

Independent Oversight Review of the Consequence Assessment Program at the Los Alamos National Laboratory



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**Office of Safety and Emergency Management Evaluations
Office of Enforcement and Oversight
Office of Health, Safety and Security
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Acronyms

ALOHA	Areal Locations of Hazardous Atmospheres
DEM	Duty Emergency Manager
DOE	U.S. Department of Energy
EAL	Emergency Action Level
ED	Emergency Director
EOC	Emergency Operations Center
EOD	Emergency Operations Division
EPA	Environmental Protection Agency
EPHA	Emergency Planning Hazards Assessment
EPICode	Emergency Prediction Information Code
EPIP	Emergency Planning Implementing Procedure
EPP	Emergency Planning and Preparedness
EPZ	Emergency Planning Zone
ERO	Emergency Response Organization
ETSC	Emergency Technical Support Center
FMT	Field Monitoring Team
FY	Fiscal Year
HAZMAT	Hazardous Material
IC	Incident Commander
IH	Industrial Hygiene
LANL	Los Alamos National Laboratory
LASO	Los Alamos Site Office
MIDAS	Meteorological Information and Dose Assessment System
NARAC	National Atmospheric Release Advisory Center
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
PAG	Protective Action Guide
TIA	Timely Initial Assessment

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1.0 PURPOSE

The Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security, conducted an independent review of the Los Alamos National Laboratory (LANL) emergency management consequence assessment program. The purpose of the review was to measure LANL's compliance against U.S. Department of Energy (DOE) orders and LANL institutional requirements. The review scope was coordinated with the Los Alamos Site Office (LASO), and the review was conducted February 7-9, 2012.

2.0 SCOPE

The scope of this review included the procedures, tools, and associated documentation that LANL uses to establish and maintain an emergency management consequence assessment program consistent with the requirements of DOE Order 151.1C, *Comprehensive Emergency Management System*. Independent Oversight evaluated the site against the following six objectives drawn from DOE O 151.1C:

- 1) Estimates of onsite and offsite consequences of actual or potential releases of hazardous materials are computed and assessed correctly and in a timely manner throughout the emergency.
- 2) Provisions are established to adequately assess the potential or actual onsite and offsite consequences of an emergency.
- 3) Consequence assessments are integrated with emergency event classification and protective action decision-making.
- 4) Consequence assessments incorporate monitoring of specific indicators and field measurements.
- 5) Consequence assessments are coordinated with Federal, state, local, and tribal organizations.
- 6) The National Atmospheric Release Advisory Center (NARAC) capability is used as the primary source of consequence assessment information, the backup to a primary source of consequence assessment, the primary source for consequence assessment at distances beyond the scope of local consequence assessment capability, or as a source for corroborating or confirming consequence assessment information.

Independent Oversight used the criteria and lines of inquiry shown in Appendix C, Review Plan, to determine whether objectives were met. The lines of inquiry were developed using the requirements contained in DOE Order 151.1C and the associated DOE emergency management guides. Independent Oversight's review was accomplished by examining the documentation that establishes and governs the LANL emergency management consequence assessment program processes, including procedures, checklists, work aids, and emergency planning hazards assessments (EPHAs); reviewing the plume projection software; reviewing after-action reports and emergency operations center (EOC) logs from a recent actual event and functional exercises; and interviewing key personnel.

3.0 BACKGROUND

DOE Order 151.1C identifies the functional emergency response requirements for a DOE/National Nuclear Security Administration (NNSA) site, and the emergency management guides associated with DOE Order 151.1C provide guidance for implementing the requirements. The order requires that

estimates of onsite and offsite consequences of an actual or potential release of hazardous materials be correctly calculated and assessed in a timely manner throughout the emergency. The order also requires that consequence assessments conducted during emergency events be integrated with event classification and protective action decision-making functions, incorporate facility and field indications and measurements, and be effectively coordinated with offsite agencies. Therefore, the capabilities and processes of the LANL consequence assessment program were reviewed to determine whether the program meets the time-urgent and accurate consequence estimate needs of emergency response during emergency events.

DOE Emergency Management Guide 151.1-4, *Response Elements*, provides recommendations for establishing and maintaining a consequence assessment process that meets DOE order requirements. The guidance identifies three phases of the consequence assessment process:

- 1) Initial event recognition, categorization/classification, and initial protective actions
- 2) Timely initial assessment (TIA)
- 3) Continuous ongoing assessment

The first phase supports extremely important and time-urgent decisions for initial event classification and protective action determinations. Event parameters and symptoms are recognized through direct observation of event indicators (e.g., fire in a building or puncturing of a 55-gallon drum) and/or the monitoring of specific indicators, such as those that detect the consequences of the event (e.g., radiation monitors, temperature and pressure gauges). Comparison of the observed indicators leads to the selection of the applicable emergency action level (EAL).

