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Inspection of  
Emergency Management  
at the

Livermore Site Office  
and  
Lawrence Livermore  
National Laboratory

June 2005



Office of Independent Oversight and Performance Assurance  
Office of Security and Safety Performance Assurance  
Office of the Secretary of Energy

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## Abbreviations Used in This Report

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EAL	Emergency Action Level
EOC	Emergency Operations Center
EPHA	Emergency Planning Hazards Assessment
EPI	Emergency Public Information
EPIP	Emergency Plan Implementing Procedure
EPZ	Emergency Planning Zone
ERAP	Emergency Readiness Assurance Plan
ERO	Emergency Response Organization
ES&H	Environment, Safety, and Health
FY	Fiscal Year
ITS	Information Tracking System
LLNL	Lawrence Livermore National Laboratory
LSO	Livermore Site Office
LTRAIN	Laboratory Training Records and Information Network
MOA	Memorandum of Agreement
NA-40	NNSA Office of Emergency Operations
NA-41	NNSA Office of Emergency Management
NA-43	NNSA Office of Emergency Management Implementation
NNSA	National Nuclear Security Administration
OA	Office of Independent Oversight and Performance Assurance
OAK	Oakland Operations Office
PAR	Protective Action Recommendation

# OVERSIGHT

The Secretary of Energy's Office of Independent Oversight and Performance Assurance (OA), within the Office of Security and Safety Performance Assurance, conducted an inspection of the emergency management program at the U.S. Department of Energy (DOE) Lawrence Livermore National Laboratory (LLNL) site in June 2005. The inspection was performed by the OA Office of Emergency Management Oversight.

Within DOE, the National Nuclear Security Administration (NNSA) Office of the Deputy Administrator for Defense Programs is the cognizant secretarial office for LLNL. As such, it has overall Headquarters responsibility for programmatic direction and funding of most activities at the site. The NNSA Office of Emergency Management Implementation (NA-43) has specific line management responsibility at the Headquarters level for the site's emergency management program. At the site level, the NNSA Livermore Site Office (LSO) has line management responsibility for LLNL operations and security. LLNL is managed and operated by the University of California, under contract to DOE.

LLNL's primary mission is to provide scientific and engineering support to U.S. national security programs. LLNL performs research, development, design, maintenance, and testing in support of the nuclear weapons stockpile, as well as theoretical and applied research and development in such areas as energy, biomedicine, and environmental science.

To support these activities, LLNL operates numerous laboratories, test facilities, and support facilities at two major sites, the LLNL main site and Site 300. The LLNL main site, located in Livermore, California, encompasses approximately 800 acres. Site 300 occupies approximately 11 square miles and is about 15 miles east of the LLNL main site. LLNL activities involve various forms of radiological and chemical hazardous materials that are present in significant quantities and that need to be effectively controlled.

Throughout the evaluation of emergency management programs, OA reviews the role of DOE/NNSA organizations in providing direction to contractors and conducting line management oversight of contractor activities. OA is placing more emphasis on the effectiveness of DOE/NNSA line management oversight of emergency management programs. In reviewing NNSA line management oversight, OA focused on the effectiveness of LSO in managing the LLNL contractor, including such management functions as setting expectations, providing implementation guidance, monitoring and assessing contractor performance, and monitoring/evaluating contractor self-assessments.

In addition to the OA review of NNSA's emergency management oversight and operational awareness activities, this inspection evaluated the site's progress in addressing weaknesses and improvement challenges identified during the June 2002 OA inspection, particularly in the area of the hazards survey and emergency planning hazards assessments (EPHAs). The inspection team also evaluated the performance of key emergency responders and exercise control and evaluation personnel at selected venues to assess the site's ability to plan, conduct, and evaluate a sitewide emergency response exercise.

Section 2 of this report provides an overall discussion of the results of the review of the LLNL emergency management program elements that were evaluated. Section 3 provides OA's conclusions regarding the overall effectiveness of LSO and the contractor in managing the emergency management program. Section 4 presents the ratings assigned as a result of this inspection. Appendix A provides supplemental information, including team composition. Appendix B identifies the findings that require corrective action and follow-up, and Appendices C through E detail the results of the reviews of individual emergency management program elements.

### 2.1 Positive Program Attributes

LSO and LLNL continue to make progress in implementing an emergency management program that meets Departmental expectations and that promotes effective response to even the most severe postulated events. Positive attributes of the emergency management program are discussed below.

**NA-43 and LSO are actively engaged in providing an appropriate degree of line management oversight to the LLNL emergency management program and are facilitating program improvement.** LSO maintains a high degree of operational awareness of the status of the site's emergency management program through an array of line management oversight activities that include document reviews, drill and exercise evaluations, and functional area assessments. LSO holds regular meetings at various LLNL management levels to promote a shared understanding of program issues and remaining work and, in fiscal year (FY) 2004, effectively used contract performance measures to facilitate LLNL improvements in program management, staffing, and implementation. LSO has also been active in tracking completion and verifying closure of corrective actions from the June 2002 OA inspection. NA-43 actively supports LSO through routine communications, exercise evaluation activities, and reviews of emergency management program documents. Furthermore, NA-43 provided significant support to LSO and LLNL in FY 2004 in facilitating assistance visits by EPHA and exercise planning experts.

**LLNL has implemented numerous improvements in the site's emergency management program since the June 2002 OA inspection.** LLNL has completed corrective actions to address the inspection findings, and most corrective actions have been effectively implemented, including developing and implementing an effective emergency public information program. LLNL has essentially

completed an effort to upgrade the EPHAs so that they better meet LSO and Departmental expectations regarding organization, content, rigor, and level of detail. Additionally, emergency action levels (EALs) are clearly written and appropriately based on EPHA analysis results. LLNL has also made progress in its efforts to manage emergency management issues and corrective actions and has created new tools to support these processes. Finally, in part as a response to an adverse performance rating by LSO, LLNL has significantly elevated the visibility of the emergency management program among site managers and reorganized the emergency programs organization. Furthermore, the cognizant LLNL associate director meets regularly with the responsible LLNL program managers to provide direction and guidance.

**LLNL has developed a rigorous framework for the emergency management training, drill, and exercise program.** LLNL has established the basis of a rigorous performance-based training program that uses a systematic approach for training development and delivery. The training program includes a series of standards for ensuring that responders demonstrate initial proficiency, and maintain that proficiency, in their assigned emergency response tasks before being added to the emergency response organization (ERO) roster. Additionally, responsibility for the quality and rigor of the ERO training materials has recently been transferred to an LLNL organization that has the processes, expertise, and tools in place to facilitate continued improvement in these materials. Appropriate requirements and expectations for developing and administering drills and exercises have also been established. The LLNL drill program provides many opportunities to practice skills in team settings for the ERO and field teams, and the annual exercise involved such unique considerations as the handling of simultaneous classifiable events and environment, safety, and health team performance as first responders to a significant hazardous material spill. Collectively, these elements form a complete

foundation for the LLNL training, drill, and exercise program, although they have only been partially implemented.

## 2.2 Program Weaknesses and Items Requiring Attention

The OA team identified several key areas in which implementation of the framework established by LLNL is incomplete or does not meet Departmental expectations. Specific weaknesses are discussed below.

**The LLNL hazardous material screening process does not ensure that the EPHAs appropriately evaluate all materials that could produce classifiable emergencies, and EALs are not always promptly updated following significant EPHA revisions.** The controlling procedure for developing EPHAs discusses three different methodologies for performing the hazardous chemical screening process. However, none of these methods is completely consistent with the intent of DOE Order 151.1B, and except for simple usage of the thresholds published in the Code of Federal Regulations (CFR), the screening process is not clearly described, is reliant on the judgment of the EPHA analyst, and is not documented in the EPHA. In practice, the current EPHA screening process removes from consideration any hazardous chemical that does not have a CFR-published screening threshold or is present in quantities less than the published threshold, irrespective of the potential impact of release of the chemical. Consequently, based on preliminary analyses conducted by the OA inspection team for selected chemicals present in three buildings, some hazardous chemicals have not been appropriately assessed, and as a result, response procedures may not have been developed for all potential hazardous chemical release scenarios. Contributing to this concern regarding EAL adequacy are two EPHAs that still have not been approved nine months after five new classifiable events and significant increases in projected protective-action distances were determined.

