exceeded out to 9428 m, and thus requires a site area emergency classification and initial protective actions and PARs to be implemented out to these distances.

Overall, LATA-KY and BWCS have developed adequate hazards surveys for their respective facilities that identify HAZMAT that could result in an airborne release initiated by severe NPEs, as well as EPHAs that quantitatively analyze and document the consequence analyses for most NPEs. LATA-KY appropriately analyzed a severe NPE in the C-746-Q EPHA, but BWCS did not consistently analyze all releases initiated by severe NPE scenarios in the DUF6 facility EPHA.

5.2 Objective 2: HAZMAT Release Determination

The site has a means for determining quickly whether an event results in the loss of a significant quantity of HAZMAT and is beyond the site's capability to respond.

Independent Oversight reviewed the EAL statements contained in the USEC site-level EAL procedure, which the USEC PSS uses during Paducah site operational emergencies, to determine whether the EALs reflect the consequence analyses in the LATA-KY and BWCS EPHAs for severe NPEs. Independent Oversight also evaluated EAL usability during plausible severe NPEs (e.g., seismic event destroying multiple facilities on site) when significant infrastructure damage is likely.

Independent Oversight determined that LATA-KY and BWCS have a means for quickly establishing whether a severe NPE results in the loss of a significant quantity of HAZMAT that is beyond the facility's capability to respond via EALs. However, Independent Oversight identified some usability concerns with the EALs and found that the DOE contractors have not analyzed the potential consequences from HAZMAT releases from USEC facilities.

DOE Order 151.1C requires the development of EALs for the potential operational emergencies identified in the EPHA, which must include protective actions corresponding to each EAL. Additionally, DOE Guide 151.1-2 recommends that EALs contain event indicators that are prompt, unambiguous, and reliably associated with the event or condition so that personnel can quickly recognize the event and apply the correct EAL.

USEC has developed an emergency classification procedure to determine emergency categorization and classification of events and to establish associated protective actions under NRC requirements. As mentioned in Section 5.1, the Paducah site has an approved waiver from DOE requirements that allows the USEC procedure to implement a two-level emergency classification system rather than DOE's four-level emergency classification system. However, the USEC emergency classification procedure is incomplete. The procedure contains EALs for HAZMAT releases from USEC facilities and instructs the user to consider releases from LATA-KY facilities, but not from BWCS facilities. Further, the only USEC EAL available for use during a NPE does not indicate that PAC could be exceeded offsite, as documented in the EPHAs, and thus does not ensure timely implementation of required offsite PARs and activation of the public warning system (PWS). (See **Finding F-1** and Section 8.0, **OFI 2**.)

For the events analyzed in the DOE facility EPHAs, LATA-KY and BWCS developed an appropriate set of EALs based on building- or activity-specific symptoms and event initiators that have been incorporated into the USEC emergency classification procedure. The LATA-KY and BWCS EALs for the C-746-Q and DUF6 facilities accurately reflect the analysis contained in the respective EPHAs. However, although LATA-KY is properly maintaining the C-746-Q EPHA, they do not ensure that the associated EALs are implemented at the same time as the EPHA. For example, LATA-KY has developed an EAL for a severe NPE affecting C-746-Q, but the EAL for this analysis, as well as EALs for additional analyses conducted in the revision of the EPHA, are still in draft form and are not included in the site-level emergency classification procedure. (See Section 8.0, **OFI 3**.)

BWCS has not developed EALs for all potential severe NPEs, because BWCS has not consistently analyzed for severe NPEs as described in Section 5.1. Although BWCS has developed general EALs for earthquakes and other adverse events (high winds, tornadoes, and tornado missiles), the general EAL for an earthquake event only results in an alert classification, even though a severe earthquake could result in a site area emergency classification, with offsite consequences. (See Section 8.0, OFI 1.)

Additionally, all of the EALs in the USEC emergency classification procedure inappropriately implement protective actions that are dependent on weather conditions, in that they prescribe a downwind evacuation of areas and/or buildings on site. This practice is contrary to DOE Guide 151.1-4, which discourages the use of real-time weather data for initial protective actions and recommends a 360-degree protective action distance utilizing PAC as the initial protective action boundary.

Further, the DOE contractors have not analyzed the potential consequences from HAZMAT releases from USEC facilities, and the USEC consequence analysis methodology is less conservative than DOE Order 151.1C requires for the appropriate protection of workers and the public. For example, USEC has approximately 26 one-ton chlorine cylinders on site, with as many as eight collocated at the water treatment facility. USEC's worst-case chlorine EAL only implements a 460 m isolation zone (equivalent to TEL) that is based on the 2012 Department of Transportation Emergency Response Guidebook (ERG) for a large spill. USEC obtained the 460 m isolation zone from the ERG green-bordered pages, which provide isolation zones and protective action distances for toxic inhalation hazards like chlorine. Although not indicated in the chlorine EAL, the ERG also indicates a downwind protective action distance (equivalent to PAC) of 3058 m during the day and 7886 m during the night. The use of the ERG is contrary to DOE requirements for fixed facilities where the types and quantities of HAZMAT are known. In contrast, using the DOE-required analytical methodologies, Independent Oversight determined that PAC is exceeded out to a distance of 4023 m and TEL is exceeded out to 884 m for a 1-ton cylinder, resulting in protective action and PAR distances significantly greater than those that USEC currently uses. Further, the assumption of a 1-ton cylinder release is non-conservative for a severe NPE and would be less than the quantity indicated by DOE requirements. (See **Finding F-1** and Section 8.0, **OFI 4**.)

Finding F-1: PPPO has not effectively integrated the activities of a leased facility and NRC licensed facilities into the technical basis for the DOE sitewide emergency management program to ensure the health and safety of onsite workers and the public, as required by DOE Order 151.1C.

Overall, the mechanisms used at the Paducah site only partially enable decision-makers to quickly determine whether analyzed events result in the loss of a significant quantity of HAZMAT and are beyond the site's capability to respond. The differences in program requirements for USEC and DOE contractors, as well as some incomplete or incorrect DOE contractor EALs, contribute to this condition. Most importantly, USEC methodologies for determining consequence assessment are less conservative in protecting workers and the public than DOE requirements, and the DOE contractors have not compensated for this discrepancy by analyzing USEC hazards in close proximity to DOE facilities using DOE methodologies.

5.3 Objective 3: Emergency Equipment and Facilities

The site's emergency response capabilities are in a state of readiness to perform the required emergency response functions during plausible NPEs.

Independent Oversight reviewed the response capabilities and equipment associated with the site-level, DUF6, and C-746-Q response plans and facilities used to implement protective actions. The equipment includes:

- Normal and backup power systems
- Emergency response equipment
- Personal protective equipment (PPE)
- Radiation detection equipment
- HF detection equipment

The Paducah site emergency management program comprises a site-level program regulated by the NRC under 10 CFR 76.91 emergency planning requirements and facility-level programs that are developed to meet either the requirements of 10 CFR 76.91, for USEC facilities, or DOE Order 151.1C, for facilities under DOE's purview, such as DUF6 and C-746-Q. DUF6 and C-746-Q are not equipped with command centers and instead rely on the EOC, which is managed and primarily staffed by USEC personnel. Personnel representing these DOE nuclear facilities deploy to the EOC and the incident command post during an operational emergency.

Independent Oversight determined that the EOC is not in an adequate state of readiness to perform the required emergency response functions during some plausible NPEs, and an alternate EOC has not been established as required by DOE policy. A major contributor to this condition is the difference between the NRC and DOE requirements underlying the site-level and facility-level emergency management programs, respectively. Independent Oversight also identified specific areas for improvement in diesel fuel sampling, emergency communication equipment testing, receipt of emergency calls when EOC evacuation is required, PSS operation of Dräger Pac III HF detectors, and large-scale decontamination techniques. These OFIs are discussed below and identified in Section 8.0.

Normal and Backup Power Systems

Independent Oversight reviewed normal power and backup power sources for the EOC, DUF6, and C-746-Q facilities and examined diesel generator refueling plans at the EOC and DUF6 to evaluate the site's capability to provide long-term emergency power. Independent Oversight also reviewed battery-backed systems to determine their service times and to identify the equipment lost during a long-term loss of alternating current (AC) power and the resulting potential consequences. Independent Oversight reviewed design, maintenance, and test documents; interviewed personnel; and performed system walkdowns to reach its conclusions.

DOE Order 151.1C does not contain prescriptive requirements for normal and backup power systems supporting command centers and response equipment; rather, this order requires provisions for an alternate location if the primary command center is not available. In addition, DOE Order 151.1C requires the site to maintain facilities and equipment adequate to support critical response functions and ensure that the facilities and equipment are available and operable. DOE Guide 151.1-4, *Response Elements EMG*, further recommends that the EOC have alternate power supplies as one of the habitability systems.

Independent Oversight used DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, as the benchmark for determining backup power supply reliability. This DOE standard applies National Fire Protection Association (NFPA)-110, *Standard for Emergency and Standby Power Systems*; NFPA-111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*; and applicable Institute of Electrical and Electronics Engineers standards to diesel generators and uninterruptible power supply (UPS) systems for equipment that protects the public, site workers, and the environment. The DOE standard establishes general and detailed requirements for reliable backup and emergency sources, regardless of the type of DOE facility using backup power systems for important equipment. The DOE standard also identifies nuclear safety systems, radiation monitors and alarms, fire protection systems,

security systems, data processing equipment, and emergency lighting as examples of important equipment. Importantly, the standard's requirements apply only if contractual documents, procurement documents, or the authorization basis for a facility invokes the standard. The Paducah site has no obligation to comply with the DOE standard or the NFPA standards it references. The site has concluded that the diesel generators that Independent Oversight reviewed are standby generators because life safety equipment does not depend on their operation. Independent Oversight concluded that communications, lighting, and monitoring and alarm systems are not solely dependent on diesel generators because those systems are also powered by battery-backed power systems that can last at least 30 minutes, enabling the completion of immediate emergency management functions.

Normal Power. The Paducah site has a reasonably reliable source of power from offsite sources. Three offsite utility companies provide normal power to the Paducah site electrical distribution system through multiple substations. The Paducah site provides normal power through a dual loop electrical distribution system with manual cross-connect capability.

Backup Power. The EOC and essential equipment for implementing emergency response functions have adequate backup power sources. The EOC and DUF6 have fixed standby generators (C-746-Q does not), and the EOC electrical distribution system also has a receptacle for installing a mobile generator. USEC has three mobile generators on site that can be used for this purpose. Battery-backed power sources can provide either continuous power for essential equipment while standby generators start and load, or at least 30 minutes of power in case of a loss of all AC power. Battery-backed systems consist of UPS systems and batteries.

Batteries for emergency lights and fire alarm and monitoring panels at the Paducah site are adequately tested in accordance with NFPA standards. Emergency lights are tested to meet NFPA-101, *Life Safety Code*, by requiring an annual 90-minute functional check and a monthly 30-second functional check. Paducah site fire alarm and monitoring panel batteries tests meet NFPA-72, *National Fire Alarm and Signaling Code*, discharge requirements; 24-hour service tests are performed every three years.

Refueling Plans. The Paducah site contractors have established adequate refueling plans for long-term diesel generator operations. USEC and the rest of the Paducah site have separate refueling plans, linked only by a work authorization that establishes a means to purchase fuel from one another in case normal suppliers cannot deliver fuel.