The purpose of the TIA phase is to provide a rapid confirmation of the initial event classification and protective action decisions. In the first minutes of a response, actions are taken to use available real-time information to improve the quantitative understanding of potential impacts. The TIA yields a rapid, event-specific estimate of the potential consequences based on known event conditions and current meteorological conditions. Since the TIA occurs at a time when decision support is time-urgent, information is typically limited and consequence assessment resources are minimal, uncertainties in the projections will usually be substantial. However, TIA estimates of the consequences should provide sufficient accuracy and bounding conservatism to confirm that initial decisions sufficiently protect workers and the public.

The purpose of continuous ongoing assessment is to project updated consequences as the emergency progresses and as the event characterization information improves in both quantity and quality. This phase begins when the TIA is complete and builds as additional information and technical and human resources become available. Increasing levels of sophistication in analysis tools, improved accuracy of input data (e.g., source term, meteorology), technical expertise, and eventually feedback from field monitoring efforts allow refined projections that are more reliable and realistic than the EAL-based assessments and the TIA results.

4.0 RESULTS

Objective 1: Estimates of onsite and offsite consequences of actual or potential releases of hazardous materials are computed and assessed correctly and in a timely manner throughout the emergency.

Independent Oversight reviewed the LANL emergency planning implementing procedures (EPIPs) for consequence assessment, categorization and classification, protective actions/protective action

recommendations, and development of EALs. The consequence assessment checklists and dispersion modeling software programs were reviewed to ensure that the site has established and maintained a consequence assessment program that has overall responsibility for initial and ongoing emergency response and provides timely and useful information to emergency response decision-makers. Further, a random sampling of EOC logs and after-action reports for a recent event and functional exercises conducted in fiscal years (FYs) 2010 and 2011 were reviewed to determine whether consequence estimates were assessed correctly and whether any concerns were identified with actions taken by the Emergency Technical Support Center (ETSC) staff.

The LANL consequence assessment process ensures that timely and useful information is provided to assist emergency response decision-makers in making informed decisions to protect the site workers, the public, and emergency responders. Consequence assessment activities occur at the LANL EOC ETSC. ETSC staff offices are located within the EOC building and, during normal working hours, consequence assessment activities begin as soon as release information becomes available to the EOC Radio Room personnel. The *ETSC Staff EPIP* (ERO-EPIP-125) provides detailed instructional steps for conducting consequence assessment activities and notes that the decision and response time of the TIA must be short (defined as minutes to an hour after event initiation) with respect to the time needed for implementing protective actions. The EPIP also provides a TIA step-by-step outline, indicated below, to evaluate the onsite and offsite consequences:

- Review facility-specific EALs for their application to the emergency event.
- Quantify radiological dose and/or chemical concentration versus distance and determine the distance to the appropriate protective action guide (PAG). The chemical PAGs are determined using, in the order of preference, Acute Exposure Guideline Levels promulgated by the Environmental Protection Agency (EPA); Emergency Response Planning Guidelines published by the American Industrial Hygiene Association and found in the ETSC library; and Temporary Emergency Exposure Limits developed by DOE, also found in the ETSC library.
- Provide the LANL incident commander (IC), the emergency director (ED), or the primary facilitator event-specific protective actions and protective action recommendations for responders, laboratory personnel, and the public to ensure that exposures are kept to a minimum.
- Evaluate the feasibility of sheltering in place or evacuating personnel from the emergency area and downwind locations and, if required, provide time estimates for evacuation of personnel and evacuation routes based on the plume projections.
- Review the initial categorization and classification (if applicable) and make recommendations for upgrades, as necessary.
- Provide a technical evaluation of the event and provide the ED information on plume projections, emergency zones, and weather predictions.

In conjunction with the *ETSC Staff EPIP*, the *ETSC Staff Checklist* (EM-FORM-061) contains procedural steps to ensure that TIAs are conducted. The checklist directs the ETSC staff to confirm initial classification and protective actions taken by the IC and conduct a TIA using source term data from the EPHAs or actual data from the release location and real-time meteorology.

To ensure that TIAs are conducted during off-normal hours, the LANL Emergency Planning and Preparedness (EPP) group has developed an *ETSC On-Call EPIP* (EPP-EPIP-127). This EPIP ensures that a staffing schedule is established for ETSC coordinators to support off-normal hour emergency activities and/or EOC activations. EPP personnel have also developed a TIA binder that provides pre-calculated dose data for hazardous material releases for worst-case and average meteorological conditions at varying distances and offsite critical receptors. Additionally, the LANL duty emergency manager (DEM) provides on-call, 24-hour coverage for emergency response. The DEM classifies the incident as

soon as possible, using all the available information (e.g., meteorological conditions, EALs, TIA binder), and issues the proper notifications. The DEMs are trained on the use of the TIA binder and EALs, and have provided input to the development of the EALs, in order to determine the level of severity of an emergency event. Each EAL contains recommended event classification and protective actions to be implemented by the DEM.