**Implementation of the training and drill program is incomplete, and execution of the exercise program is not yet sufficiently mature to facilitate consistent and systematic program improvement.** Many elements of the LLNL performance-based ERO training program have not been fully implemented. Key ERO positions do not receive position-specific training, and contrary to LLNL

ERO training standards, personnel are added to the ERO roster prior to demonstrating proficiency through participation in a drill or exercise. Furthermore, although there is a requirement for annual training and drill/exercise participation, approximately 25 percent of the ERO is currently overdue, with some members exceeding one year, and the site qualification and training tracking system is not being used effectively to determine whether ERO responders are meeting the drill/exercise requirement. Additionally, the LLNL drill and exercise program does not consistently ensure that program and performance weaknesses are identified. For example, ERO and field team drills and site exercises conducted over the past two years have not identified significant deviations from the specified process for formulating protective actions or the associated lapses in the annual refresher training program, in part because drill and exercise objectives and evaluation criteria are not always clearly stated or sufficiently specific. Other exercise planning and conduct weaknesses include message injects that precluded players from resolving issues and conflicting information, as well as the fact that the post-exercise “hot-wash” meetings that were observed and a controller/evaluator critique were in general not sufficiently critical of player performance to comprehensively identify areas for improvement.

**Issues and corrective action management processes and systems do not yet ensure that weaknesses are appropriately captured, addressed in a timely manner, and tracked to completion.** Although LLNL program self-assessments have been critical and thorough, identified weaknesses have not been consistently or systematically captured, addressed, and tracked to closure in a timely manner. Corrective action plans were not developed for the FY 2003 self-assessment, and corrective actions for the FY 2004 self-assessment were only recently entered into the site’s institutional issues management system. Similarly, weaknesses and deficiencies identified during exercises have not always been addressed in a timely fashion. Development of corrective actions for the FY 2004 annual exercise required eight months to submit to LSO and another five months for approval, and corrective actions associated with the July 2004 no-notice exercise have not been entered into the tracking system. Further, implementation of this system is incomplete; emergency preparedness staff have difficulty entering and retrieving information, and important decisions and protocols for determining which items are entered in the institutional

tracking system and which items are tracked locally have not been addressed. Finally, LLNL has not completed the actions necessary to determine which buildings can adequately support a shelter-in-place protective action that includes shutdown of ventilation

intakes. This weakness is part of a larger issue regarding the suitability of protective actions for site personnel that was initially identified during the 1999 OA inspection.

## 3.0 Conclusions

OA's previous inspection of emergency management at LLNL, conducted in June 2002, noted continuing progress in improving various aspects of the site's emergency management program in accordance with a published project plan. The OA team also identified a number of programmatic weaknesses and several significant challenges to completing the remaining scheduled work. This 2005 OA inspection determined that LLNL has completed program development work or has established an appropriate framework for nearly all the key elements critical to establishing and maintaining an effective site emergency management program. However, implementation of requirements and expectations is weak or still evolving in several important areas, including hazardous material screening, ERO training, and use of drills and exercises and issues management systems for program improvement.

The LLNL emergency management program continues to improve in most areas evaluated, in large part because LSO, appropriately assisted by NA-43, is effectively executing its responsibilities for line management oversight and, through contractual performance measures, is driving program improvements. Corrective actions implemented by LLNL to address previously-identified weaknesses have been largely effective, including completion of the EPHA development project and efforts to develop an integrated emergency public information plan and supporting response procedures. Furthermore, LLNL has elevated the visibility of the emergency management program and implemented several organizational changes intended to accelerate the rate of program improvement to better meet LSO's expectations. Other program strengths include establishing the basis for a rigorous performance-based training program and a drill program that provides frequent opportunities for ERO and field teams to practice.

A notable weakness in program implementation is that the LLNL hazardous material screening process does not comprehensively identify all of the hazardous chemicals that need to be further assessed in the

EPHAs for potential impact on site workers and the public. The OA inspection team identified several hazardous chemicals that had been inappropriately screened from further consideration without a documented basis. This shortcoming places the rigor of the EPHA set in question and may have resulted in decision-makers lacking the classification and protective-action formulation tools needed to perform these tasks effectively. The validity of these response tools is also compromised when EPHA updates require excessive time for review and approval, producing attendant delays in EAL updates, as is the case for two LLNL EPHAs.

Other implementation weaknesses in the LLNL program were noted as well. The training, drill, and exercise program lacks position-specific training for key ERO responders; responders are added to the ERO roster without first demonstrating their proficiency in a drill or exercise; and a high percentage of responders are overdue for annual training or drill/exercise participation. Furthermore, drills and exercises do not consistently identify performance weaknesses, and the exercise program is not yet mature, as indicated by several weaknesses in the conduct of the annual exercise that limited the opportunities to evaluate and improve ERO performance. Finally, readiness assurance processes and systems applicable to the emergency preparedness function do not yet ensure that programmatic and performance weaknesses are systematically and consistently identified and effectively addressed, and that corrective actions are tracked to completion.

Overall, the LLNL emergency management program continues to mature. The current program status, the performance demonstrated by the ERO during the exercise, and the post-exercise corrective actions provide confidence that site workers and the public would be adequately protected from the potential consequences of an incident involving the release of hazardous materials. In terms of quantifying program improvement since the June 2002 OA inspection, this inspection involved a much more detailed look at EPHAs, and LLNL's completion of the entire

set of EPHAs and associated EALs provided an opportunity to observe weaknesses that were not previously apparent. Furthermore, the training/drill area was not evaluated in 2002, and this 2005 inspection involved actual observation of a sitewide exercise, rather than an interim review of a narrow exercise planning element. Consequently, a direct comparison of the ratings between the two inspections may be misleading. LSO and LLNL line management attention is necessary to ensure that the hazardous material

screening process is rigorous, clearly defined, and consistently applied, and that significant EPHA revisions are expeditiously approved so that the corresponding response tools can be effectively maintained. LSO and LLNL line management attention is also needed to ensure the timely completion of ongoing efforts intended to determine what building occupants must do to adequately execute shelter-in-place protective actions.

## 4.0 Ratings

This inspection focused on a detailed assessment of five key emergency management programmatic elements, as well as the performance of key emergency response decision-makers and support functions during the annual exercise. No overall program rating has been assigned. The individual element ratings reflect the status of each LLNL emergency management program element at the time of the inspection. The rating assigned below to the readiness assurance category is specific to those assessment, corrective action, and performance monitoring mechanisms applicable to the emergency management area.

The ratings for the individual program elements evaluated during this inspection are:

**Hazards Survey and Hazards Assessments** ..... NEEDS IMPROVEMENT

### **Emergency Preparedness**

Training, Drill, and Exercise Program ..... NEEDS IMPROVEMENT

Emergency Public Information ..... EFFECTIVE PERFORMANCE

### **Readiness Assurance**

NNSA Line Program Management ..... EFFECTIVE PERFORMANCE

LLNL Feedback and Improvement ..... NEEDS IMPROVEMENT

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# APPENDIX A

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## SUPPLEMENTAL INFORMATION

### A.1 Dates of Review

Planning Visit	May 17–18, 2005
Onsite Inspection Visit	June 6–16, 2005
Report Validation and Closeout	June 28–29, 2005

### A.2 Review Team Composition

#### A.2.1 Management

Glenn S. Podonsky, Director, Office of Security and Safety Performance Assurance  
Michael A. Kilpatrick, Director, Office of Independent Oversight and Performance Assurance  
Charles B. Lewis, Director, Office of Emergency Management Oversight

#### A.2.2 Quality Review Board

Michael A. Kilpatrick  
Dean C. Hickman  
Robert M. Nelson  
Patricia Worthington

#### A.2.3 Review Team

Steven Simonson, Deputy Director, Office of Emergency Management Oversight (Team Leader)  
JR Dillenback  
Deborah Johnson  
John Nichols  
David Odland  
Jeffrey Robertson  
Tom Rogers

#### A.2.4 Administrative Support

Kim Zollinger

## APPENDIX B

### SITE-SPECIFIC FINDINGS

**Table B-1. Site-Specific Findings Requiring Corrective Action Plans**

FINDING STATEMENTS	REFER TO PAGES:
1. LLNL has not ensured that all hazardous chemicals are identified and then assessed, as appropriate, for potential impact on site workers and the public, as required by DOE Order 151.1B, <i>Comprehensive Emergency Management System</i> .	12
2. EPHAs and EALs are not consistently reviewed and accurately updated in a timely manner, as required by DOE Order 151.1B	13
3. LLNL has not implemented a process to ensure, through position-specific training, that personnel can perform all of their ERO position responsibilities, as required by LLNL EPIP-123, <i>Emergency Response Organization Training and Drills</i> .	16
4. LLNL has not implemented a process that ensures that all personnel who appear on the ERO roster have completed all initial or annual retraining requirements, including demonstration of proficiency, as required by DOE Order 151.1B and LLNL EPIP-123.	16
5. The LLNL drill and exercise evaluation criteria are not sufficiently specific to ensure that program and responder performance weaknesses are identified, as required by DOE Order 151.1B.	20
6. LLNL has not established an effective readiness assurance program that consistently identifies and addresses weaknesses in the emergency management program and implements timely corrective actions, as required by DOE Order 151.1B and DOE Order 414.1B, <i>Quality Assurance</i> .	30
7. LLNL has not determined all actions that must be taken by building occupants to effectively implement shelter-in-place protective actions, as required by DOE Order 151.1B.	31

## APPENDIX C

# HAZARDS SURVEY AND HAZARDS ASSESSMENTS

### C.1 Introduction

Hazards surveys and emergency planning hazards assessments (EPHAs) are developed to identify and assess the impact of site- and facility-specific hazards and threats and establish an emergency planning zone (EPZ). Based upon the results of these assessments, U.S. Department of Energy (DOE) and National Nuclear Security Administration (NNSA) sites and facilities must establish an emergency management program that is commensurate with the identified hazards.