USEC refueling plans are adequate for long-term operation of the standby generator that provides backup power to the EOC. USEC manages a 10,000-gallon underground storage tank near the EOC and has a contract in place with a single fuel supplier in the City of Paducah. If this supplier cannot deliver fuel, USEC plans to coordinate through the McCracken County EOC for an alternate supplier, as they did during a 2009 ice storm. USEC has a 1000-gallon fuel distribution tanker to transport fuel to the generator fuel tank.

BWCS refueling plans are adequate for long-term operation of the standby generator that provides backup power to DUF6. SST provides diesel fuel to BWCS from an SST-managed above-ground dual fuel storage tank via a 100-gallon tank in the bed of a pickup truck. The SST fuel storage tank is a 3000-gallon/1000-gallon tank located outside the property protection area fence and is kept 20-85 percent full. SST orders fuel from the best bid of two local suppliers when needed (typically every ten days). Fuel is typically delivered the day after SST places an order, depending on the time of day the order is placed.

The diesel fuel used for the EOC and DUF6 standby generators is not sampled and analyzed upon delivery, or periodically, to ensure that the fuel supply is reliable. (See Section 8, **OFI 5** and **OFI 6**.) This concern is most important at DUF6, where the fuel turnover rate is more than a year.

Overall, the Paducah site has an adequate normal power distribution system and maintains a capability to provide backup power to essential loads for an emergency response from standby diesel generators. Additionally, UPS and batteries provide continuous power for at least 30 minutes to equipment needed to support implementation of protective actions in case diesel generators cannot provide backup power, as assured through service tests. Further, the Paducah site has adequate refueling plans to sustain long-term diesel generator operations. However, as noted, a diesel fuel sampling and analysis program would help ensure the reliability of the diesel fuel.

Communication Systems

Independent Oversight reviewed the key communication systems that the USEC ERO personnel – specifically, the PSS, EOC, Fire Services, and field monitoring teams (FMTs) – use to communicate with each other; plant personnel; the surrounding public; and offsite local, state, and Federal agencies and organizations. With the exception of cell phones, USEC provides all telecommunications systems and equipment for the DOE facilities and contractors at the Paducah site. The primary and backup systems were examined, along with the processes for maintaining and periodically testing the systems to ensure operability. Independent Oversight also reviewed the availability of alternate means to perform critical tasks when a primary system is out of service due to a severe NPE.

DOE Order 151.1C requires that equipment adequate to support an emergency response be available, operable, and maintained and that tests of the communication systems used to contact offsite agencies be performed at least annually. The order further requires that sites have the capability to notify employees of an emergency and to facilitate the safe evacuation or sheltering of employees. In addition, NFPA-1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, discusses testing incoming telephone lines daily in facilities where 911-type calls are answered. DOE Guide 151.1-4 provides additional guidance for communication systems and states that systems relied on to provide notifications and activate the ERO should be tested and maintained regularly. The Guide also states that backup communications, such as cellular and/or satellite telephones and radios, should be available and periodically tested. In addition, the Guide specifies that sites should integrate their communication systems with offsite responders and should periodically verify all emergency telephone and facsimile numbers with offsite agencies.

The Paducah site radio system provides a robust mobile communications link that allows interoperability with offsite responders. Radios are the primary method for communications in the field and in process buildings. The radio system covers the entire Paducah site and allows for numerous talk groups for plant personnel and emergency responders. In addition, Fire Services recently reprogrammed their radios to include the channels used by the local fire agencies that may provide mutual aid. The USEC PSS can also patch the radios of mutual aid responders into the Paducah site radio system and can set up a portable repeater, if needed, to enhance radio coverage. Furthermore, the radio system can continue to operate with only one functioning repeater and can operate in simplex mode (limited to line-of-sight and reduced range) if all of the repeaters fail.

USEC tests and performs appropriate periodic maintenance on the radio system, but conducts only limited testing of EOC and FMT radios and uses incomplete checklists to document test results. An offsite vendor performs preventive maintenance on the radio system components semiannually; the hand-held radios do not require periodic maintenance. The PSSs and Fire Services use their hand-held radios daily, and the daily public address (PA) system test is also broadcast over all radio channels as an additional means of verifying operability of the radio system. Additionally, the operability of vehicle radios is checked by Fire Services daily and by the PSSs weekly, and the PSSs perform a radio communications check with mutual aid organizations quarterly. However, USEC does not test the operability of some

radios, and some of its checklists do not indicate that testing is required. USEC procedure CP2-EP-EP5058, *Maintenance of Emergency Facilities and Equipment*, requires USEC Emergency Management to operationally test the EOC and FMT emergency equipment; Fire Services to conduct quarterly communications checks with local emergency rooms and the offsite ambulance service; and the PSSs to perform quarterly radio communications checks. However, USEC Emergency Management does not test the EOC and FMT radios' ability to receive and transmit a message, and the USEC forms that document the required operational testing (CP-20679, *EOC Inventory Checklist*, and CP-20678, *FMT Checklist*) only require verification that the radios were present. In addition, CP-22223, *Fire Services Quarterly Communications Operability Status Checklist*, does not document whether the local emergency rooms and the offsite ambulance service were contacted as required. Finally, CP-21779, *Quarterly Communications Operability Status Checklist*, does not document the required testing of the very high frequency (VHF) radios in the two PSS vehicles. (See Section 8, **OFI 7**.)

Building C-300, which houses the EOC and PSSs, is well equipped with telephones and facsimile machines that are adequately tested to ensure the equipment is functional when needed. USEC allows company-owned and pre-approved personal cellular telephones, which most ERO members possess, to be used throughout most of the Paducah site. In addition, the EOC and the PSS workspace have several telephone lines routed through telephone switches external to the plant in case the onsite telephone system fails, along with a satellite telephone with three handsets and a portable satellite telephone system. The PSSs and several EOC members have Government Emergency Telecommunications Service (GETS) cards that provide priority telephone access and Wireless Priority Service (WPS) accounts that provide priority cellular telephone access during periods of severe network congestion or disruption. The PSSs use their telephones and facsimile machines daily, test the telecommunications equipment in their vehicles quarterly, and verify their ability to reach the GETS and WPS systems quarterly. Emergency Management tests the telephones and facsimile machine in the EOC quarterly.

The PSSs use a variety of appropriate methods for notifying employees of an emergency and facilitating the safe evacuation or sheltering of employees. The ALL CALL system, which allows a simultaneous announcement over the PA and radio systems, is the primary method the PSS uses to communicate protective actions and instructions to workers throughout the Paducah site during an emergency. The ALL CALL system, which can be activated from buildings C-300 and C-200 (housing Fire Services), covers the permanently occupied buildings, along with a few outdoor speakers and all hand-held radios. To ensure that workers who are in areas without PA system coverage receive emergency notifications, USEC requires that at least one person in the group have a radio or cellular telephone. In case of an evacuation, the PSS can contact the Local Emergency Directors, located at each assembly area, via the ALL CALL system to relay additional emergency instructions. If the PA system fails, the PSS can provide announcements by using the radio system, calling specific buildings to relay information, sending runners to specific buildings or areas, or dispatching personnel in vehicles equipped with loudspeakers to the affected areas. The PSSs perform daily tests of the ALL CALL system and weekly tests of the PA system using approved procedures. USEC also performs preventive maintenance on the PA system quarterly to ensure its continued operability.

During an emergency, the PSS can effectively warn the public near the Paducah site using the PWS, which consists of eight outdoor warning sirens and the Emergency Alert System (EAS). The PWS is the primary method for warning the public within a two-mile radius from the center of the Paducah site that they need to take protective actions. The EAS includes a local radio station, a local television station, and National Oceanic and Atmospheric Administration weather radios, and it broadcasts one of five pre-recorded emergency messages. If the PSS cannot activate the sirens at building C-300, the 911 center in Paducah can also activate the sirens. The PSSs perform periodic tests of the PWS, including a daily silent test of the sirens, a monthly audible test of the sirens verified in the field by security personnel, and a

monthly verification of the EAS telephone numbers used to request broadcast of a message. USEC also performs extensive preventive maintenance on the sirens quarterly to ensure their continued operability.

USEC uses a variety of suitable methods to activate the EOC and FMT and conducts periodic tests to confirm operability. The PSS activates the EOC and FMT using the ALL CALL system, followed by a mass notification system that transmits voice and text messages to the various devices registered in the system (e.g., pagers, home telephones, cellular telephones, and e-mail accounts) and records the receipt of positive responses. A notable feature of the mass notification system is the ability to access the system from any telephone or through the Internet. If the mass notification system fails, the PSS can contact the EOC and FMT members individually using a contact roster. Emergency Management performs a quarterly, unannounced test of the mass notification system that includes all EOC and FMT members.

The PSS provides appropriate notifications to offsite organizations via the telephone and facsimile. When notification of offsite organizations is warranted, the PSS (serving as the IC in the field) calls the Cascade Coordinator in Building C-300 and relays the information needed to complete the notification form. The Cascade Coordinator then sends the form via facsimile to the offsite organizations (including the DOE Oak Ridge Office), followed by a telephone call to ensure that the organizations received the information. The notification duties transfer from the Cascade Coordinator to the EOC Offsite Communicator when the EOC becomes operational. Emergency Management validates the telephone and facsimile numbers for the offsite organizations quarterly. To maintain familiarity with the offsite notification process, the PSSs participate in semiannual drills that consist of faxing a mock notification form to the offsite organizations and then calling to confirm receipt and answer any questions.

The EOC cadre uses white boards to capture information regarding an ongoing emergency (e.g., current status, significant events, and action items), which is recorded in a computer-generated event log and is shared with the rest of the ERO and the other onsite contractors (e.g., BWCS and LATA-KY) involved in the emergency. The USEC *Maintenance of Emergency Facilities and Equipment* procedure requires Emergency Management to operationally test the EOC emergency equipment. However, for the computer system that generates the event log, the USEC *EOC Inventory Checklist*, which is used to document the required operational testing, requires verification only that the computer was present, not that the testing was completed. (See Section 8, **OFI 7**.)

The PSSs adequately operate the emergency reporting telephone system but do not test the incoming emergency telephone line daily and cannot transfer incoming calls to an alternate location. The PSSs have one incoming line for emergency telephone calls from plant personnel that roll over to other extensions in building C-300 if the incoming line is busy. Plant personnel can also report emergencies via the radio or by using the “red handle” emergency telephones located in the PGDP buildings that ring at a separate alarm panel in building C-300. The PSSs check the operability of the red handle telephones weekly but do not perform daily tests of the incoming emergency telephone line as suggested by NFPA-1221 to ensure its operability. (See Section 8, **OFI 7**.) More significantly, if personnel have to evacuate building C-300, no documented procedures are in place to route incoming emergency calls to the telephone line or from the red handle telephones to another location, leaving the radio as the sole means of reporting emergencies to the PSS. (See Section 8, **OFI 8**.)

Overall, communication systems are ready to facilitate information flow during severe NPEs. The redundancy in the communication systems for most critical emergency response functions increases the likelihood that one or more systems can perform each function in case of any disruptions caused by a severe NPE. Nonetheless, limitations in equipment testing and documentation of completed testing somewhat diminish the robustness of the communication systems. More significantly, the emergency reporting telephone system can only be answered in building C-300, and there are no provisions for routing the system to another location if building C-300 is evacuated.