The EALs form the basis for notification, participation of offsite organizations, and determination of what and when protective measures should be implemented. EALs, contained in *Protective Action Guides EPIP* (EPP-EPIP-215), have been developed for all potential operational emergencies identified in the facility-specific EPHAs; generic laboratory EALs have also been developed. EAL information is available on the EOC server and is downloaded by the DEMs to their laptops. Controlled hardcopies of the *Protective Action Guides EPIP* are also issued to the DEMs through the document control process.

To ensure that estimates of consequences are assessed throughout an emergency event and/or functional exercise, the *ETSC Staff EPIP* and the *ETSC Coordinator EPIP* (ERO-EPIP-120) delineate the process for conducting periodic and continuous assessments. The *ETSC Staff EPIP* requires the ETSC staff to:

- Continually review event information and recommend upgrade or termination of the event, as appropriate, when there are changes in conditions or in the situation that may warrant different levels of response or concern.
- Compare field monitoring results, as they become available, to the modeled dose projections, and evaluate all of the “best guess” or conservative dose projections with field data.
- Modify the source term as necessary based on field monitoring results, and re-run appropriate model(s) to obtain corrected plume and dose projections.
- Use NARAC to refine the source term using field measurements.
- Provide the *ETSC Dose Projection Form* (EOC-FORM-057) for each periodic assessment to both the IC and ED.
- Continually monitor the status of protective actions implemented for emergency responders/workers and laboratory personnel and protective action recommendations issued for the public, and recommend additional measures as necessary.
- Determine and monitor the status of physical, administrative, and configuration barriers between the source and the outside environment.
- Coordinate initial and periodic consequence assessment results with the Hazardous Material (HAZMAT) Group Supervisor, the IC, the ED, and the ETSC Coordinator, as appropriate.
- Develop a field monitoring plan with the assistance of the HAZMAT Group Supervisor.

The *ETSC Coordinator EPIP* requires the coordinator to ensure the completion and accuracy of the above-mentioned tasks throughout the emergency and/or functional exercise. Additionally, the ETSC staff checklist contains the same information to ensure that these tasks are performed.

A record of the events during an emergency response at LANL is captured through the Radio Room logger and through completion of EOC logs for all EOC emergency responders. The Radio Room logger documents the information relayed to the EOC from the field. These activities are documented in the *Radio Room Console Operator EPIP* (ERO-EPIP-155), which requires completion of the *EOC Log Form* (EOC-FORM-001). Additionally, the *Radio Room Coordinator EPIP* (ERO-EPIP-150) requires the coordinator to ensure pertinent communications from the field are logged, while coordinating the information exchange between the field; ETSC; EOC operations, planning, and logistics section chiefs; and EOC facilitators.

The *EOC Operations EPIP* (EM-EPIP-205) requires EOC logs to be signed, dated, and delivered to each section chief after termination of EOC activation. The completed EOC logs are gathered at the end of an emergency and/or functional exercise and are retained by LANL administrative/finance personnel. Independent Oversight reviewed a random sample of ETSC logs, as well as after-action reports and functional exercises, for the past two years' real events and functional exercises and determined that the ETSC staff has adequately performed the assigned tasks in a timely manner.

Overall, the LANL ETSC Staff and Coordinator EIPs and information in the ETSC logs and after-action reports indicate that the ETSC staff adequately assesses onsite and offsite consequences of actual or potential releases of hazardous materials, both initially and continuously throughout real emergency events and functional exercises.

Objective 2: Provisions are established to adequately assess the potential or actual onsite and offsite consequences of an emergency.

Independent Oversight reviewed the LANL EIPs for consequence assessment and development of the EPHAs. The EPHAs for the Sigma Complex, Technical Area-55, the Chemical and Metallurgy Research Facility, and the Beryllium Technology Facility were reviewed to determine the accuracy and adequacy of analyses used to provide default source term information. Additionally, the consequence assessment dispersion modeling software programs were reviewed to ensure their adequacy in assessing hazardous material releases.

The LANL EPP group has developed a comprehensive EPIP for developing the EPHAs that identifies the requirements and expectations of DOE Order 151.1C and the associated DOE emergency management guide. The EPP group has also incorporated an effective hazardous material identification and screening process that is based on a thorough identification of the hazardous materials present in the facilities, which in turn relies to a great extent on an accurate site inventory of hazardous materials and appropriate screening thresholds. Independent Oversight reviewed the EPHAs identified above and found that they comprehensively address site events and hazards, consistently develop hazardous material source terms, appropriately analyze the hazardous materials, and adequately support development of EALs. Further, the EPHAs provide for recognition and notification of protective actions (onsite) and protective action recommendations (offsite) associated with identified hazardous material releases.