This evaluation included a review of the Lawrence Livermore National Laboratories (LLNL) hazards survey and EPHAs (referred to as emergency preparedness hazards assessments at LLNL) associated with several LLNL facilities and transportation activities. These reviews focused on LLNL's efforts to complete the EPHA upgrade program that was under way during the June 2002 inspection conducted by the Office of Independent Oversight and Performance Assurance (OA) and on the collective rigor of the EPHA set.

### C.2 Status and Results

The hazards survey and EPHAs serve as the foundation of the emergency management program; consequently, their rigor and accuracy are key to developing effective emergency response procedures and other elements of the program. The degree to which these documents effectively serve this function depends primarily on the completeness of the institutional processes for developing a hazards survey and EPHA, the effectiveness of the screening process by which hazardous materials are initially identified and evaluated, and the rigor and accuracy of the analyses contained within the EPHA.

The June 2002 OA inspection determined that LLNL had implemented a set of EPHAs that, for the events analyzed, formed an adequate technical basis for the site's emergency management program, and had embarked on a program to further improve the EPHAs to better meet Departmental expectations. At that time, only one of the 16 EPHAs had been completed using a new process that was intended to

institutionalize EPHA development and maintenance. This 2005 OA inspection found that the quality of analyses and content of LLNL EPHAs has improved. However, weaknesses in the hazardous material screening process, errors and inconsistencies among EPHAs and emergency action levels (EALs), and delays in updating EPHAs detract from the overall effectiveness of the EPHAs as the basis for the site's emergency management program.

Since then, LLNL has revised the 16 EPHAs, including one that addresses transportation activities, and three additional facilities have recently been identified as requiring an EPHA. The EPHAs are well organized and consistently formatted. They adequately describe facility operations and appropriately identify facility and site boundaries, as well as critical receptors of interest, for use in consequence assessment calculations and developing EALs and the EPZ. Other positive aspects include consideration of a complete spectrum of events; use of both average and severe meteorology in calculating event consequences; and appropriately documented source term quantity and form, analytical assumptions, and results. Facility management is involved in the development, review, and approval process, and the completed hazards survey and EPHAs are submitted to the Livermore Site Office (LSO) for review and comment. EALs, which are essentially EPHA response procedures, are appropriately based on the results of the EPHA analyses. The EALs are clearly written and well-organized, and they contain such useful features and information as a tabular summary of classifiable events for each facility; hazardous material quantities expressed in commonly used and easy-to-interpret units; distances to the site boundary and the point at which the protective action criteria is exceeded; and references to the applicable EPHA scenario and analysis.

The processes and responsibilities for developing and maintaining the LLNL hazards survey and EPHAs are generally described in the LLNL emergency plan and detailed in the associated implementing procedure, *Emergency Preparedness Hazards Survey and Hazards Assessment*. With the exception of the hazardous material screening process, discussed below, this procedure effectively identifies requirements and expectations identified in DOE Order 151.1B and the associated DOE emergency management guide, and

the procedure provides detailed instructions on the methodology, content, and format for developing the site hazards survey, EPHAs, EALs, and EPZs.

The effectiveness of the hazardous material screening process, which determines the need for a quantitative EPHA, depends on the identification of a comprehensive set of screening criteria, consistent and well-documented application, and an accurate inventory of hazardous materials in the facility against which to apply the criteria. The EPHA development procedure describes the hazardous material screening process in three different sections of the procedure using three different methodologies. Not only is the procedure internally inconsistent, but none of these methods is comprehensive or totally consistent with Departmental expectations or the LLNL emergency plan, which states that the EPHAs apply the methodology described in the DOE emergency management guide. The practice at LLNL is to use the simplest method discussed in the EPHA development procedure, which is to compare the facility inventories of hazardous materials with threshold planning quantities published in designated sections of the Code of Federal Regulations. Chemicals that are not listed or do not exceed the published planning quantities are typically screened from further consideration in the associated EPHA, although in some cases, the EPHA analyst determined that hazardous chemicals present in quantities below the published screening thresholds should be evaluated in the EPHA based on their toxicity.

To evaluate the effectiveness of the hazards identification process employed in the facility EPHAs, the OA team conducted walkdowns of multiple facilities with facility managers and facility environment, safety, and health representatives. The EPHA for each facility and, where applicable, the facility chemical inventory list were reviewed prior to the walkdown. These walkdowns confirmed that facility chemical inventories were generally accurate. The OA team then performed a set of preliminary analyses to determine the impact of the weaknesses in the chemical screening process. These analyses indicated that in several instances, hazardous chemicals that had not been analyzed in the EPHA could, if released, result in classifiable emergencies because protective action criteria might be exceeded at a facility or site boundary. For example, hydrofluoric acid and nickel chloride in Building 322, ammonia in Building 131, and tetramethylammonium hydroxide and hexamethyldisilazane in Building 153 were not analyzed, although these materials constitute potentially significant toxic hazards. The impact of these weaknesses in

hazardous chemical screening is that emergency responders may not have all the response procedures and other tools necessary to provide adequate protection to site workers and the public in the event of a release of these materials.

**Finding #1: LLNL has not ensured that all hazardous chemicals are identified and then assessed, as appropriate, for potential impact on site workers and the public, as required by DOE Order 151.1B, *Comprehensive Emergency Management System*.**

The five EPHAs that OA reviewed contained several errors and inconsistencies in analytical methodology or application that collectively diminish their quality and rigor. In one instance, the source term determination for a release of chlorine used accurate release fraction assumptions; however, these assumptions were not used correctly in the plume dispersion model, and a “general emergency” determination was made for an event whose calculated consequences did not meet the definition of a classifiable emergency. In another instance, EPHA analyses for two Building 322 scenarios indicated the potential for site area emergencies, but these results were not carried forward into the event consequence table of the EPHA or into the associated EALs. There were also numerous inconsistencies within and among EPHAs in the application of the source term descriptions, damage ratio, airborne release fraction, and deposition velocities. Similar issues identified during a technical assistance visit conducted by the NNSA Office of Emergency Management (NA-41) in April 2004 are being tracked by LSO, and are expected to be addressed during the next EPHA update.

Weaknesses were also noted in the process used for updating EPHAs and related documents. Although recent EPHA reviews by LSO have been detailed and timely, the resolution of comments and final issuance of EPHAs and associated EALs have been significantly delayed in two cases. In the first case, the September 2004 revision of the transportation EPHA identifies five general emergencies not previously analyzed. The revised EPHA and associated EALs have not yet been issued, primarily due to a protracted comment resolution period that ended in May 2005. In the second case, the updated EPHA for Building 332 contains updated consequence analyses for an inadvertent criticality, resulting in the need to greatly increase protective action distances. Despite the importance of this result, this EPHA and associated EALs have been delayed

since September 2004 awaiting the update of authorization basis documents for the facility. Consequently, nine months after the EPHAs for these two facilities indicated a need for additional or enhanced response actions, emergency responders still lack updated EALs that contain all of the postulated classifiable emergencies and accurate protective-action distances. These delays are particularly significant because in anticipation of issuance of a revision to DOE Order 151.1B, LSO is permitting LLNL to review and update EPHAs triennially rather than annually, as currently required. The EAL weaknesses caused by the delay in EPHA approval are at least partially mitigated by the familiarity of the LLNL fire department duty chiefs (who have initial emergency response decision-making authority) with the 2004 Emergency Response Guidebook and the conservative nature of their training on the extent of required protective actions and protective action recommendations for any event.