Personal Protective Equipment

Independent Oversight reviewed the essential PPE used by USEC Fire Services, Emergency Squad, and FMTs in support of an emergency at a DOE contractor facility, along with the processes for any required maintenance and periodic testing of the equipment. DOE Order 151.1C requires that adequate PPE be available and operable to meet the needs determined by the results of the EPHA. In addition, DOE Guide 151.1-4 states that periodic inspections and testing of equipment should be carried out in accordance with the manufacturer's instructions.

Fire Services and the Emergency Squad are suitably equipped with PPE that is consistent with the identified hazards. Based on the hazards that Fire Services and the Emergency Squad might encounter, Level A suits are available for use, along with self-contained breathing apparatus (SCBA) units. BWCS and LATA-KY do not maintain their own Level A suits or SCBA units for emergency response purposes, but they do have personnel trained to use the USEC Level A suits and SCBA units if USEC requests that someone with facility-specific knowledge accompany their entry team during an emergency response. The PSSs also receive training on using the USEC Level A suits and SCBA units, although their role as IC would not normally require them to don PPE during an emergency response. Fire Services inventories and visually inspects the Level A suits monthly and pressure-tests the suits annually, as well as on initial receipt and after each use. For the SCBA units, Fire Services conducts periodic inspections that include daily status checks, weekly inventories, monthly functional tests, and periodic pressure testing. Fire Services refills the SCBA units using a breathing air compressor in building C-200; a mobile cascade truck capable of refilling USEC's breathing air cylinders is also available via mutual aid. To ensure the quality of the breathing air, Fire Services sends samples to an offsite laboratory for testing quarterly, and the USEC industrial hygienists review the results. Additionally, an offsite vendor performs preventive maintenance on the breathing air compressor every six months or after 73 hours of operation. All USEC PPE test and maintenance activities are consistent with the manufacturers' recommendations.

USEC provides the FMTs with appropriate PPE for their response duties. The FMTs' mission is to collect monitoring data in areas unaffected by the HAZMAT release and detect only the outer boundary of the plume. Under no circumstances are the FMTs expected to enter the plume or receive an exposure. As a result, the FMTs' PPE consists of company-issued clothing and latex gloves, which are contained in the FMT response kits. If the FMTs unexpectedly encounter HAZMAT, they also carry 5-minute escape masks to help them immediately evacuate the area. Emergency Management inventories the FMT response kits and escape masks quarterly.

Overall, appropriate PPE for response to a severe NPE is available for Fire Services, Emergency Squad, and FMTs, and it is maintained and tested according to the manufacturers' recommendations.

Radiation Detection Equipment

Independent Oversight reviewed the essential radiation survey equipment used by the radiological control technician, along with the relevant inventory checklists and processes for any required maintenance and periodic testing of the equipment. DOE Order 151.1C requires that detectors adequate to support an emergency response must be available, operable, and maintained.

A USEC onsite FMT monitors for airborne radiological hazards during radiological operational emergencies and appropriately maintains and calibrates the equipment. The onsite FMT radiological equipment, located in C-300, consists of a minimum of four beta-gamma and alpha Geiger counters to detect ionizing radiation and four high-volume or radiological air samplers. The equipment meets the needs identified by the EPHAs. The onsite FMT conducts periodic inspections, operational checks,

calibration, preventive maintenance, and testing of the various radiation detectors as required by the manufacturer's instructions and industry standards. Check sources are also available to perform quick operability checks before using the equipment.

Overall, an adequate quantity of operable and calibrated radiation survey equipment is available to respond to a radiological release caused by a severe NPE, and it is maintained and tested according to manufacturers' instructions.

Chemical Detection Equipment

Independent Oversight reviewed the USEC and BWCS chemical detection equipment used in support of an emergency at a DOE contractor facility, along with the processes for calibrating the equipment. DOE Order 151.1C requires that detectors adequate to support an emergency response must be available, operable, and maintained.

The USEC FMT monitors for the appropriate airborne hazardous chemicals and appropriately calibrates their detectors. The FMT uses Gastec pumps and Sensidyne detector tubes to measure the concentration of HF, which is the most significant chemical hazard identified in the BWCS and LATA-KY EPHAs. The FMT maintains proficiency in performing their duties through participation in a drill or exercise at least annually. USEC Emergency Management checks the expiration date of the detector tubes during their quarterly inventory and USEC industrial hygienists performance-check the pumps annually in accordance with the manufacturer's recommendation.

Fire Services and the PSSs also monitor for airborne hazardous chemicals and appropriately calibrate and maintain their detectors. Fire Services uses an MX6 IBRID Multi-Gas Monitor to detect chlorine, hydrogen sulfide, combustible gases and vapors, and oxygen-deficient and oxygen-rich atmospheres, and they use an MSA HAZMAT Response Kit to detect and classify unknown chemical gases and vapors. Fire Services also uses a Gastec pump and detector tubes to measure such chemicals as chlorine, HF, and chlorine trifluoride and a Dräger Pac III detector to measure chlorine and fluorine. The multi-gas monitor's calibration is checked daily, and the monitor is recalibrated monthly. USEC industrial hygienists performance-check the detector pumps annually and calibrates the chlorine and fluorine detector every three months in accordance with the manufacturer's recommendation. In addition, BWCS provides and maintains Dräger Pac III HF detectors for Fire Services and the PSSs. BWCS performs a functional test on the HF detectors monthly using the manufacturer's recommended procedure and returns the detectors annually to the manufacturer for calibration and servicing.

A review of drill and exercise reports and interviews with PSSs indicated that some PSSs may not have been trained to use the BWCS-provided Dräger Pac III HF detector correctly. Some PSSs have used the detector by holding it out the window of a moving vehicle while approaching an incident scene, believing that the detector provides an instantaneous measurement of the maximum HF concentration in air. However, for proper operation, the detector requires a 5-minute warm-up period, after which it can take up to 60 seconds to indicate 50 percent of the HF concentration in the air at a stationary location. Improper use of the HF detector could lead the PSSs to enter an area that has a significantly higher concentration of HF than they expect. (See Section 8, **OFI 9**.)

Overall, an adequate quantity of operable and calibrated chemical detection equipment is available to respond to a hazardous environment caused by a severe NPE. However, if the PSSs do not understand how to properly operate the BWCS-provided HF detector, they could enter an area with a substantially higher concentration of HF than they expect.

Decontamination Equipment

Independent Oversight reviewed USEC's preparations for a mass-casualty contamination event that would be used in support of an emergency at a DOE contractor facility. DOE Order 151.1C requires that decontamination equipment adequate to support an emergency response must be available, operable, and maintained.

Fire Services is suitably equipped to provide gross decontamination in support of a mass-casualty contamination event. Fire Services uses a custom-made mat with staging areas and three built-in decontamination pools that can be set up in 15 minutes and estimates that they can decontaminate approximately 30 people per hour. Fire Services can also conduct gross mass decontamination using the nozzles on the fire engine and a ladder to create an emergency low-pressure deluge that can remove contamination from clothed workers, although Fire Services has not practiced this technique. (See Section 8, **OFI 10**.) The HAZMAT One Regional Response Team, located in Paducah, can also provide additional decontamination assistance through a mutual aid agreement. Fire Services ensures the operability of the mat and maintains proficiency by conducting two or three decontamination drills annually for each shift.

Overall, USEC is ready to respond to a large-scale contamination event that may result from a severe NPE.

Emergency Operations Center

Independent Oversight reviewed the EOC's documented capability to withstand analyzed severe NPEs and its ability to survive and enable the ERO to remain in a safe environment to perform its emergency response functions. Items of interest include alert and warning systems, communication systems, habitability systems, backup power sources, and response procedures to support a response to an emergency originating at a DOE facility or to protect personnel at DOE facilities from events occurring elsewhere.

DOE Order 151.1C does not contain prescriptive requirements for EOCs; rather, it requires a viable command center where required emergency response functions can be performed, along with provisions for an alternate location if the primary command center is not available. DOE Order 151.1C also requires the site to maintain facilities and equipment adequate to support critical response functions and ensure that the facilities and equipment are available and operable. DOE Guide 151.1-4, *Response Elements EMG*, further recommends that the EOC have habitability systems and that an alternate EOC be located to minimize the risk of losing both facilities from the same event due to habitability or accessibility concerns. DOE Guide 151.1-4 defines a habitable EOC as one capable of remaining operable and life-supporting for an extended period under accident conditions and maintaining its structural integrity under various design basis events, including a severe NPE. A habitable EOC must maintain a breathable atmosphere, provide sufficient shielding from radioactive material and other HAZMAT, and have a backup power supply.

Background. For an operational emergency at the Paducah site, the USEC PSS becomes the initial emergency director (ED) and activates the ERO, if warranted by the event. The PSS resides in building C-300, which houses the PGDP central control room and the EOC. After initial actions are completed, the PSS deploys to the event scene as the ED and the IC until the PSS transfers the ED functions to the USEC crisis manager. If the operational emergency originated at one of the DOE facilities, DOE operating contractor representatives deploy to the EOC and the incident command post to support the response. USEC provides the site-level emergency response at DOE facilities via a work authorization,

and the NRC regulates the USEC emergency management program to meet 10 CFR 76.91 emergency planning requirements.

Building C-300 is a hardened facility centrally located on the Paducah site to provide an efficient PGDP central control room. USEC has determined that the structure can withstand the design basis NPEs of 0.165 gravitational accelerations from a seismic event and 70 miles per hour straight winds. The EOC is located at grade level adjacent to the PGDP central control room and above a basement that contains the UPS system powering the sitewide PA system; a 48-volt battery system for the site criticality accident alarm systems (CAASs), including alarm conditions from the CAAS at C-746-Q; and a 125-volt battery system for EOC direct current lighting and control power. The basement is adequately equipped with sump pumps and has no historical water leakage problems. Tunnels for control and monitoring cables connect the basement to PGDP buildings. The PGDP buildings are operated in negative pressure conditions, and air leakage past cable penetrations and tunnel doors makes it difficult for operators to establish a positive pressure in building C-300. USEC has procedures in place to enhance the effectiveness of the building C-300 ventilation system in attaining positive pressure conditions; however, these plans include dispatching operators outside to vent the tunnels, and operator PPE is stored in the fire station.

Emergency Operations Center. The DOE facilities at the Paducah site rely on the USEC EOC in their emergency management program, and USEC is not required to meet DOE Order 151.1C requirements under existing regulations and contracts. For this reason, the EOC does not meet those requirements, and during a HAZMAT release event, the EOC cadre may not have a command center available that provides the capabilities needed to perform functions required by DOE Order 151.1C. For example:

- The EOC is in range of multiple potentially toxic concentrations of airborne HAZMAT (as determined by site EPHAs) that could prevent the EOC cadre from assembling where the required functions are performed, and there is no designated alternate EOC
- USEC removed from service the instrumentation installed to detect airborne chemical contaminants outside and inside building C-300
- USEC did not have the intake high efficiency particulate air (HEPA) filters in the building C-300 ventilation system certified at a DOE-approved filter test facility prior to installation
- Positive pressure in the EOC may not be possible

Finding F-2: Provisions have not been established for use of an alternate location if the primary command center is not available, as required by the DOE Order 151.1C *Contractor Requirements Document*, 10.2.

USEC provides adequate testing of the standby generator, UPS system, and batteries that power EOC equipment to ensure that sufficient power is available for 30 minutes, which is adequate for issuing and implementing initial protective actions.