During emergency events and/or functional exercises, the ETSC staff conducts initial consequence analyses using the source term data from the relevant EPHA to assess the potential or actual onsite and offsite consequences. ETSC staff members modify the source term when field measurements or actual data from the release location are obtained and re-run the appropriate model(s) to provide more accurate plume and dose projections.

Plume projection modeling is accomplished using the Areal Locations of Hazardous Atmospheres (ALOHA) or Emergency Prediction Information Code (EPICode) dispersion modeling software programs for chemical releases and the HotSpot Health Physics Code dispersion modeling software program for radiological releases. The ETSC staff conducts ongoing consequence analyses for both chemical and radiological releases using the NARAC dispersion modeling software program and the Meteorological Information and Dose Assessment System (MIDAS) modeling software. Additional software and programs are also available to the ETSC staff. The staff has the software capability to analyze fire and explosive effects; obtain real-time meteorological data using the geographic information system, meteorological monitoring stations, and the LANL Weather Machine website; and obtain real-time lightning tracking using a lightning detection system stationed in Technical Area-15 or from the National Weather Service website.

Overall, the ETSC staff can quickly determine source term data contained in the EPHAs and can adequately analyze the potential or actual onsite and offsite consequences using a variety of plume projection modeling software, as well as additional software and programs, to ensure that the analyses of hazardous material releases are adequately conducted.

Objective 3: Consequence assessments are integrated with emergency event classification and protective action decision-making.

Independent Oversight reviewed the LANL EIPs for consequence assessment; categorization and classification; protective actions/protective action recommendations; and development of EALs. A random sampling of after-action reports for exercises conducted in FYs 2010 and 2011 were also reviewed to determine whether they identified any concerns about actions taken by the ETSC personnel.

To ensure accurate and timely event categorization/classification, EALs have been developed to aid in the recognition and event categorization/classification process and to provide predetermined protective actions for onsite and offsite populations. The DEM or IC categorizes and classifies emergency events and provides protective action determinations using the information contained in the EALs.

The *ETSC Staff EPIP* includes steps for validating initial classification and protective action decision-making and evaluating both categorization and classification of events and protective action decision-making determinations made by the DEM or IC. The ETSC staff is required to identify the accident scenario in the facility-specific and generic EAL table that best matches the emergency event, determine the classification and protective actions, and compare the determinations with those already made. Any discrepancies must be discussed with the IC and resolved. The ETSC staff is also required to periodically review the emergency classification to ensure that it remains commensurate with response activities. Additionally, the ETSC staff continually evaluates the protective actions and provides input to the IC if emergency conditions change.

Independent Oversight conducted a random review of the ETSC logs for the past two years' real events and functional exercises and identified that ETSC staff or the ETSC coordinator confers with the IC on the initial classification and protective action determinations. Additionally, the ETSC coordinator presents each plume projection plot to the IC and ED and discusses whether the classification and/or protective actions and protective action recommendations have been recorded on the EOC logs. Additionally, Independent Oversight reviewed a random sample of after-action reports for a real event and functional exercises and determined that the ETSC staff has adequately performed the assigned tasks in a timely manner.

Overall, EALs have been developed that aid in classification determinations and provide predetermined protective actions for onsite and offsite populations. The ETSC staff confirms initial classifications and protective action decision-making conducted by the DEM or IC and resolves any identified discrepancies. The ETSC staff also conducts evaluations of protective actions throughout an emergency and confers with the IC on necessary changes or recommendations.

Objective 4: Consequence assessments incorporate monitoring of specific indicators and field measurements.

Independent Oversight reviewed the LANL EIPs for consequence assessment and consequence assessment checklists to ensure that consequence assessments make use of field monitoring capabilities and measurements. Independent Oversight also reviewed documentation from the Las Conchas wildfire event and a random sampling of ETSC logs and after-action reports for functional exercises conducted in FYs 2010 and 2011.

LANL has established a field monitoring team (FMT) for radiological and chemical releases in accordance with an FY 2009 performance based incentive. The functional exercise after-action reports for FYs 2010 and 2011 indicate that the radiological FMT capabilities have been tested in exercises. During exercises, the FMT provided radiological ground deposition readings and contamination readings for locations around the outer edge of developed plume projection plots and provided the measurements to the ETSC staff. The ETSC staff used the measurements to verify, update, and refine the source term and develop new plume projection plots using NARAC.