**Finding #2: EPHAs and EALs are not consistently reviewed and accurately updated in a timely manner, as required by DOE Order 151.1B.**

### C.3 Conclusions

Since the previous OA inspection in 2002, LLNL has implemented numerous improvements in the hazards survey and EPHA area. The site hazards survey appropriately identifies generic applicable emergency conditions, and LLNL has completed the initial EPHA upgrade effort. As a result, EPHAs have better rigor, analytical quality, and content. The EPHAs and EALs are clearly documented, well organized, and consistently formatted, facilitating review and updating. LLNL has also initiated a program to further improve the EPHAs and EALs, and a detailed implementing procedure directs the hazards survey and EPHA development process. However, this inspection involved a much more detailed look at the entire set of EPHAs and associated EALs than was possible in 2002, because the EPHA upgrade program had then been in progress for a relatively short time. Consequently, despite the effective performance rating assigned at that time, this inspection identified several areas of weakness in the site's emergency planning basis. There are inconsistencies among the EPHA development procedure, DOE Order 151.1B requirements, and actual practices at LLNL regarding the hazards screening process. Furthermore, the hazardous chemical screening process now in use removes from

consideration any chemical that does not have a published threshold quantity, irrespective of the potential health effects that could result from a loss of control of the material. Additionally, the EPHA analyses contain a number of both overly conservative and non-conservative errors and omissions. Finally, revised or updated EPHAs and EALs are not consistently reviewed, updated, and implemented in a timely manner. As a result, emergency responders may not have all of the necessary response procedures and tools to respond effectively to postulated events.

### C.4 Rating

A rating of NEEDS IMPROVEMENT is assigned to the area of hazards survey and emergency planning hazards assessments.

### C.5 Opportunities for Improvement

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible NNSA and contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic emergency management objectives.

#### Lawrence Livermore National Laboratory

- Enhance the usefulness of EPIP-61, *Emergency Preparedness Hazards Survey and Hazards Assessment*, for developing and maintaining the hazards survey and EPHAs by providing additional specificity to the procedure. Specific actions to consider include:
  - Clearly define the hazardous material screening process and remove inconsistencies. Consider using the Los Alamos National Laboratory screening thresholds as a starting point for identifying facility-specific screening quantities. Coordinate changes to the screening process with NA-41 to avoid additional changes after DOE Order 151.1 is revised.
  - Simplify the procedure by eliminating the redundancies between the first attachment (Emergency Preparedness Documentation

Development Guidance), Attachment A (Emergency Preparedness Hazards Survey Development Guidance), and Attachment B (Emergency Preparedness Hazards Assessment Development Guidance). Ensure that all pertinent information in the first attachment is included in Attachment A and/or Attachment B and remove the first attachment from the procedure.

- Include instructions for promptly notifying management of EPHA revision outcomes that involve new classifiable emergencies and changes to protective-action distances in order to expedite changes to the associated EALs and composite EPZ.
- Verify that the deposition velocities provided in the procedure are appropriate and revise as necessary.
- Enhance the EALs to make them a more effective emergency response tool. Specific actions to consider include:
  - Perform a detailed EPHA-to-EAL comparison to ensure that each EPHA analysis that indicates a classifiable emergency is specifically tied to a corresponding EAL.
  - Ensure that the EALs are issued concurrently with EPHA revisions.
  - Determine whether EALs can be enhanced by the addition of symptom-based EALs that include specific instrument setpoints. Installed

instruments and indicators, such as toxic gas monitoring system, criticality alarm system, or constant air monitor readings, should be incorporated into EALs wherever possible to facilitate timely classification of events.

- Consider the addition of discretionary EALs to compensate for scenarios outside of those analyzed to ensure that timely decisions can be made based on the current understanding of the situation.
- Consider enhancing the EPHAs by incorporating comments, as appropriate, from the NA-41 technical assistance visit. Consider developing a process that ensures a consistent approach across all EPHAs, irrespective of when the EPHA is updated, and that is coordinated with LSO to ensure that expectations are shared and adequately addressed.
- Consider expediting the review and approval of EPHA revisions and EALs to ensure that emergency planning document revisions are completed in a timely manner. Specific actions to consider include:
  - Determine how to address needed EPHA revisions pending revisions to associated authorization basis documents.
  - Ensure that milestones for EPHA revisions are established sufficiently far in advance of EPHA completion requirements to ensure sufficient time for completing the reviews by facility personnel, resolving comments, and documenting approvals.

# APPENDIX D

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## EMERGENCY PREPAREDNESS

### D.1 Introduction

A coordinated program of training, drills, and exercises is necessary to ensure that emergency response personnel and organizations can effectively respond to emergencies impacting a specific facility or the site as a whole. This response includes the ability to make time-urgent decisions and take actions to minimize the consequences of the emergency and to protect the health and safety of responders, workers, and the public. To be effective improvement tools, exercises should be used to validate all elements of an emergency management program over a multi-year period using realistic, simulated emergency events and conditions, and to provide emergency response organization (ERO) members an opportunity to practice their skills. An effective emergency public information (EPI) program provides the public, media, and U.S. Department of Energy (DOE) employees with accurate and timely information during an emergency event. In part, effectiveness is based on having in place a long-term, documented program to educate the public and the media about actions that may be required during an emergency response.

The Office of Independent Oversight and Performance Assurance (OA) team evaluated the Lawrence Livermore National Laboratory (LLNL) training, drill, and exercise program used to support the ERO at the institutional and facility levels. As part of the programmatic review of the training, drill, and exercise elements, the OA team evaluated the plans and procedures that support these elements and reviewed training and proficiency records for key site emergency responders. Drill and exercise reports were also reviewed for indications that they are being used effectively to enhance responder proficiency, evaluate the level of the site's response preparedness, and identify areas for programmatic improvement. Additionally, the inspection team evaluated the performance of key emergency responders and exercise control and evaluation personnel at selected venues to assess the site's ability to plan, conduct, and evaluate a sitewide emergency response exercise. Finally, the team also evaluated EPI plans and applicable processes for an emergency at LLNL.

### D.2 Status and Results

#### D.2.1 Training Program

Training program requirements are specified in emergency plan implementing procedure (EPIP)-123, *Emergency Response Organization Training and Drills*, which forms the basis of a comprehensive, performance-based training program. This procedure requires the use of performance-based training that includes a systematic approach to the development and delivery of training. EPIP-123 appropriately details the training standards and requirements for satisfactory completion of initial and annual refresher training and requires that job proficiency be demonstrated as a part of completing such training. Implementation of ERO training is shared by the emergency programs organization and the LLNL safety education training section, which has the processes, expertise, and tools to facilitate continued improvement of ERO training materials. The safety education training section has implemented a wide set of performance-based processes for developing and maintaining course materials, including updating course materials for procedure changes, collecting student feedback to determine instructor effectiveness, requiring periodic observation of instructors by managers and peers, and conducting a formal instructor qualification program. However, as discussed below, many elements of the LLNL ERO training program have not been effectively implemented.

The systematic training development and implementation process as described in EPIP-123 has not been fully implemented. The LLNL ERO core training program consists of nine classroom courses that were developed in late 2001 as a sitewide training program for the ERO. These courses teach lower-level objectives at an "overview" level and have not been revised to reflect the improvements that have been made in ERO processes and procedures. Furthermore, although LLNL assigns ERO duties based on personnel technical background, such as using personnel experienced in developing authorization basis documents as consequence assessment team members, LLNL has not determined what additional training these personnel may need to span the differences between

their normal job duties and ERO duties. Finally, LLNL has not determined which position-specific elements should be taught in the classroom, and which elements require on-the-job training and a performance evaluation. As a result, LLNL has no position-specific training for key positions in the ERO, thus contributing to weaknesses in responder performance during the LLNL annual exercise in the areas of protective action recommendations (PARs) and consequence assessment, as discussed in the following section. Additional examples of shortfalls in training material development and implementation include:

- Significant changes in ERO procedures have not always been effectively incorporated into the ERO annual refresher training programs. Revisions to EPIP-71, *Protective Actions and Re-entry*, that impact the method of determining protective actions were completed in 2002. However, the fact that annual ERO refresher training did not reflect these changes contributed to some protective actions being formulated during the 2005 annual exercise that were not in accordance with procedural direction.
- Annual refresher training examinations are not designed to test knowledge of program changes or other appropriate components, such as lessons learned. The evaluation questions are generic in nature, and annual refresher examinations routinely contain the same questions each year.

**Finding #3: LLNL has not implemented a process to ensure, through position-specific training, that personnel can perform all of their ERO position responsibilities, as required by LLNL EPIP-123, *Emergency Response Organization Training and Drills*.**

Additionally, requirements regarding the completion of training have not been implemented. EPIP-123 requires that prospective ERO members pass all written evaluations and demonstrate acquired skills through participation in a drill or exercise. However, for some LLNL organizations, the current practice is to add personnel to the ERO roster after classroom training is completed, regardless of whether the individual has completed a drill or exercise. EPIP-123 further requires that to meet the performance-based requirement for annual refresher training, ERO members must participate in an annual drill or exercise as a player in

their assigned position or as a controller or evaluator. However, credit is given for participating in tabletop training that may not always have the rigor or degree of documentation required to demonstrate performance. Additionally, personnel are not removed from the ERO roster when they do not meet management expectations for maintenance of annual training. According to the 2005 LLNL emergency readiness assurance plan, ERO members are removed 30 days after they are considered overdue (i.e., not completing annual refresher training within the past year) by withholding the responders' response access card. This process is not described in any training implementation documents. Furthermore, 25 percent of the ERO is currently overdue for training, with some members exceeding one year overdue, and there is no evidence that response access cards have been withheld.