Overall, there is inadequate planning for the EOC cadre to safely assemble and perform their required emergency management functions, as established by DOE requirements, because the EOC is located in close proximity to HAZMAT and lacks an operable habitability system or an alternate EOC. Still, the EOC is likely to survive all but the most severe NPEs and has a reliable electrical distribution system to enable the implementation of site protective actions.

Nuclear Facilities

Independent Oversight reviewed the documented capability of the DUF6 conversion building (C-1300) and the Hazardous and Low-Level Waste Storage Facility (building C-746-Q) to withstand analyzed severe NPEs and the ability of these buildings to receive protective action information, implement planned protective actions, and conduct personnel accountability after an evacuation. Key items of interest include communication systems, power supplies, and facilities and equipment used to perform protective actions, such as assembly stations, shelters, accountability mechanisms, and ventilation system controls, as well as abnormal operating procedures, emergency operating procedures, and safe shutdown procedures.

DUF6 Conversion Facility. The DUF6 conversion facility is adequately documented to be designed and constructed for NPEs using current building code standards. It consists of buildings and structures to support the conversion of DUF6 into powdered uranium oxide. BWCS performs the conversion in building C-1300 of the DUF6 conversion facility, which operates as a hazard category 3 nuclear facility based on the resident radionuclide inventory. As a nuclear facility, C-1300's foundation and superstructure are designed to Performance Category (PC)-2 resistance criteria for the effects of seismic events and PC-3 for non-seismic NPEs, including high winds, tornadoes, tornado missiles, and other severe weather events.

The DUF6 conversion facility has an adequate electrical distribution system that is normally powered through offsite utilities using the site electrical distribution system. An adequately sized standby generator, central UPS system, and batteries provide sufficient backup power in case normal power is lost. The backup power sources provide a minimum of 30 minutes, which is sufficient to complete immediate protective actions for employees. BWCS adequately ensures that the UPS will provide power to equipment via a 30-minute service test performed every three years.

Nevertheless, improvements are warranted in the generator and fuel test programs to ensure the reliability of the DUF6 standby generator. BWCS has not evaluated backup power systems using the DOE *Standard for Backup Power Supplies at DOE Facilities* or for compliance with NFPA-110 because these standards have not been invoked via contract, authorization basis document, or other commitment. (See Section 8.0, **OFI 6**.) BWCS has designated the generator as a standby diesel generator because life safety code loads do not depend on its operation. Because it is a standby generator, BWCS has established a goal to test-start the generator quarterly and run it with connected loads for two hours, and to load this 350 kilowatt (kW) generator to 300 kW for two hours annually. To date, the quarterly test has been performed twice and the annual test once. By the DOE standard, start tests are to be performed monthly and are to include a test of the automatic transfer switch. Aside from not meeting the DOE standard, the infrequent testing/operation of the generator does not allow turnover of the diesel fuel in the supply tank to maintain fresh fuel, and the diesel fuel is not periodically sampled and analyzed to ensure its purity. (See Section 8.0, **OFI 6**.) Finally, the generator and fuel system are designed to operate for eight hours without refueling, but facility operator inspections verify only that the 270-gallon fuel tank is at least one quarter full. (See Section 8.0, **OFI 6**.)

BWCS plans, procedures, facilities, and equipment are adequate to implement protective actions, place the DUF6 facility in a safe shutdown mode, and support external responders. DUF6 buildings contain readily available EAPs that identify primary and alternate assembly points on opposite sides of the facility; two robust tornado shelter areas; and three take-cover areas in fixed permanent structures. DUF6 has 100 percent PA system speaker coverage for area alerts and warnings, and normally-occupied buildings have portable HF detectors in place to alert personnel to the presence of HF, which is a hazardous byproduct of the DUF6 conversion process.

BWCS is adequately prepared to implement shelter-in-place protective actions. All DUF6 buildings have controls for heating, ventilation, and air conditioning (HVAC) shutdown; all personnel are trained to perform shutdown of HVAC, and building wardens are responsible for shutdown of ventilation systems during shelter-in-place protective actions and building sweeps during evacuations. One primary and at least one alternate building warden are assigned to designated areas to ensure complete building coverage, and on-duty building wardens coordinate with their alternates when they will be absent from the building.

BWCS has established an adequate personnel accountability system via a network of accountability coordinators, resident rosters, and a visitor logbook. A BWCS site accountability coordinator, who is equipped with a PA system, telephone, radio, and an HF detector at his/her workstation, leads the team of accountability coordinators. There is one primary and at least one alternate accountability coordinator assigned to designated areas to ensure full building coverage.

BWCS has adequate safe shutdown procedures in place for C-1300 operations. BWCS operators perform safe shutdown via either normal shutdown procedures or an emergency shutdown switch at operator workstations. The emergency switch isolates all process flow except nitrogen and de-energizes process heaters, placing operations in a safe configuration before operators evacuate the building.

To support external responders arriving to a DUF6 event, BWCS maintains adequate pre-fire plans through a work authorization with the USEC fire department, which develops and maintains pre-fire plans for DUF6 facilities.

Overall, site documents indicate that C-1300 is adequately constructed to survive all but the most severe NPEs and is adequately equipped to implement protective actions. BWCS has adequate plans and procedures in place to implement protective actions, perform a safe shutdown of operations, and support responders arriving at DUF6. However, improvements are warranted to increase the reliability of the DUF6 standby generator through a more frequent and comprehensive generator and diesel fuel test program.

C-746-Q Hazardous and Low-Level Waste Storage Facility. C-746-Q is documented to be adequately constructed to standard building codes for its function as a hazardous and low-level waste storage facility. The facility is categorized as a nuclear hazard category 2 facility for its assays of U-235, which could initiate an inadvertent nuclear criticality. Otherwise, C-746-Q's maximum inventory of hazardous and low-level waste would establish the facility as nuclear hazard category 3. The building is a single open area with a metal frame structure, metal sides, and a metal roof that is shared between LATA-KY and USEC. LATA-KY and USEC operations are performed in distinct areas, separated by a concrete/block wall, and both operations require a CAAS.

C-746-Q has adequate electrical power from a 13.8 kV primary overhead feeder that supplies two transformers located just outside the building. Facility backup power consists of battery-backed systems; there is no backup generator for this facility. USEC maintains the C-746-Q backup power systems for all but the emergency lights. LATA-KY ensures that the emergency lights are adequately tested to NFPA Life Safety Code requirements through monthly and annual tests.

C-746-Q is adequately equipped to alert building occupants to an operational emergency, and adequate written instructions are available at the facility to prepare and instruct personnel on the building-specific protective actions. The building is equipped with emergency lighting, alarm speakers, PA speakers, and a CAAS. LATA-KY has adequate EAPs in place to address earthquakes, tornado/severe weather, and fires. The designated rally point is sufficiently far (well over 60 m) from the building. Although the route to the rally point goes past USEC operations, which could be the location of a criticality event, LATA-KY confirmed that outside the building, they would be at least 60 m from potential USEC criticality events.

C-746-Q is not normally occupied and is not used for sheltering personnel; rather, work crews in C-746-Q are directed to relocate to building C-333, a hardened USEC process facility, for shelter protective actions. No special operations are required for a safe shutdown of C-746-Q before personnel evacuate the facility. To support responders arriving at C-746-Q for an event originating there, LATA has ensured that an adequate pre-fire plan is in place.

Overall, site documents indicate that C-746-Q is adequately constructed for its operations but is not likely to survive a severe NPE; therefore, the building is not used for protective actions. Personnel who may be in the building are instructed to relocate to a designated hardened USEC process building for shelter or to a sufficiently distant evacuation rally point, unless the ED provides alternate instructions. The building is adequately equipped with monitoring and alarm systems and speakers to alert and warn personnel in the building when there are hazards and to provide them with protective action instructions, and emergency lighting is available, with sufficient backup power to enable a safe evacuation. No special procedures are needed to place the facility in safe shutdown mode before operators evacuate, and adequate pre-fire plans are in place to support responders arriving at the C-746-Q facility.

Emergency Response Organization

Independent Oversight reviewed the ERO capabilities that are essential for response to an emergency caused by a severe NPE.

In accordance with an MOA and work authorization with DOE, USEC is responsible for managing and providing the ERO (e.g., PSS, crisis manager, plant emergency squad, safety officer) and emergency response support systems, including the direction, control, and evaluation of emergency responses. The USEC emergency plan fittingly captures the concept of operations, in which facility managers/supervisors and other key on-shift personnel immediately transition to an ERO after an operational emergency is declared. Additionally, as the initial ED, the USEC PSS has full authority and responsibility to implement the emergency plan during an operational emergency. Procedures, desk aids, and checklists appropriately require the PSS either to initially perform or to oversee initial response functions, including command and control in accordance with the National Incident Management System (NIMS). Furthermore, USEC procedure CP2-EP-EP5046, *Emergency Operations Center*, adequately defines roles and responsibilities and action steps required for select ERO cadre positions – the PSS, crisis manager, and technical assessment group (TAG) advisors.

A USEC procedure clearly defines training requirements and qualifications for USEC ERO personnel, but the curriculum does not provide all necessary training to allow them to properly perform consequence assessment modeling projections. The USEC Emergency Management Specialist maintains records and training requirements associated with qualifications for each EOC cadre position. Independent Oversight determined that USEC has an adequate number of experienced and trained personnel, including designated alternates, available on demand.

Importantly, USEC has not ensured that DOE contractor personnel are assigned to key ERO decision-making positions. During a BWCS or LATA-KY based emergency event, the respective plant manager (or designee) and TAG representative proceed to the EOC if it is safe to do so. However, USEC is not required to fill the positions of contractor plant managers, designees, and TAG representatives who declare the EOC operational for DOE facility events. Although the contractor plant manager is the person knowledgeable of their facility operations and HAZMAT, he/she acts only as an advisor to the crisis manager. (See Section 8, **OFI 11.**)

Additionally, the USEC TAG advisor is tasked with producing projected plume models for all emergency release events on site, including BWCS and LATA-KY operated facilities. However, the USEC TAG

advisors do not have the training or radiological dispersion modeling software required to produce projected plume models in the EOC. The USEC TAG advisor only has Areal Locations of Hazardous Atmospheres (ALOHA), a chemical dispersion modeling software, but the consequence analyses in the C-746-Q facility EPHA were conducted using the National Atmospheric Release Advisory Center (NARAC) software (for uranium releases), HotSpot (for criticality analyses), and ALOHA (for chemical releases), and all consequence analyses in the DUF6 facility EPHA were conducted using NARAC. Although LATA-KY and BWCS have trained certain designated TAG representatives to use ALOHA, HotSpot, and NARAC, these individuals are not required, as stated above, to declare the EOC operational. Further, in the event of a severe NPE, the contractor TAG representatives may not be available or able to reach the EOC. (See Section 8, **OFI 12.**)

Overall, USEC procedures clearly establish ERO positions, and these positions are generally staffed with appropriately trained personnel, including alternate personnel, to provide continuous emergency response coverage. However, DOE contractor personnel assigned to key ERO positions are not required to be present for USEC to declare the EOC operational for DOE facility events, and the USEC TAG advisor does not have all the necessary tools and training to conduct predictive analysis for onsite radiological or criticality emergency events.

Protective Force

Independent Oversight reviewed the protective force capabilities that are essential for response to an emergency caused by a severe NPE. This review also determined whether offsite law enforcement agencies use any specific protocols for Paducah site events.