An exercise to test the industrial hygiene (IH) capabilities has not been conducted to date; however, the FMT conducts monthly drills to ensure that IH capabilities will be provided, if necessary. During the Las Conchas wildfire event, the FMT provided environmental data using high-volume air samplers. The data from the air samplers indicated that no releases had occurred, and no coordination with the ETSC staff was required. Further, the FMT has the air sampling equipment needed to provide chemical release readings from an IH event that may occur at facilities around the site.

The *ETSC Staff EPIP* requires the staff to coordinate with the emergency management team if additional DOE radiological assets (e.g., Radiological Assistance Program, Aerial Measuring System, Atmospheric Release Advisory Capability, etc.) and additional EPA assets (e.g., Airborne Spectral Photometric Environmental Collection Technology) may need to be deployed. During the 2011 Los Conchas wildfire event, the DOE/NNSA regional Radiological Assistance Program assets were deployed to conduct radiological monitoring, and the EPA Airborne Spectral Photometric Environmental Collection Technology aircraft was deployed to conduct overflights of affected areas to look for possible contaminant releases.

Overall, LANL's FMT has successfully obtained and provided the ETSC staff with radiological field monitoring measurements, which were then incorporated into the consequence assessment activities to refine the source term and obtain real-time plume projection plots. The FMT also successfully obtained IH field monitoring measurements during the Las Conchas wildfire event. Additionally, LANL has demonstrated the ability to deploy available DOE/NNSA and EPA assets.

Objective 5: Consequence assessments are coordinated with Federal, state, local, and tribal organizations.

Independent Oversight reviewed a random sampling of EOC logs and after-action reports for real events and functional exercises conducted in FYs 2010 and 2011 to determine whether consequence assessments are coordinated with offsite organizations. Independent Oversight also interviewed the LANL EPP group lead and the LASO emergency management program manager.

The LANL Emergency Operations Division (EOD) has worked to provide an EOC that includes decision-makers from Los Alamos County, LANL, and LASO. LANL expects other offsite emergency management decision-makers to either muster at the EOC or be in ready telephone contact for relaying hazardous material release information, including status, protective action recommendations, and recent analysis details. The LANL EOD is continually working to include local, state and tribal jurisdictions (e.g. San Ildefonso Pueblo) and Federal agencies, but some of the entities do not want to participate at this time.

Independent Oversight's review of a random sample of EOC logs and after-action reports for a real event and functional exercises identified that all mandatory and appropriate offsite notifications were made to Federal, state, local, and tribal agencies. ETSC staff provided adequate background information regarding plume projection models to decision-makers during these events. However, not all offsite

agencies have participated in these events, and many have not received information regarding the modeling and its limitations. To ensure that all offsite agencies are informed of consequence assessment activities, EPP personnel attend the Local Emergency Planning Committee meetings to present EPHA consequence assessment analysis results and protective action recommendations, including the corresponding assumptions and limitations. Additionally, if an EPHA is revised so as to change the analysis results and protective action recommendations, these changes are presented to the committee members as they are approved by LASO.

Overall, appropriate notifications are made to offsite entities. To ensure that all offsite agencies are informed of consequence assessment activities, EPP personnel present the consequence assessment analysis results and protective action recommendations contained in the EPHAs during Local Emergency Planning Committee meetings. LANL EOD is working to include Federal, state, local, and tribal organizations, but some agencies do not want to participate.

Objective 6: The NARAC capability is used as the primary source of consequence assessment information, the backup to a primary source of consequence assessment, the primary source for consequence assessment at distances beyond the scope of local consequence assessment capability, or as a source for corroborating or confirming consequence assessment information.

Independent Oversight reviewed the LANL EPIPs for consequence assessment, consequence assessment checklists, work aids, and dispersion modeling software programs to ensure that the NARAC capability is available to and used by the ETSC staff. Independent Oversight also reviewed a random sample of ETSC logs and after-action reports for real events and functional exercises conducted in FYs 2010 and 2011 to determine whether NARAC has been used and whether any concerns were identified.

The *ETSC Staff EPIP* requires the staff to use the NARAC computer model as soon as possible after a hazardous material release. The *ETSC Coordinator EPIP* requires the coordinator to ensure that the ETSC staff uses the NARAC modeling procedure to evaluate projected exposures for emergency responders, laboratory personnel, and the general public. The ETSC staff checklist also requires the staff to use NARAC to check modeling results and to refine the source term when field monitoring measurements are provided.

ETSC staff members have received training on modeling hazardous material releases using NARAC. Work aids are available to ensure that they select the appropriate modeling parameters when inputting data into NARAC. Independent Oversight's review of a random sample of real event documentation and functional exercise packages for the past two years found that NARAC had been used and that accurate output plume projections had been developed. Depending on the availability of ETSC staff at the beginning of an event, NARAC may be used as the primary source for timely initial consequence assessment, but it is generally used as the backup to HotSpot for radiological releases and EPICode and ALOHA for chemical releases. However, continuous, ongoing consequence assessments are conducted using NARAC as the primary source.