Contributing to this issue is the fact that LLNL's implementation of the Laboratory Training Records and Information Network (LTRAIN) system, which is LLNL's training status tracking system, does not facilitate accurate tracking of participation in drills and exercises to determine whether ERO responders are meeting their required drill/exercise requirements. LTRAIN credits participation to every player whose name is entered on a drill/exercise player roster. However, as currently used, LTRAIN does not differentiate between an ERO member actually filling a creditable position during the drill and an ERO member filling a different role. For example, multiple laboratory emergency duty officers routinely sign in for exercises, and all are entered in the LTRAIN database, although the only creditable positions are the emergency director or a controller/evaluator for the emergency director position. Allowing multiple sign-ins contributed to the emergency programs organization not being able to determine that one laboratory emergency duty officer did not actually meet the site requirements for an annual drill or exercise participation in 2004. In response to this observation, LLNL removed this individual from the ERO roster pending drill completion.

**Finding #4: LLNL has not implemented a process that ensures that all personnel who appear on the ERO roster have completed all initial or annual retraining requirements, including demonstration of proficiency, as required by DOE Order 151.1B and LLNL EPIP-123.**

To summarize, the controlling procedure for the conduct of training and drills establishes the framework for a comprehensive performance-based training program. The program includes an appropriate set of requirements for preparing and delivering initial and refresher training, and it includes appropriate standards for evaluating the readiness of personnel to assume duties as fully qualified ERO members. However, weaknesses in implementation of the initial and annual refresher training processes have resulted in the possibility that ERO members may be placed on the ERO watch bill without having the skills necessary to execute their assigned positions or being fully cognizant of program changes, such as revisions to response procedures.

## D.2.2 Drill and Exercise Programs

The December 1999 OA inspection, which is the most recent inspection in which LLNL emergency preparedness training and drill programs were reviewed, linked weaknesses observed during performance tests to key ERO responders having inadequate knowledge, indicating that training and drills had not fully prepared ERO responders for their emergency response duties. Additionally, weaknesses in the development and evaluation of both drills and exercises were noted. This 2005 inspection found that LLNL has established clearly defined drill and exercise programs. However, these programs are not fully implemented.

### Drill Program

The LLNL drill program, which is primarily defined in EPIP-123, is a composite of drills developed and implemented by various LLNL divisions and facility staff to provide many opportunities to practice skills in team settings. The drill program design concepts are well considered in that they incorporate an array of response teams. Drill opportunities include quarterly ERO drills; annual environment, safety, and health (ES&H) field team drills consisting of a duty chief and an ES&H team; and annual criticality, medical, and evacuation and accountability “self-help” drills. Furthermore, commencing later this year for seven facilities, a facility-specific “tabletop” parking lot drill program is scheduled to begin. Its goal is to ensure that an evaluated drill is conducted at all facilities with an emergency planning hazards assessment (EPHA). Drill packages representative of recently conducted

ERO and ES&H team drills are well written, include a wide variety of plausible scenarios, and adhere to many of the exercise program requirements. Drill results are adequately documented in an after-action report that includes recommended corrective actions and action items for improvement.

The extent to which the various components of the LLNL drill program are implemented and their maturity vary. The ERO, evacuation and accountability, medical, and criticality drills have been conducted for many years, and EPIP-123 appropriately defines the process for their development and conduct. ES&H field team drills, which are used to qualify and maintain the response proficiency of ES&H team members, were implemented two years ago, but these drills are not addressed by EPIP-123. The emerging tabletop facility drill program is not yet embodied in a drill development or execution procedure; developers plan to emulate drill packages developed under EPIP-123.

Several implementation weaknesses were noted within the most-mature segments of the LLNL drill program. Foremost among them is that the LLNL drill program does not consistently ensure that “hands-on” training is fully implemented or that identified items for improvement are corrected. ERO and field team drills conducted over the past two years have not identified any discrepancies between the method used by responders (primarily the duty chief position) to formulate protective actions and PARs and the process specified in the applicable response procedure. As discussed in more detail in Section D.2.3, the incorrect method observed during the exercise is a longstanding practice regularly used by other personnel who fill the duty chief position. A review of evaluation methods described in recent drill packages indicated that undocumented interview questions were used to evaluate the duty chiefs’ ability to formulate protective actions rather than hands-on use of approved decision-making tools. This issue is part of a broader weakness related to the specificity of evaluator criteria and checklists, which is also discussed in more detail in Section D.2.3. Additionally, drill records do not indicate that the shelter-in-place protective action is ever fully evaluated, although LLNL has indicated that they practice sheltering actions not involving the manipulation of ventilation systems. A finding that encompasses this drill weakness is contained in Section E.2.2 of this report. Finally, although weaknesses and improvement items identified during drills are entered into the emergency preparedness tracking system, these items are closed when closure of the item is assigned to other

LLNL departments rather than when they are corrected. Section E.2.2 contains a finding on this weakness as well.

## Exercise Program

During the 2002 OA inspection, the exercise development procedure and the drill and exercise planning committee were new approaches for improving the LLNL exercise program. At that time, OA considered the initiative to be well-conceived, but it had not been tested through the development and administration of an exercise. Since then, LLNL has developed and conducted four site exercises in accordance with that approach.

The LLNL exercise program is defined by an implementing procedure (EPIP-131) that, as in 2002, contains many positive attributes. These include exercise package development guidance; requirements for post-exercise “hot washes” and controller/evaluator critique meetings; and expectations regarding the development of lessons learned and the identification and tracking of issues to foster program improvement. Since 2002, LLNL has improved the exercise procedure by incorporating exercise evaluation standards to establish a consistent method of grading the performance observed in exercises from year to year. The procedure also now includes provision for developing a five-year exercise schedule to support long-term exercise planning.

Although the exercise development procedure adequately addresses most attributes of an effective exercise program, the current program structure contains several weaknesses that collectively diminish the formality of the program and the effectiveness of the exercise planning process. These include:

- Responsibilities for the emergency preparedness drill and exercise planning committee are not defined in the procedure.
- Review and approval authorities for drill packages are not defined in the procedure.
- A method for placing administrative holds and their release during exercises and the authority to do so is not specified.
- As in 2002, the procedure does not specify the documents to be retained, requiring only that

“appropriate” records be maintained. It should be noted that a review of records indicated that the emergency preparedness training and drill specialist does maintain an adequate set of records.

- The specific use of evaluator records by the emergency preparedness training and drill specialist and the exercise committee in developing lessons learned from the exercise is not discussed in the procedure. The current practice adequately balances the use of evaluator records and critique minutes, but documenting the process formalizes the practice and may facilitate the identification of additional improvements.

To summarize, both the drill and exercise programs are governed by implementing procedures and contain a number of positive attributes. The drill program provides many well-considered opportunities for responders to practice their skills in team settings and for site workers to practice their evacuation and accountability procedures. Drill packages for the ERO and field teams provide plausible scenarios and the documentation necessary to promote program improvements, and the emerging parking lot tabletop drills could ensure adequate annual evaluations of all EPHA facilities. The exercise program structure and administration continue to be adequate, and improvements since the last inspection include the incorporation of exercise evaluation standards to establish consistency in exercise evaluation and provision for the development of a five-year exercise for long-term planning. In addition, the experience and judgment of the emergency preparedness training and drill specialist has compensated for some program details that are not specified by procedure. Nonetheless, the drill program could be made more effective through increased emphasis on using “hands-on” demonstrations and practice of skills and using more specific objectives and evaluation criteria to identify program and performance weaknesses. Additionally, the parking lot tabletop drills are not currently described in program documents, and this segment of the drill program has not yet begun. Lastly, the practice of closing corrective actions identified through the drill program when the action is assigned to another organization does not ensure that corrective actions are actually effectively implemented.

### D.2.3 Exercise Performance by Controller/Evaluators and Responders

The OA inspection team evaluated the performance of exercise control and evaluation personnel and key emergency responders at selected venues to assess the site's ability to plan, conduct, and evaluate a sitewide emergency response exercise and to tie program weaknesses to observations of performance. Conclusions regarding implementation of the LLNL exercise evaluation process are based on the exercise observations, the observed post-exercise venue hot washes and controller/evaluator critique, and a review of selected LLNL evaluator checklists. It is recognized that certain key LLNL exercise evaluation

activities, such as the development of the exercise after-action report, are still in progress.