Protective force emergency planning adequately addresses nearly all operational emergency events. USEC provides the operational and manpower elements for the protective force, in addition to the planning and oversight elements. USEC also organizes the protective force in shifts, with each shift under the supervision of a shift commander. Each shift contains all of the disciplines necessary for a full security response, including access control and Special Response Team personnel. The protective force works under various agreements with local law enforcement agencies to ensure effective integration of supplemental personnel, equipment, and capabilities. USEC has a letter of agreement with the City of Paducah police department to request and receive law enforcement assistance that includes the bomb squad, special weapons and tactics team, canine unit, and the crisis intervention team. Additionally, USEC has letters of agreement with the McCracken County sheriff's office and the Kentucky State Police, who has prepared a response plan for the Paducah site. USEC also has an agreement with U.S. Department of the Army Explosive Ordnance Disposal, located at Fort Campbell, Kentucky, to evaluate, render safe, remove, and destroy hazardous explosive items. USEC appropriately plans for the integration of local law enforcement agencies to provide supplementary personnel to the protective force during an emergency event inside the Paducah site. Although USEC has a few pre-planned protocols with offsite agencies for supporting the protective force, they contain minimal information on roles, responsibilities, logistical requirements, and procedures for use during an emergency event. (See Section 8, **OFI 13.**) In contrast, agreements with the Federal Bureau of Investigation (FBI) appropriately define the roles, responsibilities, and procedures used during an event at the Paducah site that requires intervention by the FBI. Aside from the FBI agreements, USEC does not have site/facility-specific catastrophic event response plans and procedures to support security operations at the Paducah site after a catastrophic event with severe consequences.

Overall, the protective force is ready to provide full security services and appropriately interacts with offsite local law enforcement personnel in case of a severe NPE. USEC intends to use local law enforcement agencies to supplement onsite USEC protective force personnel during an emergency event but has not fully developed protocols for that possibility.

5.4 Objective 4: Offsite Response Interfaces

The site's planning is adequate for obtaining and integrating offsite response assets for events beyond the site's response capability.

Independent Oversight reviewed the site's planning and interactions with offsite response authorities and organizations responsible for protecting the public and augmenting site response resources. This review also looked at the routine dialogue and interfaces with organizations needed to establish and maintain emergency response roles, responsibilities, capabilities, and information needs, consistent with the requirements of the NIMS. Independent Oversight also examined written support agreements with offsite response agencies and organizations, evaluated related response plans, and assessed the adequacy of response and short-term recovery procedures to be used after a severe NPE.

Independent Oversight determined that the site's planning is mostly adequate for obtaining and integrating offsite response assets for events beyond the site's response capability. However, USEC's leased facilities at the PGDP present unique difficulties for the multiple DOE contractor emergency management programs in protecting onsite worker health and safety, establishing consistent interfaces with offsite emergency response organizations, and integrating the activities of the leased facilities with the DOE sitewide emergency management program to ensure an effective emergency response.

Offsite Interactions

DOE Order 151.1C requires that effective interfaces be established and maintained to ensure integration and coordination of emergency response activities with Federal, state, and local agencies and with organizations responsible for emergency response and protection of workers, the public, and the environment. Further, a formal exercise program must validate all elements of the emergency management program over a five-year period, including provisions to assess the potential or actual offsite consequences of an emergency. Additionally, consequence assessments must incorporate monitoring of specific indicators and field measurements and must be coordinated with Federal, state, and local organizations.

Because USEC is the direct interface with offsite entities, the USEC emergency plan appropriately documents a clear and comprehensive understanding of USEC's offsite relationships and includes detailed listings of Federal, state, and local organizations with emergency response or regulatory control responsibilities relevant to the USEC PGDP. Additionally, USEC fittingly holds periodic interface meetings with offsite organizations to exchange information and address any response issues as part of routine planning activities. Likewise, USEC periodically invites offsite organizations to participate in its site-level exercises designed to test offsite interfaces and capabilities and incorporates offsite participation in exercises, including significant participation and interaction with the NRC.

In contrast, McCracken County and Commonwealth of Kentucky emergency management authorities do not interact comparably with DOE and are not aware of DOE/NNSA national assets capabilities and availability. Offsite authorities responsible for Paducah site emergency planning expressed to Independent Oversight that they are not familiar with the DOE Region 2 Radiological Assistance Program (RAP), NARAC, and Radiation Emergency Assistance Center/Training Site (REAC/TS). The most likely DOE/NNSA asset to support an emergency response to Paducah is the Region 2 RAP, which covers six states, including the Commonwealth of Kentucky. The *DOE Region 2 RAP Response Plan* covers basic response within the region and emphasizes that the primary responsibility for an emergency or incident involving radioactive material remains with the party having custody of the material. Upon request, Region 2 RAP teams (assembled from personnel located in Oak Ridge, Tennessee) can provide

radiological monitoring and assessment services to help resolve PGDP incidents involving radiological materials.

Importantly, the Commonwealth of Kentucky does not have FMTs and relies on the HAZMAT One Regional Response Team, located in Paducah, to perform monitoring. In the absence of a written plan or procedure that defines how offsite monitoring of actual or perceived PGDP radiological hazards will occur, performance of the response function will likely default to the RAP or NRC incident analysis team. For example, the NRC would send an incident analysis team to the PGDP to assist with a USEC site area emergency event, including offsite monitoring. Interagency agreements between the NRC and DOE could also provide support from DOE/NNSA assets; however, there is no understanding that the NRC would similarly respond to a DOE event using an NRC incident analysis team. PPPO, the Commonwealth of Kentucky, or local government can request RAP assistance after an incident involving the offsite release of radiological materials from the site. Nevertheless, no protocol or procedure integrates PGDP field monitoring concepts of operation with other potential offsite monitoring teams, which may include the Commonwealth of Kentucky National Guard 41st Civil Support Team, the DOE Region 2 RAP, NRC Region II, Environmental Protection Agency Region IV, or other Federal agencies. Additionally, BWCS and LATA-KY did not provide documentation to demonstrate that effective planning for offsite radiological assessment, monitoring, and decontamination processes exist for implementation after a significant release of DOE-owned radiological material. Furthermore, neither the BWCS and LATA-KY emergency plans nor the Commonwealth and County emergency plans adequately discuss the offsite field monitoring resources needed to assist local governments in identifying the radiological plume, relocation area, and food control boundaries after an actual or perceived PGDP radiological emergency. (See Section 8, **OFI 14**.)

In addition, BWCS and LATA-KY do not have an adequate exercise program that validates all elements of the emergency management program over a five-year period, as required by DOE Order 151.1C, including provisions to assess the potential or actual offsite consequences of an emergency. Consequently, BWCS and LATA-KY have not validated some facility- and site-level emergency management program elements. For example, DOE assets (Region 2 RAP, NARAC, and REAC/TS) have not participated in a Paducah site event response or exercise. (See **Finding F-3** and Section 8, **OFI 15**.) Similarly, PGDP has not participated in an exercise with the DOE Headquarters Emergency Management Team to demonstrate an effective capability to provide DOE Headquarters with up-to-date significant event information, as prescribed in the DOE Headquarters Emergency Management Team Situation Report. (See **Finding F-3** and Section 8, **OFI 16**.) Furthermore, BWCS and LATA-KY do not conduct annual exercises of their facility-specific response capabilities, as required by DOE Order 151.1C. Both contractors identified that the DOE work authorization with USEC provides for only one DOE exercise annually; BWCS and LATA-KY do not have the capability to conduct exercises without USEC's support; and USEC resists requests for additional exercises since they would necessitate overtime for the USEC exercise participants. (See **Finding F-3** and Section 8, **OFI 17**.)

Overall, USEC appropriately documents a clear and comprehensive understanding of their required offsite relationships and frequently interacts with response agencies and organizations capable of augmenting USEC response resources. Offsite interaction with DOE is not as evident, as exemplified by offsite authorities being unaware of DOE/NNSA national assets capabilities and availability. Additionally, the site has not demonstrated the appropriate planning, coordination, and response capabilities to assist local governments in identifying the radiological plume, relocation area, and food control boundaries after a DOE radiological emergency. Finally, the absence of a comprehensive exercise program is evident in the lack of any participation with the DOE Headquarters Emergency Management Team, Region 2 RAP, NARAC, and REAC/TS.

Support Agreements

DOE Order 151.1C and the Resource Conservation and Recovery Act (40 CFR 264, Subpart D) require that emergency plans and procedures document arrangements agreed to by local police departments, fire departments, hospitals, contractors, and state and local emergency response teams to coordinate emergency services. Specific to the Paducah site, a *Memorandum of Agreement between DOE and USEC for the Supply of Services, Exhibit F* authorizes USEC to manage and provide an ERO, which includes adherence to any mutual aid agreement executed by DOE.

Accordingly, USEC has established an appropriate interface with each offsite entity that has agreed to provide support during Paducah site emergencies. The USEC emergency plan describes and identifies the mechanisms for integrating local agencies and other external organizations into the site response. These mechanisms include letters of agreement with offsite emergency response assistance organizations; local agencies entering into agreements with USEC include area hospitals, local fire services, and local law enforcement agencies. The Paducah site also benefits from a statewide mutual aid and assistance agreement with all participating government entities. This agreement negates the need to execute mutual assistance agreements with all potential offsite response organizations, although it allows for such agreements if desirable.

USEC has signed suitable memoranda of understanding with regional hospitals to receive and medically treat chemically and radiologically contaminated injured site personnel. Mercy Health Partners – Lourdes Hospital, located in Paducah, is the closest major hospital to the PGDP and is the primary hospital that would treat injured personnel. The emergency department staff handles arrangements for transferring patients who need treatment beyond what is available locally. If a mass casualty incident (MCI) occurs at the Paducah site, the Lourdes Hospital coordinates with other hospitals to transfer and subsequently treat patients, depending on the type of injury and extent of contamination. Lourdes Hospital is not a trauma center, nor is Western Baptist Hospital, which is located in Paducah and has agreed to provide similar assistance and emergency support.

USEC documents appropriate planning for a MCI in its medical emergencies procedure and has determined possible MCI transport modes, including one ambulance for primary emergency medical services (EMS) needs within the Paducah site and a backup ambulance. USEC also has letters of agreement with offsite ambulance and medical helicopter services for EMS assistance. Specifically, the McCracken County government would coordinate the request for assistance, and when they exhaust their EMS resources (e.g., personnel and ambulances) the Commonwealth of Kentucky EOC would assist local officials with deployment of additional resources. In addition, the Kentucky Cabinet for Health and Family Services would coordinate with local governments, as necessary, for other resources (e.g., ambulances or medical helicopters) located outside the initial response region.

DOE Order 151.1C does not specifically address the need for an agreement with a level 1 trauma center to receive and medically treat chemically and radiologically contaminated injured Paducah site personnel. However, the risk of death for a severely injured person is 25 percent lower if the patient receives care at a level 1 trauma center. Vanderbilt University Medical Center in Nashville, Tennessee, is the nearest level 1 trauma center. Even though the Vanderbilt University Medical Center trauma center is approximately 150 miles from Paducah, PPPO may need to evaluate the need for additional planning with Vanderbilt to receive and treat contaminated injured personnel, such as burn victims. (See Section 8, **OFI 18.**)

DOE Order 151.1C requires PPPO to participate in the development and implementation of mutual assistance agreements with Federal, Commonwealth of Kentucky, and local authorities. However, USEC has entered into agreements with area hospitals, local fire services, and EMSs, without DOE participation

in the development and approval of those agreements. Likewise, the USEC protective force works under various agreements with local law enforcement agencies, Kentucky State Police, FBI, and U.S. Department of the Army to ensure effective integration of supplemental personnel, equipment, and capabilities, without DOE participation in the development and approval of those agreements. (See **Finding F-3** and Section 8, **OFI 19**.) The *National Contingency Plan* requires DOE to designate an on-scene coordinator (OSC) at the Paducah site if an event results in the release of a hazardous substance, and 40 CFR 300.120(c) gives DOE the authority to act as the OSC for all releases of hazardous substances. Nevertheless, PPPO has not pre-designated the OSC and appropriately included the concept of operations in appropriate USEC and DOE emergency plans. (See **Finding F-3** and Section 8, **OFI 20**.)