Overall, the ETSC staff uses NARAC and has developed accurate plume projections during emergency events and/or functional exercises. NARAC is generally used as the backup for TIA, but it is the primary source for ongoing consequence assessments.

5.0 CONCLUSIONS

LANL's consequence assessment process ensures that estimates of onsite and offsite consequences of hazardous materials are analyzed and adequately assessed in a timely manner throughout an emergency

event and/or functional exercise. The consequence assessments assist emergency response decision-makers in making informed decisions to protect the site workers, the public, and emergency responders. The LANL EPP group has developed comprehensive EPHAs that address site events and hazards, adequately support development of EALs, and provide for recognition and notification of protective actions (onsite) and protective action recommendations (offsite) associated with identified hazardous material releases. The LANL ETSC staff uses the data from the EPHAs and EALs to quickly determine source terms and adequately analyze the potential or actual onsite and offsite consequences using a variety of plume projection modeling software. Appropriate plume projection modeling software and additional software and programs are used to perform analyses of hazardous material releases. The EALs aid the LANL DEM or IC in making classification determinations and providing protective actions for onsite and offsite populations. LANL has established an FMT that has successfully obtained radiological and IH field monitoring measurements, and provided relevant measurements to the ETSC staff. LANL has demonstrated the ability to deploy available DOE/NNSA and EPA assets to obtain field measurements. LANL has also ensured that offsite notifications are made to Federal, state, local, and tribal organizations and that consequence assessments are coordinated with offsite entities. The NARAC capability is appropriately used as the backup modeling source for TIA and as the primary modeling source for ongoing consequence assessments.

6.0 OPPORTUNITIES FOR IMPROVEMENT

Independent Oversight did not identify any opportunities for improvement.

7.0 ITEMS FOR FOLLOW-UP

Independent Oversight did not identify any items for follow-up.

Appendix A

Supplemental Information

Dates of Review

Onsite Data Collection: February 7-9, 2012

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
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Appendix B

Documents Reviewed and Interviews

Documents Reviewed

- DOE Guide 151.1-4, Response Elements, 7/11/07
- DOE Order 151.1C, Comprehensive Emergency Management System, 11/2/05
- EM-AAR-165, June 27, 2011 Fire on Los Alamos National Laboratory (LANL) Property Resulting from the Las Conchas Wildfire Emergency Report, Rev. 0, 9/11
- EM-EPIP-205, Emergency Operations Center Operations, Rev. 1.1, 11/23/10
- EM-FORM-061, ETSC Staff Checklist, Rev. 0.1, 1/10
- EOC-FORM-001, EOC Log Form, Rev. 0
- EOC-FORM-057, ETSC Dose Projection Forms, Rev. 0.1, 1/10
- EPP-AAR-089, February 24, 2010 Los Alamos National Laboratory No-Notice Exercise After Action Report
- EPP-AAR-099, May 12, 2010 Chemistry & Metallurgy Research (CMR) Drill After Action Report, Rev. 0, 5/24/10
- EPP-AAR-105, August 31, 2010 Los Alamos National Laboratory Full-Scale, Full Participation Exercise After Action Report, Rev. 1, 10/12/10
- EPP-AAR-112, July 27, 2010 Sigma Complex Loss of Power (LOP) Tabletop After Action Report, Rev. 0, 9/27/10
- EPP-EPHA-120, Emergency Planning Hazards Assessment for the Sigma Facility (TA-03-0066), Rev. 0, 3/31/09
- EPP-EPHA-145, Emergency Planning Hazards Assessment for Technical Area (TA) 55, Rev. 1, 5/15/09
- EPP-EPHA-150, Emergency Planning Hazards Assessment for Beryllium Technology Facility (BTF), Rev. 1.1, 8/15/10
- EPP-EPHA-180, Emergency Planning Hazards Assessment for the Chemistry and Metallurgical Research Facility Technical Area (TA)-03, Building 0029, Rev. 0, 9/29/11
- EPP-EPIP-127, ETSC On-Call Procedure, Rev. 0, 8/31/10
- EPP-EPIP-215, Protective Action Guides, Rev. 6, Draft
- ERO-EPIP-100, LANL Incident Commander, Rev. 1, 3/31/11
- ERO-EPIP-120, ETSC Coordinator, Rev. 0.3, 3/28/11
- ERO-EPIP-125, ETSC Staff, Rev. 0.3, 3/28/11
- ERO-EPIP-155, Radio Console Operator, Rev. 0.4, 12/21/11
- ERO-EPIP-150, Radio Room Coordinator, Rev. 1, 12/21/11