#### Planning and Conduct of the 2005 Annual Exercise

The 2005 exercise package adequately addressed the topical areas recommended by the DOE emergency management guide, including purpose and scope, a scenario narrative, timelines, injects, safety and security plans, objectives and criteria, and controller and evaluator instructions. Furthermore, the exercise scenario provided two notable challenges to ERO members: response to two simultaneous events, and response of the ES&H team as the first responder to a significant hazardous material release.

#### OVERVIEW OF THE 2005 LLNL EMERGENCY RESPONSE EXERCISE

The LLNL annual exercise was designed to challenge the ERO to manage two overlapping operational emergencies. The exercise scenario involved a simulated inadvertent criticality at the Superblock facility that included injured personnel requiring medical attention. The event would require classification as a site area emergency, and the EOC and joint information center would be activated. Expected protective actions included evacuation of the affected building and shelter-in-place for adjacent buildings; however, no release was postulated. During the mitigation stage of the criticality event, a postulated transportation event occurred at B695, resulting in a hazardous chemical spill of hydrochloric acid. Based on the proximity to the site boundary, this event would require classification as a general emergency. The exercise-specified wind direction would lead to expected protective actions that include shelter-in-place for downwind buildings at LLNL and at Sandia National Laboratories – California.

Public affairs personnel from the City of Livermore participated in this exercise, which also included limited participation by DOE Headquarters.

Specific objectives that the OA team evaluated included those related to the roles of the LLNL duty chief and other responders in the incident command structure, and the performance of the key emergency management decision-making functions that would be needed in an emergency involving the potential for release of a hazardous material and personnel injuries. Participants who were evaluated included the duty chief, emergency director and other key EOC personnel, public affairs personnel at the joint information center, consequence assessment staff, facility personnel responding to the criticality event, and ES&H personnel responding to the hazardous chemical spill.

#### OVERVIEW OF THE LLNL EMERGENCY RESPONSE CONCEPT OF OPERATIONS

In the event of an emergency, the LLNL fire department duty chief provides direction and control of the LLNL emergency response until the EOC is activated. The duty chief is responsible for command and control at the event scene, through the fire department incident commander, and for making key decisions regarding the safety of emergency responders, event categorization and classification, protective actions for site workers, and PARs for offsite populations; initiating notifications to offsite authorities; and initiating recall of the EOC responders. After the EOC is activated, the emergency director oversees the overall response. Key emergency director responsibilities are to ensure appropriate incident commander decisions regarding event categorization, classification, and protective actions and to review and approve offsite media releases and information provided to all site workers regarding the event. The LSO emergency manager reviews the emergency director's decisions and provides concurrence or additional directions, as necessary. The LLNL consequence assessment team supports the duty chief and the emergency director by identifying areas that could be affected by event hazards and recommending event classification and predetermined protective action plans for implementation.

However, planning weaknesses limited the collection of useful information during the exercise as a result of various impacts on player or evaluator performance. Foremost among these is that some evaluation checklists do not contain the specificity necessary to ensure that the performance item is critically evaluated. For example, the emergency operations center (EOC) checklist item for evaluating the verification of protective actions and PARs asks only whether the EOC reviewed the tasks identified by the incident commander as “necessary to mitigate the event.” Other checklist items ask whether actions were accomplished in accordance with generic references to manuals or planning documents (e.g., “...meet the requirements of the LLNL emergency plan.”) that would not be used by responders and whose nature precludes use by the evaluator in identifying the performance expectation. Furthermore, evaluation criteria are not always tailored to the venue or evaluator assignment so as to focus evaluator attention on a limited number of applicable objectives and criteria. For example, although the ES&H team was expected to perform as first responders to the hazardous chemical spill until the fire department was available, the evaluation criteria and checklists did not specifically address adherence to site expectations to adopt a defensive strategy rather than attempt spill mitigation measures.

**Finding #5: The LLNL drill and exercise evaluation criteria are not sufficiently specific to ensure that program and responder performance weaknesses are identified, as required by DOE Order 151.1B.**

Other exercise planning weaknesses include:

- The shelter-in-place evaluation criteria used at B331 did not evaluate the closing of doors and windows and the shutdown of ventilation systems (where practical), as specified in the protective action response procedure. Instead, the actions evaluated were those identified in the facility safety plan, which is not consistent with the protective action response procedure.
- The expected response described in the exercise package for onsite protective actions was inconsistent with the protective action response procedure and the emergency action level that the exercise developers intended to be used, although

the expected response was consistent with training that had been provided to the duty chiefs.

- The packaging and quantities of the chemical involved in the hazardous material release were inconsistent with the applicable emergency planning hazards assessment.
- The use of prepared meteorological data resulted in field responder confusion and was not warranted to accomplish the exercise objectives.
- The exercise is nearly the same as the fiscal year 2003 exercise and the evaluated criticality event designed as part of the 2005 exercise is drilled at least once annually. Using other scenarios at a different facility would have enhanced the validity of information and conclusions regarding program status and responder preparedness.
- The newly-assigned ES&H team leader being evaluated at the scene of the hazardous chemical spill did not have an opportunity to practice as a first responder in a drill prior to the exercise.
- The evaluation criteria checklists allow for the evaluator to make use of a “not observed” category without requiring clarification as to whether or not the activity occurred. Requiring documentation of all uses of this category would encourage follow-up questioning whenever the evaluator was not able to observe actual performance of a required item.

The 2005 annual exercise was performed safely and was adequately controlled to permit evaluation of most exercise objectives. However, some message injects prevented players from having to resolve certain issues and conflicting information and to demonstrate the management and communication skills necessary during an actual event. In one instance, an inject was used in the EOC to correct the identity of the hazardous chemical that had been spilled. Another inject was used to ensure that the emergency director classified the second event as a general emergency (even though the duty chief had already classified the event as such) when the EOC cadre was considering declaring a site area emergency. This inject essentially ended all EOC discussions regarding the relative priorities of emergency action levels and consequence assessment information and precluded observing how the EOC resolved the issue.

During the post-exercise hot-wash meetings attended by the OA team and the controller/evaluator critique meeting, LLNL personnel identified and discussed most performance weaknesses that the OA team observed during the exercise. However, a few significant performance issues and areas for improvement were either not addressed or were not critically examined during these meetings. A contributing factor was the absence of note-taking and objective reviews at the observed hot-wash meetings, which is contrary to program requirements, and a controller/evaluator critique that did not ensure that all objectives were appropriately discussed. Furthermore, evaluators were not required to complete their evaluation reports until the following week, thus diminishing the quality of information collected due to the passage of time. Important improvement items that were not addressed during the post-exercise critique and hot washes attended by the OA team include:

- The inadequate isolation zone distance initially established by the ES&H team at the scene of the spill
- The ES&H team's reuse of potentially contaminated personal protective equipment and partially-used breathing air bottles during a re-entry
- Potential confusion between emergency director and duty chief responsibilities in making event classifications and notifications for a separate event when the EOC is activated
- EOC personnel circumventing the on-scene laboratory emergency duty officer liaison to obtain information directly from the duty chief.

### **Responder Performance During the 2005 Annual Exercise**

Emergency responders from the fire department and within the Superblock facility demonstrated effective command and control in executing the incident command system and in accomplishing designated response functions during the exercise. Event classifications and notifications made by the duty chief were accurate and timely, protective actions were rapidly implemented for Superblock personnel, and safe conditions at the assembly points were rapidly verified. Re-entry planning at Superblock appropriately addressed the possibility of re-criticality.

With few exceptions, the EOC team appropriately supported the duty chief and other local responders at the event scenes and EPI personnel in the joint information center. Additionally, the status of the event was effectively communicated to offsite stakeholders. The EOC team appropriately verified the initial event classification for the accidental criticality and was clearly aware of specific responsibilities for timely notification. Additionally, the EOC was sensitive to the need to protect site personnel, and EOC personnel monitored the status of protective actions that had been directed by the duty chief. Joint information center operations were quickly established and effectively executed, and news releases and news conferences were accurate and frequent. Furthermore, the rumor control process demonstrated during the exercise reflected exceptional recognition of the importance of identifying rumors and correcting them efficiently and effectively. Lastly, in most cases, responders demonstrated effective communications on radios and telephones, and in briefings.

Several response weaknesses in the areas of protective actions, communications, and consequence assessment reduced the overall effectiveness of ERO performance. During the hazardous chemical spill, the duty chief did not formulate protective actions and PARs in accordance with emergency response procedures. Although a protective action distance of 190 meters was required by the applicable emergency action level, the duty chief directed shelter-in-place downwind one mile, which took the protective action to the site boundary. This decision was inappropriately based on past training that emphasized using information appearing in the "emergency planning zone" column on the emergency action level summary page. Furthermore, although protective action implementation is an emergency director responsibility after EOC activation, EOC staff did not ensure proper use of the protective action process specified in the protective action response procedure. One impact of the overly conservative nature of the protective actions was that some ES&H team members were impeded in responding to the scene of the hazardous chemical spill, and the ambulance that was transporting a victim of the postulated criticality event to an offsite hospital was delayed. Additionally, some confusion was noted in the EOC regarding responsibility for the initial classification of a second event if the EOC is already operational.