Overall, appropriate written support agreements exist between USEC and offsite response agencies and organizations, including area hospitals, local fire services, and local law enforcement agencies. However, PPPO was not involved in the development and implementation of those USEC agreements, and given the uncertainty of continued USEC operations at the PGDP; those agreements warrant further review by PPPO. PPPO also has not pre-designated OSCs and incorporated the OSC concept of operations into applicable emergency planning, as required by the *National Contingency Plan*. In addition, PPPO does not have an agreement with a level 1 trauma center to receive and medically treat chemically and radiologically contaminated injured Paducah site personnel; this limitation significantly increases the mortality risk for severely injured employees who would receive care at a non-trauma center.

Offsite Response Planning

DOE Order 151.1C requires that contractors at all DOE/NNSA facilities coordinate with state and local agencies and organizations responsible for offsite emergency response and for protection of the health and safety of the public. The site emergency management program can incorporate or invoke by reference existing plans, such as catastrophic earthquake plans or mass-casualty plans detailing compliance with Federal or state standards. Additionally, contractors must develop a methodology for informing the public of emergency plans and planned protective actions before and during emergencies.

USEC leases the majority of the facilities at the Paducah site and conducts extensive uranium enrichment activities in the PGDP process buildings. The NRC, in accordance with 10 CFR 76, *Certification of Gaseous Diffusion Plants*, regulates emergency planning for USEC leased facilities. Based on NRC determinations, USEC has appropriately documented in their emergency plan that the most extreme credible scenario used for offsite emergency planning is an accident involving a large release of UF₆. USEC documents emergency planning for other hazardous radioactive and non-radioactive materials stored and used in USEC facilities in the *PGDP Spill Prevention, Control and Countermeasure Plan*.

All facilities (including leased or NRC-regulated) are required to effectively integrate into the DOE sitewide emergency management program. USEC references the *DOE Paducah Environmental Management and Enrichment Facilities Integrating Emergency Plan* as a necessary support document in the USEC emergency plan to ensure appropriate integration with non-USEC operations at the PGDP. However, the referenced plan is no longer in effect, and no emergency planning document has replaced its sitewide integrating function. Furthermore, as discussed in the *DOE Emergency Readiness Assurance Plan for the PGDP*, contractor experience to date indicates that the USEC emergency plan and associated implementing procedures do not adequately cover DOE emergency management program requirements. For this reason, BWCS, LATA-KY, and SST have each developed separate emergency management plans for their respective operations. These emergency plans differ significantly in format and content, and they do not form the basis for a DOE sitewide emergency management program that integrates both emergency management requirements for DOE regulated HAZMAT operations and leased facility operations. (See **Finding F-3** and Section 8, **OFI 21**.)

Finding F-3: The individual DOE contractor and USEC emergency management activities have not resulted in a fully comprehensive and integrated Paducah site emergency management program, as required by DOE Order 151.1 C.

Several Commonwealth of Kentucky and County emergency planning documents govern offsite emergency response for a major Paducah site emergency, although some are not finalized:

- The *Commonwealth of Kentucky Emergency Operations Plan (DRAFT)* describes the Commonwealth's planned responses to all hazards using the Department of Homeland Security *National Response Framework*
- The *Commonwealth of Kentucky Catastrophic Earthquake Plan (DRAFT)* describes the Commonwealth's approach for responding to a catastrophic disaster involving the New Madrid seismic zone
- The *McCracken County Emergency Operations Plan* establishes protocols for all local agencies involved in emergency operations

Importantly, the Commonwealth of Kentucky and McCracken County do not consider the PGDP uranium enrichment facilities or DOE operations as fixed nuclear facilities under Federal criteria. Based on this determination, the Commonwealth and the County manage events at the Paducah site in accordance with their respective emergency operations plans' HAZMAT annexes. Therefore, the Commonwealth of Kentucky and McCracken County have no Paducah site-specific response planning.

Overall, USEC has adequately coordinated and implemented PGDP emergency planning with the Commonwealth of Kentucky and McCracken County, in accordance with 10 CFR 76.91. However, a one-of-a-kind agreement between DOE and USEC, where the DOE lessee provides the site emergency response capability and is not governed by DOE requirements, has resulted in an emergency management program that is not fully compliant with DOE Order 151.1C. USEC was not required and did not develop their emergency management program to comply with DOE requirements. However, the DOE contractors at the Paducah site did not develop supplementary programs to compensate for this deficiency in meeting DOE requirements.

Response and Recovery Operations

DOE Order 151.1C requires appropriate application of resources to mitigate an emergency event, and recovery from a terminated operational emergency must include communication and coordination with state and local government and other Federal agencies; planning, management, and organization of the associated recovery activities; and ensuring the health and safety of the workers and public. Additionally, the contractor must have the means for estimating exposure to HAZMAT and for protecting workers and the public from exposure during reentry and recovery activities.

At DOE's request, USEC has agreed to manage and provide emergency response services for DOE operations at the Paducah site, as specified in a lease agreement between DOE and USEC. USEC provides the specified response services through a Government Furnished Services and Items work authorization agreement with DOE. In general, this agreement allows USEC to extend their existing emergency response capabilities regulated by NRC to DOE in accordance with the requirements of 10 CFR 76.91, but does not obligate USEC to participate in the planning and preparedness activities required by DOE Order 151.1C. Therefore, DOE must stipulate in their work authorization any additional services from USEC to meet DOE requirements and guidance, such as wildland fire management, technical rescue, and recovery planning. For this reason, some USEC response and recovery capabilities do not meet all applicable DOE expectations.

Additionally, baseline needs assessment (BNA) processes, performed by BWCS and LATA-KY in accordance with DOE Order 420.1B, *Facility Safety*, appropriately determined the necessary onsite fire, EMS, and HAZMAT support resources based on conclusions contained in the USEC emergency plan. The BNAs concluded that:

- The USEC Fire Services and plant emergency squad are capable of responding to most fire emergencies at the site using only USEC assets
- The BNA establishes four Fire Department members as the minimum USEC response staffing level, which accounts for multiple types of events, including an EMS incident in conjunction with a single event response, as well as contingencies for incident response through callback of off-duty personnel and reciprocal aid agreements
- USEC maintains several formal agreements for firefighting assistance with regional fire departments as identified in the USEC emergency plan

However, BWCS, LATA-KY, and SST have not documented provisions for important technical rescue capabilities in accordance with the NFPA-1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*. A variety of hazards, including earthquakes, manmade accidents, and terrorist activities, may result in the need for urban search and rescue (USAR) and could involve the location, extraction, and initial medical stabilization of victims trapped in confined spaces due to a structural collapse. Notably:

- DOE has not tasked USEC to provide technical rescue for the non-leased areas of the site, and USEC does not possess NFPA-1670 technical rescue capability for structural collapse, confined space, and trench and excavation work
- Assistance agreements with offsite organizations do not identify technical rescue capabilities or the intent for offsite organizations to provide these services at the Paducah site
- The closest Federal Emergency Management Agency USAR team is the Tennessee-Task Force One (approximately 100 miles away), a 70-person USAR task force based in Memphis, Tennessee
- The BWCS and LATA-KY BNAs do not identify and establish the levels of capabilities needed for conducting technical rescue operations (See Section 8, **OFI 22.**)

Further, DOE Guide 420.1-3, *Implementation Guide for DOE Fire Protection and Emergency Services Programs*, provides guidance on wildland fire protection and suppression in accordance with NFPA-1143, *Wildland Fire Management*, and NFPA-1144, *Protection of Life and Property from Wildfire*. Although the Commonwealth of Kentucky considers wildland fires a moderate risk, BWCS, LATA-KY, and SST do not have adequate planning for wildland fires. Specifically:

- The work authorization between DOE and USEC does not request USEC to provide wildland firefighting for the non-leased areas of the site and USEC does not have wildland fire fighters trained in accordance with NFPA-1051, *Wildland Fire Fighter Professional Qualifications*
- BWCS identifies in the DUF6 DSA and hazards survey that wildland fires are a potential threat on the Paducah site
- BWCS, LATA-KY, and SST have no response plans or agreements with Federal, state, or county agencies to respond to a wildland fire, though USEC would likely request West McCracken County Fire District to provide initial response to a wildland fire on the Paducah site
- The BWCS and LATA-KY BNAs do not identify and establish response capabilities needed for conducting wildland fire operations (See Section 8, **OFI 23.**)

Independent Oversight also looked at the ability of offsite response organizations to access the Paducah site during an emergency. USEC has adequately planned for the arrival of offsite organizations using Hobbs Road (south access) and entering through Post 57. However, USEC has installed physical barricades, without PPPO approval, at the east, west, and north access points to the Paducah site, potentially impeding the arrival of offsite response organizations if the south access road is inaccessible. Furthermore, this configuration significantly limits safe evacuation of the site to using only the south access road during a severe NPE involving a HAZMAT release. (See Section 8, **OFI 24.**)

BWCS, LATA-KY, and SST describe basic emergency event recovery operations in their respective procedures. However, Independent Oversight noted several limitations in response and short-term recovery planning for severe NPEs. For example:

- The *PPPO Continuity of Operations Plan Implementation Plan* identifies mission-essential functions that may be helpful in determining priorities for restoration and mitigation efforts during a severe NPE scenario, but the plan documents only nominal reconstitution planning
- Potential severe NPEs postulated for the Paducah site lack specific event response planning or procedures that include short-term recovery actions, such as considering infrastructure damage and outages that may impede the normal response of onsite or offsite responders (See Section 8, **OFI 25.**)
- BWCS and LATA-KY conduct some exercises that focus on severe NPEs, but none of these exercises postulates consequences that result in significant structural damage or building collapse and generate resource requirements that the Paducah site cannot meet (See Section 8, **OFI 26.**)

Overall, USEC has appropriately established the onsite response assets necessary to respond to most events at the Paducah site, based on USEC hazards analyses and NRC guidance. The response to some potential emergency response scenarios important to DOE, such as technical rescue (collapsed structure, confined space, trench and excavation), wildland fire, and severe NPEs, would likely be ad hoc, since little or no onsite capability is available and no planning has been completed. Independent Oversight also determined that the DOE contractors have incomplete planning for response and short-term recovery activities related to a severe NPE and have not identified how infrastructure damage and outages might affect the recall of onsite responders and assistance from offsite responders, who may be prevented from responding due to the rural location of the site. Finally, DOE contractors do not conduct recovery exercises, and few exercises focus on the response to severe NPEs.