Interviews

- LANL Emergency Operations Division Leader
- LANL Emergency Operations Division, Emergency Management Group Leader
- LANL Emergency Operations Division, Emergency Manager Duty Officer
- LANL Emergency Operations Division, Emergency Planning and Preparedness Group Leader
- LANL Emergency Operations Division, Exercise Coordinator
- LANL Field Monitoring Team Coordinator
- LASO Emergency Management Program Manager

Appendix C

Review Plan

Los Alamos National Laboratory Consequence Assessment Program

SCOPE

The scope of this review includes an evaluation of the procedures, processes, tools, and associated documentation used by the Los Alamos National Laboratory (LANL) to establish and maintain their emergency management consequence assessment program. This includes emergency plan implementing procedures, response checklists, plume projection modeling software programs, and exercises associated with the LANL consequence assessment program, as defined by the Los Alamos Site Office (LASO) and the LANL emergency plans. Additionally, after-action reports for a random selection of real events and functional exercises will be reviewed. The Office of Safety and Emergency Management Evaluations will perform this assessment in accordance with DOE Order 226.1B, *Implementation of DOE Oversight Policy* using criteria derived from the functional requirements of DOE Order 151.1C, *Comprehensive Emergency Management System*. The Office of Safety and Emergency Management Evaluations will use the criteria and lines of inquiry contained herein to determine whether the objectives are met. The lines of inquiry were developed using the requirements contained in DOE Order 151.1C and the associated DOE emergency management guides.

OBJECTIVES

- Verify that the LANL consequence assessment team provides estimates of onsite and offsite consequences of actual or potential releases of hazardous materials.
- Verify that estimated consequences are correctly computed and assessed in a timely manner throughout an emergency or during exercises.
- Verify that consequence assessment activities are integrated with classification and protective action decisions, incorporate facility and field indications and measurements, and are coordinated with offsite agencies.
- Verify that procedures and processes, tools, and associated documentation ensure that a consequence assessment program has been developed, approved by LASO, and adequately implemented.

CRITERIA

1. Estimates of onsite and offsite consequences of actual or potential releases of hazardous materials are computed and assessed correctly and in a timely manner throughout the emergency.
2. Provisions are established to adequately assess the potential or actual onsite and offsite consequences of an emergency.
3. Consequence assessments are integrated with emergency event classification and protective action decision-making.
4. Consequence assessments incorporate monitoring of specific indicators and field measurements.
5. Consequence assessments are coordinated with Federal, state, local, and tribal organizations.
6. The National Atmospheric Release Advisory Center (NARAC) capability is used as the primary source of consequence assessment information, the backup to a primary source of consequence assessment, the primary source for consequence assessment at distances beyond the scope of local consequence assessment capability, or as a source for corroborating or confirming consequence assessment information.

REFERENCES

- DOE Order 226.1B, Implementation of DOE Oversight Policy, 4/25/11
- DOE Order 151.1C, Comprehensive Emergency Management System, 11/2/05
- DOE Guide 151.1-1, Vol. 4, Response Elements, 11/1/06

APPROACH

Documents Reviews

- Review the LANL EOC ETSC implementation procedure(s).
- Review consequence assessment processes.
- Review consequence assessment tools (e.g., dispersion modeling software, meteorological monitoring software, checklists, and work aids).
- Review a sampling of LANL EPHAs.
- Review a sampling of functional exercise after-action reports developed over the past two years.
- Review real event after-action reports, if developed, over the past two years.
- Review the formal document control system implemented during exercises and/or emergencies to record, sequence, validate, and track the flow and chronology of information.
- Review the LANL consequence assessment self-assessment reports developed over the past three years.
- Review the most recent LASO assessment report conducted for consequence assessment.

Interviews

As appropriate, interview:

- LANL personnel responsible for developing, reviewing, and maintaining these documents
- LASO and LANL managers who review and/or approve the EOC ETSC implementing procedure(s)
- LANL ETSC personnel responsible for conducting consequence assessment activities during an emergency

Lines of Inquiry

- Has LANL established and maintained a consequence assessment program with overall responsibility for initial and ongoing consequence mitigation and determination, for each facility/site?
- Do the LANL EOC Emergency Technical Support Center (ETSC) implementation procedure(s) adequately describe required consequence assessment functions and activities?
- Are consequence assessment processes integrated with processes for categorizing an event as an emergency, determining the appropriate emergency classification, making protective actions and protective action recommendations, and locating and recovering hazardous materials?
- Are consequence assessment tools (e.g., dispersion modeling software, meteorological monitoring software, checklists, and work aids) available, reliable, calibrated, and consistent with DOE/NNSA and industry standards?
- Has a formal quality assurance program been implemented and maintained for control of the consequence assessment tools?
- Do the EPHAs appropriately identify source term information (e.g., release fractions and damage ratios)?