Response to the hazardous chemical spill by ES&H personnel at the scene was inconsistent with actions required by emergency response procedures and

training. Prior to arrival of the fire department, poor command and control and communication errors with the EOC and the duty chief resulted in establishing an inadequate isolation zone, transmitting inaccurate information on the identity of the spilled chemical, and improperly entering the isolation zone. The ES&H response team established a 30-foot isolation zone based on olfactory detection, which was contrary to directions from the duty chief to establish a 100-meter isolation zone and the response procedure for protective actions (EPIP-71). Furthermore, traffic was allowed to continue through the isolation zone for 16 minutes after it was established. ES&H technicians were directed by the acting ES&H incident controller to mitigate the spill, contrary to the defensive posture required by site procedures, hazardous waste operations training (HS 9100), and direction from the duty chief. Other response weaknesses by ES&H personnel at the scene include not developing the required re-entry plan before two ES&H technicians in level B personal protective equipment entered the isolation zone, and not establishing a backup re-entry team with sufficient supporting equipment. In response to the identified performance deficiencies, LLNL management issued a memo during the course of the inspection clarifying ES&H team responsibilities in the first responder role to maintain a defensive posture. To some extent, confusion at the scene of the hazardous chemical spill can be attributed to circumvention of the laboratory emergency duty officer liaison by EOC personnel and a series of handoffs between ES&H responders as more senior individuals arrived.

Consequence assessments were not consistently accurate or effectively utilized. During the criticality event, the consequence assessment team lead performed a plume projection without first verifying the correct material at risk and also selected an incorrect source term file, which resulted in conflicting data being produced in the hazards control department operational support center and by the consequence assessment team modeler. This discrepancy was never reconciled during the exercise and was incorrectly attributed to the use of two different versions of HOTSPOT. During assessment of the transportation hazardous chemical spill, the consequence assessment team modeler did not input the correct air temperature in the initial plume projection for the material at risk, resulting in a non-conservative plume prediction and a classification recommendation for a site area emergency. This was subsequently corrected by the modeler; based on the spill location, it should have resulted in a recommendation for a general emergency classification.

However, the consequence assessment team lead did not act on the corrected plume projection.

To summarize, the laboratory's annual exercise was designed to challenge the site ERO's ability to manage two overlapping operational emergencies and, in particular, to test the first response ability of an ES&H team. LLNL demonstrated the ability to adequately plan for the exercise and prepare an exercise package that addresses the expected topical areas. Additionally, emergency response personnel demonstrated a number of improvements in emergency response. Emergency responders from the fire department and the Superblock facility demonstrated effective command and control, use of the incident command system, and implementation of protective actions for an inadvertent criticality. With a few exceptions, the EOC team provided the expected support to the duty chief and other local responders, and EPI personnel provided effective communications to offsite stakeholders. Nonetheless, a number of weaknesses in exercise planning, conduct, and performance were observed. The design of the hazardous material spill portion of the scenario contained several defects, evaluation objectives and criteria did not consistently promote critical evaluations, and the scenario was too similar to other recent drills and exercises. The exercise was limited in its effectiveness by the insertion of message injects at points when continued free play would have led to additional observations of player response, and immediate follow-up actions after the exercise were not always sufficient to provide useful feedback. Finally, actions taken by ES&H personnel at the scene of the hazardous chemical spill were inconsistent with direction given by the duty chief and actions required by site emergency response procedures and training. Protective actions and PARs for the chemical spill were not formulated in accordance with procedural requirements or properly verified by EOC personnel, and consequence assessment analyses were not always accurate or useful in supporting ERO decision-makers.

#### **D.2.4 Emergency Public Information**

The 2002 OA inspection determined that LLNL and the Oakland Operations Office, LSO's predecessor, had not implemented an integrated set of fully developed EPI plans and procedures that would ensure that timely and accurate information would be effectively communicated to site workers and the public during rapidly developing events. Since that inspection, LSO and LLNL have developed and tested a well-conceived,

integrated, documented, and comprehensive EPI program.

The EPI plan effectively describes the development of information in the EOC and activation and operation of the public affairs operations support center and the joint information center. The news release approval process is well considered and in most cases appropriately detailed, and it includes a memorandum of agreement (MOA) between LSO and LLNL regarding the initial release of information. The plan also includes pre-approved templates for subsequent news releases and an appropriate set of roles and responsibilities and position-specific response checklists for EPI staff in the EOC, public affairs operational support center, and the joint information center. Furthermore, during the exercise, the OA inspection team observed several particularly noteworthy strengths; these are discussed in more detail in Section D.2.3 above.

However, the EPI plan and procedures and the two site emergency plans (i.e., main site and Site 300) contain potentially confusing, and in some cases inconsistent, guidance regarding the authority and timing of the initial release of information. In response to this issue, the LSO public affairs officer has developed standardized language, consistent with DOE expectation for issuance of the initial news release within one hour of event occurrence, to be included in each of the site emergency plans. Additionally, EPI procedures delineating the rumor control process lack specific mechanisms of implementation.

To summarize, LSO and LLNL have developed a well-conceived, integrated, and comprehensive EPI concept of operations that was successfully demonstrated during the exercise. A few areas within the EPI plan and the associated implementing procedures require further detail, but overall, the site's EPI program is well documented and effectively implemented.

### D.3 Conclusions

Since the previous OA inspection, LLNL has completed many improvements in the training, drill, and exercise program, including a comprehensive set of implementing procedures that establish the required program elements and define LLNL's expectations. The training and drills procedure provides the basic framework for a performance-based training program, and the procedure governing the exercise program provides a sound basis for an effective program. LLNL

has implemented training that provides ERO members with basic instruction in nine fundamental response areas, and the drill program provides many opportunities to conduct training and practice skills. Furthermore, LLNL has gained the experience associated with planning and conducting four annual exercises. In the EPI area, LLNL and LSO have greatly improved their ability to respond to public information needs during a significant event by developing a comprehensive EPI plan and supporting procedures. The effectiveness of this program in providing timely and accurate information to the media and public was demonstrated during the annual exercise. However, the training, drill, and exercise program has not been fully implemented, and some weaknesses hamper its effectiveness. Position-specific training for ERO members has not been developed, and effective processes for maintaining the quality of training materials and identifying and removing personnel who have not met training, drill, and exercise requirements from the ERO roster have not been established. While the drill program is effective in some areas, such as evacuation and accountability drills, some other areas, such as facility drills for facilities with hazardous materials, are not yet effectively implemented. Also, the effectiveness of the exercise program has been limited by some observed weaknesses, such as the similarity of scenarios from year to year and the use of objectives, criteria, and follow-up techniques that do not promote critical analysis and identification of potential performance improvements. Finally, the drill and exercise programs have not been used effectively to identify and correct such emergency management program weaknesses as the lack of responder knowledge regarding determination of protective actions. Because of the integrated nature of the training program, the drill and exercise programs, and controller/evaluator and player performance during the exercise, OA has assigned one rating to the areas encompassed by the applicable sections in this appendix.

### D.4 Ratings

A rating of NEEDS IMPROVEMENT is assigned to the area of training, drills, and exercises.

A rating of EFFECTIVE PERFORMANCE is assigned to the area of emergency public information.

## D.5 Opportunities for Improvement

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible NNSA and contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic emergency management objectives.

### Livermore Site Office and Lawrence Livermore National Laboratory

- Improve the timeliness of the initial and subsequent news releases. Specific actions to consider include:
  - Review the EPI plan and implementing procedures to ensure that they are consistent with the MOA between the LSO and LLNL public affairs organizations regarding the initial release of information.
  - Ensure that each of the site emergency plans includes the wording found in the LSO and LLNL public affairs MOA regarding the news release approval process established in the EPI plan.
  - Review all procedures for individuals with news release responsibilities (e.g., EPIP-111 Appendix A, *Emergency Director*, and Appendix D, *PA Liaison*) to ensure that those responsibilities are clearly defined and consistent with the MOA.
- Improve the rumor control process by documenting the roles and responsibilities of the administrative supervisor in the joint information center. Consider including this role and the corresponding implementing mechanisms in all procedures that address this position.

### Lawrence Livermore National Laboratory

- Consider enhancing the level of detail in the ERO training lesson plans to improve repeatability and ensure consistent quality of instruction.