6.0 CONCLUSIONS

Independent Oversight noted several positive observations during its review of the Paducah site emergency management program's preparedness for severe NPEs. For example, the EOC, DUF6, and C-746-Q facilities have adequate normal power distribution system and capability to provide backup power to essential loads for an emergency response from standby diesel generators. Additionally, UPS and batteries provide continuous power for at least 30 minutes to equipment needed to support the implementation of protective actions, and there are adequate refueling plans to sustain diesel generator long-term operations. Further, emergency communication systems are adequate to facilitate information flow during severe NPEs. Building C-1300 (DUF6 conversion facility) is adequate to survive all but the most severe NPEs, and adequate plans, procedures and equipment are in place to implement protective actions, perform a safe shutdown of operations, and support emergency responders.

Both LATA-KY and BWCS have developed hazards surveys that adequately identify HAZMAT that could result in an airborne release initiated by severe NPEs, as well as EPHAs that quantitatively analyze and document the consequence analyses as required.

USEC has procedures that clearly establish ERO positions and show a clear and comprehensive understanding of their required offsite relationships and periodic interactions with offsite agencies and organizations capable of augmenting the Paducah site response resources. The ERO positions are staffed with appropriately trained primary and alternate personnel. USEC also has support agreements with area hospitals, local fire services, and local law enforcement agencies and has developed EALs for quickly determining whether analyzed events at the Paducah site result in the loss of a significant quantity of HAZMAT and are beyond the site's capability to respond. Fire Services, Emergency Squad, and FMTs have the appropriate PPE for conducting their duties, along with adequate radiation survey and HAZMAT detection equipment.

Importantly, Independent Oversight observed a high level of willingness by the contractors to cooperate and attempt to work through issues resulting from the unique organizational relationships at the Paducah site.

During this review, it became apparent that deficiencies in the integration and coordination of individual facility emergency management programs negatively impact the Paducah site's ability to plan response and recovery operations resulting from severe NPEs. The Paducah site lacks a sitewide emergency management program that provides an integrated and comprehensive emergency management system and ensures a prompt, efficient, and effective response to any emergency involving DOE facilities/sites or activities to protect workers, the public, the environment, and national security.

USEC operates the PGDP facility under a lease agreement with DOE and is regulated by the NRC. Additionally, USEC is tasked by both MOA and work authorization to provide specific sitewide emergency response services and select emergency management services for the Paducah site. However, USEC is not tasked with integrating the four separate contractor plans or state and local plans, and those sitewide services are not exempt from the requirements of DOE Order 151.1C. The resulting lack of integration and coordination can have a detrimental effect on planning and response. For example, there is no state, local, or site plan for performing offsite field monitoring if a release is projected or determined to go offsite. The response would depend on the affected facility contractor and the Federal regulating authority (DOE or NRC), which would determine what national assets could be requested to respond.

The USEC PGDP facility is exempted from the requirements of DOE Order 151.1C by virtue of being subject to NRC license requirements (although the facility has a permit, not a license, from the NRC). However, the agency regulations are not equivalent, and there are significant differences between agency requirements. For example, the protective actions that DOE methodology would deem adequate differ from those contained in the USEC EALs, and the differences have not been resolved. Although USEC uses generally accepted initial response guidance (the ERG) as the basis for its protective actions/PARs, DOE guidance states that when the type, form, and quantity of the HAZMAT are known, an EPA hazard-specific analysis should be performed. For the case of chlorine, these two methodologies produce significantly different personnel evacuation distances (460 m for USEC vs. 884 m for DOE).

All facilities depend on the USEC EOC for management of an onsite event. While the EOC is likely to structurally survive all but the most severe NPEs, the EOC cadre's ability to occupy the structure and perform their required duties is compromised by the lack of an operable habitability system. Further, no alternate EOC is designated as required to serve the EOC function if the primary facility is not available.

BWCS, SST, and LATA-KY are required to implement all appropriate provisions of the CRD contained in DOE Order 151.1C (with the exception of incident classification). These DOE contractors have not documented the need for technical rescue capabilities (structural collapse, confined space, trench excavation, and USAR) as required. Severe NPEs may necessitate these capabilities, and their needs

should be documented and, if necessary, provided either internally or via agreements with offsite organizations. With respect to emergency access, the plans limit offsite response organizations to accessing the Paducah site only through Post 57, the primary site access point. Evacuation of the site is similarly restricted, with barricades having been placed at two of the three other parameter access points. There has been no planning for a HAZMAT release or other incident that could impede traffic in or out of the primary access point.

This Independent Oversight review of select elements of emergency management program indicates that the Paducah site may not be able to protect the safety and health of workers and the public according to DOE requirements. Based on the significance of the documented issues and the inconsistencies between regulating agencies, EM and PPPO (in collaboration with the NRC) should undertake a comprehensive reevaluation of the site's emergency management program to further identify and resolve all the issues preventing the Paducah site from having an integrated, coordinated, and comprehensive emergency management program.

7.0 FINDINGS

Findings indicate significant deficiencies or safety issues that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. Findings may identify aspects of a program that do not meet the intent of DOE policy.

The differences in program requirements for USEC and DOE contractors have resulted in mechanisms that only partially enable decision-makers to ensure the health and safety of onsite workers and the public. PPPO does not have a copy of the USEC hazards assessment to ensure that DOE requirements are being adequately fulfilled and documented by USEC. Further, PPPO has not verified the accuracy of the consequence assessment analyses used in the development of the USEC EALs. As a result, the USEC EALs do not provide emergency responders with the correct tools for determining the appropriate protective actions and PARs for all emergency events occurring on the Paducah site.

Finding F-1: PPPO has not effectively integrated the activities of a leased facility and NRC licensed facilities into the technical basis for the DOE sitewide emergency management program to ensure the health and safety of onsite workers and the public, as required by DOE Order 151.1C.

The primary EOC is located within PAC from several HAZMAT locations, is not equipped with operable habitability systems, has high air infiltration rates, and may not be structurally sound following some severe NPEs. Further, no alternate EOC location is designated.

Finding F-2: Provisions have not been established for use of an alternate location if the primary command center is not available, as required by the DOE Order 151.1C *Contractor Requirements Document*, 10.2.

USEC was not tasked with providing a sitewide integrated emergency management program compliant with DOE requirements. Therefore, the DOE contractors must develop supplementary programs to meet these requirements. These programs include, but are not limited to:

- Demonstrating the appropriate planning, coordination, and response capabilities to assist local governments in identifying the radiological plume, relocation area, and food control boundaries after a DOE radiological emergency

- Developing a comprehensive exercise program that includes participation with the DOE Headquarters Emergency Management Team, Region 2 RAP, NARAC, and REAC/TS
- Involving the PPPO in the development and implementation of written support agreements between USEC and offsite response agencies and organizations, including area hospitals, local fire services, and local law enforcement agencies
- Effectively integrating the activities of all onsite facilities and operations, including leased and NRC regulated facilities, into the DOE/NNSA sitewide emergency management program

The program elements not reviewed by Independent Oversight should be assessed and the results addressed when considering corrective actions to rectify this finding.

Finding F-3: The individual DOE contractor and USEC emergency management activities have not resulted in a fully comprehensive and integrated Paducah site emergency management program, as required by DOE Order 151.1 C.

8.0 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

United States Enrichment Corporation

OFI 2: To improve site-specific planning for implementing protective actions and PARs, consider:

- Ensuring that the USEC EAL used during a severe NPE appropriately references event-specific EALs from the LATA-KY and BWCS EAL sets
- Ensuring that the USEC EAL used during a severe NPE indicates appropriate initial protective actions and PARs (sheltering or evacuation) and activation of the PWS

OFI 5: To improve the reliability of standby generators, consider implementing a diesel fuel sampling and analysis program per NFPA-110, *Standard for Emergency and Standby Power Systems*, or a similar industry standard.

OFI 7: To strengthen the USEC testing of emergency communication equipment, consider:

- Adding testing of the EOC computers to the *EOC Inventory Checklist*
- Adding testing of the EOC and FMT hand-held radios to the *EOC Inventory Checklist* and *FMT Checklist*
- Adding the specific local emergency rooms and offsite ambulance service to be contacted to the *Fire Services Quarterly Communications Operability Status Checklist*
- Adding testing of the VHF radios in the PSS vehicles to the *Quarterly Communications Operability Status Checklist*
- Adding a requirement for daily testing of the emergency reporting telephone system's operability
- Expanding the detail in the following checklists to note the operability expected of the equipment (such as the ability to create and display an event log or transmit and receive a radio message):

- *EOC Inventory Checklist*

- *FMT Checklist*
- *Fire Services Quarterly Communications Operability Status Checklist*
- *Quarterly Communications Operability Status Checklist*

OFI 8: To strengthen the USEC PSS’s ability to perform the critical function of receiving emergency telephone calls from plant personnel, consider providing an alternate location that can receive incoming emergency calls far enough from building C-300 that an emergency would not necessitate an evacuation of both locations.

OFI 9: Consider providing periodic training to the USEC PSSs on the proper field operation of the Dräger Pac III HF detector.

OFI 10: To enhance the capability to respond to a large-scale contamination event, consider including a demonstration of gross decontamination activities in the USEC Fire Services training requirements.

OFI 11: To strengthen response activities for events involving contractor facilities at the Paducah site, consider revising the EOC procedure to require the presence of DOE contractor personnel assigned to key ERO decision-making positions before the EOC is declared operational.

OFI 12: To ensure appropriate implementation of protective actions and PARs, consider:

- Providing radiological dispersion modeling software for use by the TAG advisor
- Revising the training and qualification requirements for the TAG advisor to include all relevant radiological dispersion software

OFI 13: To continue to improve site-specific planning and protocols for local law enforcement augmenting the protective force during emergency events at the Paducah site, consider:

- Further defining the roles, responsibilities, logistical requirements, and procedures used during an emergency event that requires local law enforcement officers to supplement the USEC protective force
- Expanding the understanding of command and control by defining how USEC integrates local law enforcement officers into the USEC protective force chain of command
- Identifying whether local law enforcement officers will utilize a separate and distinct chain of command and the mechanism for integration with the USEC command and control structure
- Defining the process used to identify and authorize local law enforcement personnel who need time-urgent access through checkpoints and roadblocks during an emergency response

Portsmouth/Paducah Project Office

OFI 18: To improve EMS and MCI response planning, consider:

- Ensuring that the Vanderbilt University Hospital, located in Nashville, Tennessee, agrees to receive and medically treat chemically and radiologically contaminated injured Paducah site personnel at their level 1 trauma center
- Incorporating the Centers for Disease Control and Prevention’s *Guidelines for Field Triage of Injured Patients*, 61(RR01), which serves as the basis for triage protocols to guide initial EMS providers through the decision steps to determine the most appropriate destination facility within the local trauma care system

OFI 19: Consider the need to participate in the development and implementation of mutual assistance agreements with Federal, Commonwealth of Kentucky, and local authorities.

OFI 20: To strengthen the PPPO's ability to perform the critical function of OSC, consider pre-designating the OSC and providing appropriate response planning in the Paducah site emergency plans.