- Do the EPHAs identify receptors of interest, including receptor locations at the facility and site boundaries, the emergency planning zone (EPZ) boundary, schools, daycares, and populations with special needs?
- Do the EPHAs provide plume travel times to the receptors of interest?
- Are natural phenomena events identified and analyzed in the EPHAs to identify the potential consequences from unplanned releases of (or loss of control over) hazardous materials?
- Do the analyses contained in EPHAs provide worst-case onsite and offsite consequences of potential releases of hazardous materials?
- Have consequence estimates been accomplished in a timely and efficient manner throughout an exercise or emergency to adequately assess the actual or potential onsite and offsite consequences?
- Are provisions in place to request support from the DOE/NNSA radiological emergency response assets to assist in consequence assessments?
- Are provisions in place to estimate the integrated impact of a hazardous material release to onsite and offsite populations within the EPZ?
- Have natural phenomena events that may result in, or exacerbate, an emergency condition at the site been considered?
- Do ETSC personnel have the ability to monitor natural phenomena events? If yes, how?
- Is a formal document control system implemented during an exercise or emergency to record, sequence, validate, and track the flow and chronology of information?
- Have timely initial assessments of consequences been made in a timely and effective manner?
- If conducted, did the timely initial assessments result in a more event-specific description of the consequences than was provided by the initial default estimate?
- Are in-depth assessments of event consequences continuously made throughout an exercise or emergency?
- Are provisions in place for continuous monitoring of critical consequence parameters?
- Are consequence assessments updated when there are actual or projected changes in facility status, release conditions, or meteorology?
- Are different models, assumptions, and data used to add to the understanding of the event and its consequences?
- Are the necessary indicators (e.g., system pressures, flow rates, radiation levels, and release rates) identified and monitored to continually assess the consequences of the events/conditions?
- Is the type of hazard and source term for the release of a hazardous material successfully determined, either based on available and reliable facility system parameters and effluent monitors or without normally monitored and measured data?
- Are source term estimates available from reliable sources (e.g., stack or process flow rates, tank volumes, containment or process building leak rates)?
- Is the methodology for determining the type of hazard and source term compatible with instrumentation/monitor values (e.g., engineering units, range, and conversion factors)?
- Do chemical detection instruments have sufficient range to accurately determine the concentration of the released material(s) in air versus the Acute Exposure Guideline Levels (AEGs), Emergency Response Planning Guidelines, or Temporary Emergency Exposure Limits (TEELs)?
- Are indicators that are not continually monitored (e.g., contamination levels) sampled to identify particular indicators to be continually monitored to assess the consequences of potential events, in addition to occurring events, by identifying trends, relationships, etc., that would indicate degrading conditions?
- Is adequate meteorological information obtained for use in transport and dispersion modeling and/or calculations to project the consequences of the release to the environment on site and off site, and to the population within the EPZ?

- Are provisions in place to acquire and evaluate short- and long-term meteorological information to support characterization of atmospheric diffusion and transport conditions and the consequences of a hazardous material release?
- Are onsite and offsite receptors of interest identified quickly and made readily available to emergency managers?
- Are consequence estimates for actual or potential releases of hazardous materials made accurately and in a timely manner?
- Do consequence estimates reflect appropriate receptors, exposure pathways, and release characteristics?
- Have exercises of consequence assessment projection capabilities included ground-level and elevated release points, monitored and unmonitored pathways, post-accident analysis results, and/or field monitoring team data, as appropriate?
- Does the consequence assessment capability perform calculations of radiological dose or chemical exposure projections for the external, inhalation, and ingestion pathways, as appropriate?
- Do consequence assessment capabilities provide release estimates for identified receptors of interest?
- Are appropriate facility-specific protective action criteria identified and readily available for estimating health effects at specified distances from the event?
- Are field sampling and monitoring activities used to verify, update, and refine the source term and projected release consequences?
- Do the field teams (radiological and non-radiological) successfully accomplish field monitoring and plume tracking within and beyond the EPZ, and, similarly, verify the absence of contamination in specific areas?
- As available, is data from environmental monitoring programs used to support consequence assessment, including data from area and radiation monitors and in-plant surveys for assessment under accident conditions?
- Is effective coordination established with Federal, state, tribal, and local organizations to estimate the impact of the release on the public and the environment, locate and track hazardous material released, and locate and recover materials, especially those with national security implications?
- Are field monitoring and data collection by facility and site teams and state, local, and Federal teams coordinated to facilitate information exchange and to correlate information?
- Are consequence assessments and analyses clearly communicated to offsite emergency management decision-makers?
- Are engineering units used in the consequence assessments understood and compatible with the units used by offsite emergency response authorities?
- Are differences in modeling methods understood by onsite and offsite emergency response personnel?