OFI 21: To improve sitewide emergency planning and integration, consider:

- Establishing a single sitewide emergency plan for the Paducah site, with integration of the USEC emergency management program elements into the sitewide program
- Establishing consistency in application of key program elements, including the technical planning basis, training and drills, exercises, response elements, offsite interfaces, communications and notifications, consequence assessment, protective actions, and emergency public information
- Assigning a single program administrator to develop and maintain the emergency plan, develop and update the ERAP, develop and conduct training and exercise programs, coordinate assessment activities, develop related documentation, and coordinate emergency resources

Babcock & Wilcox Conversion Services, LLC

OFI 1: To ensure consistency in the EPHA consequence analyses and improve specific planning for implementing protective actions at the DUF6 facility, consider:

- Conducting consequence analyses for severe NPEs at each of the DUF6 HAZMAT facilities
- Developing event-specific EALs for the severe NPE analyses in the DUF6 facility EPHA
- Including the maximum distance to PAC associated with identified impacted inventories in the DUF6 EALs
- Revising situation-specific EALs to indicate where appropriate initial protective actions (sheltering or evacuation) are implemented

OFI 6: To improve the reliability of the DUF6 standby generator, consider:

- Invoking DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, by contract
- Performing monthly, quarterly, and annual testing of the standby generator and its automatic transfer switches consistent with NFPA-110, *Standard for Emergency and Standby Power Systems*
- Implementing a diesel fuel sampling and analysis program per NFPA-110, *Standard for Emergency and Standby Power Systems*, or a similar industry standard
- Revising operator inspection procedures so operators verify that diesel generator fuel tank levels will provide at least eight hours of generator operations without refueling

Los Alamos Technical Associates-Kentucky, LLC

OFI 3: To improve specific planning for implementing protective actions at the C-746-Q facility, ensure that revisions to the EALs are included in the site-level emergency classification procedure.

Babcock & Wilcox Conversion Services, LLC and Los Alamos Technical Associates-Kentucky, LLC

OFI 4: To ensure the health and safety of facility personnel, consider:

- Documenting the potential consequences of HAZMAT releases from USEC facilities in the LATA-KY and BWCS EPHAs
- Revising facility EAPs to include appropriate protective actions to be taken in the event of a HAZMAT release from a USEC facility

OFI 14: To improve emergency planning for offsite radiological support for McCracken County and the Commonwealth of Kentucky, consider:

- Developing a comprehensive plan for offsite field monitoring that defines an overall monitoring and sampling strategy, including minimum resources (personnel and equipment), command and control, data acquisition protocols, communications, and safety-related guidelines
- Emphasizing that the primary objective for offsite monitoring is to verify the absence of an airborne plume and identify the boundaries of the area contaminated with a HAZMAT deposition (i.e., bound the plume)
- Ensuring that monitoring capabilities include airborne sampling, direct measurement of the radiation dose rate or contamination levels, and sampling with appropriate radiological analysis of air, water, soil, and vegetation
- Developing standard operating procedures for offsite monitoring that include staffing, assignment of responsibilities, control of field teams, and specific sampling and monitoring protocols

OFI 15: To ensure validation of all emergency management program elements over a five-year period and to optimize the usefulness of annual exercises, consider:

- Using a scheduling matrix to assist with long-range planning for future exercises and short-range planning for the current year's exercises
- Ensuring that all response program elements are tested and validated over a five-year period
- Coordinating, via PPPO, the participation of DOE radiological emergency response assets (e.g., NARAC, REAC/TS, and RAP) in the exercise plan, as appropriate

OFI 16: Consider periodic exercise participation with the DOE Headquarters Emergency Management Team to demonstrate an effective capability to provide required event information.

OFI 17: To improve the validation of facility-specific response capabilities, consider:

- Ensuring that EPHA facilities with facility-specific response capabilities conduct evaluated exercises annually
- Reviewing and revising the annual and five-year exercise schedules to ensure that HAZMAT facilities' integrated response with the site organization is evaluated at least once every five years
- Incorporating information on the exercises conducted over the previous five years that specifies the initiating event, facilities, hazards, emergency response program elements, and site-level ERO elements that were included to ensure that all program elements are validated

OFI 22: To improve site-specific planning for technical rescue operations, consider:

- Establishing and documenting, in the BNA, the levels of functional capability, in accordance with NFPA-1670, for technical rescue operations (structural collapse, rope rescue, vehicle and machinery rescue, confined space rescue, and trench excavation search and rescue)
- Establishing the minimum job performance requirements for personnel who provide a specific functional capability

- Documenting, in the BNA, specific functional rescue capabilities relied on through mutual aid agreements
- Providing a summary of technical rescue capabilities in the Paducah site emergency plans

OFI 23: To improve site-specific planning for wildland fire management, consider:

- Establishing and documenting the strategy for initial response to a wildland fire
- Establishing the strategy for management of wildland fires beyond initial response capability
- Documenting, in the BNA, wildland fire-fighting capabilities relied on through mutual aid agreements
- Providing a summary of wildland fire response capabilities in the Paducah site emergency plans

OFI 24: To improve site access by offsite response organizations and enable more than a single evacuation route for the onsite workforce, consider:

- Replacing the jersey barriers across the access roads with properly anchored arresting cable and high security locks, as approved by the security organization
- Developing site evacuation procedures for employees using multiple evacuation routes
- Developing ingress procedures with local response organizations for use during emergency response

OFI 25: To continue to improve site-specific planning for severe NPEs at the Paducah site, consider:

- Planning for response to NPEs that could have a significant and widespread impact on the site and surrounding community emergency response infrastructure
- Integrating NPE response planning with applicable state and Federal catastrophic event plans
- Referencing other appropriate site-specific emergency planning documents as annexes to the emergency plan (e.g., the heightened security conditions response plan and continuity-of-operations plan)
- Including the planning assumptions that severe NPEs overwhelm site and local response capabilities, adversely impact site safeguards and security measures, cause a long-term outage of critical site infrastructure and systems (e.g., power, water, and communications), and cause secondary events such as fires or landslides
- Developing functional (e.g., protective force operations, power and utilities, fire protection, telecommunications, shift operations, and critical facilities/operations) emergency response procedures, matrices, or checklists needed to respond to a severe NPE
- Developing an incident action plan template for a multiagency response at the Paducah site that includes a statement of objectives, NIMS/incident command system organization, tactics and assignments, and supporting materials (e.g., maps, communications plan, medical plan, traffic plan, and special precautions)
- Pre-determining the types of additional resources needed by the site, the availability of those resources, and logistical requirements once the resources arrive at the site
- Triggering self-help response, including the identification of roles and responsibilities, life-saving skills among workers, and locations of medical and life-sustaining supplies currently on site

OFI 26: To continue reinforcing the Paducah site ERO's and offsite responders' skills and capabilities related to severe NPEs, consider:

- Continuing to include severe NPE scenarios in the Paducah site drill and exercise program

- Conducting tabletop exercises with appropriate Federal, state, and local response agencies and organizations that would respond to an event caused by a severe NPE, a manmade disaster, or terrorism
- Updating response plans and procedures to reflect information extrapolated from severe NPE planning workshops, drills and exercises, and lessons learned from past disasters

9.0 UNRESOLVED ITEMS

The protective actions that DOE methodology would deem adequate differ significantly from those contained in the USEC EALs. The ERG guidance referenced by USEC to determine its protective actions and PARs differs from DOE guidance, resulting in significantly different protective actions and recommendations. Determination of which methodology best protects workers, the public, the environment, and national security is an unresolved issue for the DOE Office of Environmental Management, the NNSA Office of Emergency Management, and the NRC.

10.0 ITEMS FOR FOLLOW-UP

As part of its oversight activities, Independent Oversight will follow the closure of the findings identified in Section 7.0 and monitor the disposition of the OFIs, particularly those concerning protective actions, offsite planning, and radiological field monitoring. Because this review encompassed only selected emergency management elements identified in DOE Order 151.1C, future assessments should consider focusing, in part, on other elements of the emergency management program, including readiness assurance, exercises, and termination and recovery. Upon request, Independent Oversight can conduct follow-up to clarify the issues addressed in this report or the adequacy of proposed corrective actions.

Appendix A Supplemental Information

Dates of Review

Scoping Visit:	October 16-18, 2012
Onsite Data Collection Visit 1:	October 29, 2012 – November 1, 2012
Onsite Data Collection Visit 2:	November 12-15, 2012
Validation:	November 15, 2012

Office of Health, Safety and Security Management

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Independent Oversight Reviewers

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Appendix B

Referenced Documents and Interviews

Referenced Documents

- CP-20678, FMT Checklist, Rev. 13, 3/23/12
- CP-20679, EOC Inventory Checklist, Rev. 13, 3/23/12
- CP-21779, Quarterly Communications Operability Status Checklist Rev. 13, 3/23/12
- CP-22223, Fire Services Quarterly Communications Operability Status Checklist, Rev. 13, 3/23/12
- CP2-EP-EP5058, Maintenance of Emergency Facilities and Equipment, Rev. 13, 3/23/12
- Department of Homeland Security, National Response Framework, January 2008
- DOE Guide 151.1-4, Response Elements Emergency Management Guide, 7/11/07
- DOE Guide 420.1-3, Implementation Guide for DOE Fire Protection and Emergency Services Programs, 9/27/07
- DOE Order 151.1C, Comprehensive Emergency Management System, 11/2/05
- DOE Order 420.1B, Facility Safety, 12/22/05
- Emergency Planning and Community Right-to-Know Act of 1986, Title III, Public Law 99-499, no date
- HSS Criteria, Review, and Approach Document 45-51, Emergency Management Program Inspection Criteria, Approach, and Lines of Inquiry, Targeted Review of Site Preparedness for Severe Natural Phenomena Events, Rev. 0, 11/17/11
- NFPA-1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, 2002
- NFPA-1670, Standard on Operations and Training for Technical Search and Rescue Incidents, 2009
- Plan for the Independent Oversight Review of the Site Preparedness for Severe NPEs at the Paducah Gaseous Diffusion Plant, October 2012
- Resource Conservation and Recovery Act 40 CFR 264, Subpart D, Contingency Plan and Emergency Procedures, 1/31/85
- U.S. NRC 10 CFR 76.91, Emergency Planning, no date

Interviews

- BWCS Building Warden
- BWCS DUF6 Conversion Facility Manager
- BWCS DUF6 Plant Electrical System Engineer
- BWCS FUF6 Shift Technical Advisor
- BWCS Fire Protection Engineering Consultant
- BWCS Firewater System Engineer
- BWCS Industrial Hygiene/Environmental Specialist
- BWCS Industrial Hygiene Program Manager
- BWCS Nuclear Safety Manager
- BWCS Safeguards & Security/Emergency Preparedness Manager
- Environmental Management Consolidated Business Center Emergency Management Specialist
- LATA-KY Facility Manager
- LATA-KY Fire Protection
- LATA-KY Radiological Protection Manager/Emergency Programs Manager
- LATA-KY Radiological Protection and Emergency Management Specialist

- LATA-KY Waste Disposition Project Manager
- LATA-KY Waste Disposition Superintendent
- McCracken County Emergency Management Director
- PPPO Facility Representative
- PPPO Fire Protection Authority having Jurisdiction
- PPPO Infrastructure Engineer
- SST Senior Procurement Specialist
- State of Kentucky Regional Emergency Management Director
- USEC Electrical Design Engineer
- USEC Emergency Management Specialists
- USEC Fire Chief
- USEC Fire Fighter EMTs
- USEC Fire Major
- USEC Health Physics Sampling Section Supervisor
- USEC HVAC System Engineer
- USEC Manager of Materials Management
- USEC Mechanical Design Engineer
- USEC Plant Shift Superintendents
- USEC Power Coordinator
- USEC Protective Force Chief
- USEC Security Manager
- USEC Supervisor of Fire Services and Electricians
- USEC Telecomm Analyst