- Revise lesson plan objectives and content to specify procedure sections and key concepts to cover during the lesson.
  - Include detailed information for practice exercises in lesson plans (e.g., the four practice exercises in EM-9002) to ensure that they are performed correctly per procedure and site expectations, and to lessen the workload on the instructor.
  - Provide structure for tabletop exercises similar to drills to ensure that the desired results are obtained and that areas for improvement are captured.
- Consider expanding the number of questions available for initial training examinations to allow rotation of test questions and trending of test results so that mastery of the subject matter is more easily determined.
  - Consider enhancing the remediation process outlined in EPIP-123 by requiring that line supervisors be made aware of performance weaknesses and requiring re-examination after completion of remedial training.
  - Consider tracking student feedback regarding course improvements to ensure that suggestions are captured and addressed. Currently, student feedback is collected and entered into a tracking system used to evaluate instructor effectiveness; however, students' suggestions for course improvements are not used to improve the training materials.
  - Strengthen the drill and exercise program development and administration process and procedures. Specific actions to consider include:
    - Describe the responsibilities for the emergency preparedness drill and exercise committee.
    - Define the review and approval authorities of drill packages.
    - Describe the method for placing and releasing administrative holds on exercises, and the authority to do so.

- Define specific records to be retained.
- Describe how the emergency preparedness training and drill specialist and the exercise committee are to use evaluators’ records in their analysis to identify lessons learned.
- Clarify the applicability of emergency response procedures to responders across LLNL. Where possible, broaden the scope of these procedures to minimize the need for redundant documents and ensure a consistent response from different responder disciplines.
- Enhance the design and usefulness of drill and exercise scenarios. Specific actions to consider include:
  - Ensure that established procedure requirements are used when developing expected responses to scenario conditions.
  - Ensure that such scenario conditions as material quantities, packaging, and transport practices and units of measurement are consistent with operational practices.
  - Provide more diversity from year to year by targeting facilities and materials that are less frequently subjected to drills and exercises to ensure that all aspects of the emergency action levels are reviewed and exercised.
  - Minimize the use of pre-determined data, such as weather conditions and consequence assessment data, and instead use the data obtained and developed by players. This approach will help minimize confusion and allow operation of equipment for gathering meteorological data.
- Enhance the quality and usefulness of data collected during drills and exercise. Specific actions to consider include:
  - Better control the use of injects for drill control to ensure that player performance is accurately captured and evaluated.
  - Develop evaluation criteria that are specific both to the drill and to the observed venue,

rather than “in accordance with procedure.” This will improve the evaluators’ ability to determine player and program performance.

- Encourage evaluators to conduct follow-up discussions with players after the exercise is terminated to ensure that player actions (or inactions) are fully understood.
- Remove the “not observed” category from the evaluator checklists or require the evaluator to provide a record to explain this selection to ensure that all evaluation criteria are either evaluated or listed as not applicable.
- Shortly after each exercise, solicit specific feedback from evaluators regarding the ease of use of their evaluation criteria so that future data collection activities can be more effective.
- Reduce the time allowed for completing exercise evaluation records to minimize evaluators’ difficulties in recalling specific performance and evaluation details.
- Provide more specificity in the evaluation criteria to aid in performance evaluation. For example, if the players are expected to form an isolation zone around a hazardous material spill, specify the standoff distance in the body of the associated evaluation criterion.
- Provide more clarity in the evaluation criteria so that evaluators can understand exactly what activity is to be observed and reported on. For example, instead of using such general terms as “event mitigation,” clearly indicate whether a criterion is met through *determination* of the correct protective action(s) or by *demonstration* of protective action implementation.
- Enhance the overall quality and usability of exercise packages. Specific actions to consider include:
  - Ensure that each page in the package is numbered in accordance with a package index and includes a revision number to help users find a particular section and determine whether the package is complete and current.

- Delete obsolete acronyms and old references from past exercises that no longer pertain.

- Make available electronic copies of the exercise package for ease of distribution and to allow word searching for ease of revision.

# APPENDIX E

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## READINESS ASSURANCE

### E.1 Introduction

Emergency management program administration includes elements of readiness assurance as well as performance of some planning and response functions. Readiness assurance activities ensure that emergency management program plans, procedures, and resources of the Livermore Site Office (LSO) and Lawrence Livermore National Laboratory (LLNL) will facilitate an effective response to an emergency at the site. Site readiness assurance activities include implementation by both LSO and LLNL of a coordinated schedule of program evaluations, appraisals, and assessments and the effective use of issues management systems to affect program improvement. Key elements of the readiness assurance program include the active involvement of National Nuclear Security Administration (NNSA) line organizations in monitoring program effectiveness; implementing self-assessment programs; and ensuring that timely corrective actions for identified weaknesses are identified, implemented, and appropriately closed. NNSA field elements also have direct responsibility for performing some emergency response activities, including oversight of the site's emergency response and activities related to the release of emergency public information to site workers and the public.

As a follow-up to the June 2002 inspection conducted by the U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA), this inspection examined the processes by which LSO provides guidance and direction to and maintains operational awareness of the LLNL emergency management program. The inspection included a review of LSO emergency management program assessment processes, selected aspects of the LSO training and qualification program for emergency response organization (ERO) staff, and the status of actions taken to address findings identified in the previous OA inspection. The inspection also included a review of the LLNL emergency management self-assessment and issues management processes.

### E.2 Status and Results

#### E.2.1 NNSA Line Program Management

The June 2002 OA inspection determined that the Oakland Operations Office (OAK), LSO's predecessor organization, was actively engaged in providing line management oversight of the site's emergency management program through a variety of operational awareness activities. Those activities had been identified and scheduled through a comprehensive program management plan developed to dovetail with the LLNL upgrade project. However, OAK resource constraints and the aggressive deliverable schedule limited the effectiveness of OAK emergency preparedness staff in conducting the necessary array of operational awareness activities and providing real-time feedback to LLNL emergency preparedness staff. This inspection revealed that LSO continues to provide effective oversight of the LLNL's emergency management program.

LSO implementing procedures assign roles and responsibilities and direct the processes for conducting line management oversight of the LLNL emergency management program. LSO emergency management oversight activities are further governed by project management and assessment management plans that provide a thorough set of expected oversight activities and a related set of assessment criteria. LSO procedures also assign responsibilities and govern the actions for managing identified issues and verifying and validating corrective actions. The LSO emergency management program manager uses the Functional Information on Safety, Health and the Environment database to document oversight activities and track the status of open issues. Entries in this database are comprehensive and provide the information necessary to analyze emergency preparedness oversight activities and maintain issue status until closure.

Since the 2002 OA inspection, LLNL has constructed a new emergency operations center. Some LSO emergency response positions have been moved to the new center, although the communications equipment and the related communicator position remain in the emergency communications center. Significantly increased co-location of LSO and LLNL

emergency response positions represents a marked improvement in LSO's ability to fulfill its emergency event responsibilities. LSO staffs five positions in the ERO, and an LSO procedure provides roles and responsibilities for those ERO members, along with implementing checklists. LSO has developed a training program and associated matrix for fully qualifying ERO members; however, the training and qualification program for ERO members contains only minimal position-specific training and performance-based demonstration of proficiency.

In addition to fulfilling its emergency event responsibilities, LSO is actively engaged in oversight of the LLNL emergency management program and is well supported by the NNSA Office of Emergency Operations (NA-40). LSO has evaluated drills and exercises and reviewed significant numbers of such programmatic and planning documents as the emergency plan, emergency plan implementing procedures, and emergency planning hazards assessments. LSO managers are engaged in regular meetings with responsible LLNL managers to discuss the status of actions and issues affecting the LLNL emergency preparedness program. Furthermore, LSO has been active in tracking completion and verifying closure of corrective actions from the June 2002 OA inspection, and information in the LSO evidence packages is thorough and comprehensive. Notably, in early 2005, LSO re-opened an environment, safety, and health (ES&H) finding (related to the comprehensive identification and resolution of past issues) because the emergency management portion was not effectively completed. The NNSA Office of Emergency Management Implementation (NA-43) provides support to LSO through routine communications, participation in the evaluation of annual exercises, and review of emergency management program documents. In addition, NA-43 provided significant support to LSO and LLNL in fiscal year 2004 by facilitating an emergency planning hazards assessment technical assistance visit, executing a no-notice exercise, and delivering an exercise planning training course.

To ensure that the annual LLNL emergency readiness assurance plan (ERAP) meets the expectations of the responsible managers, both NA-43 and LSO personnel have provided guidance to LLNL as part of the preparation process, and have reviewed and commented in detail on LLNL's submittal. LSO has appropriately used the ERAP to define expectations for emergency management program improvements, and during the current fiscal year, the schedule of expected improvement actions is included in the ERAP.

Many, but not all, of the LSO oversight activities are tied to LLNL's commitments in the ERAP. LSO has also performed formal functional area assessments of training, readiness assurance, and program administration during the previous two fiscal years, and plans to perform functional assessments of two areas during the current fiscal year. However, LSO has not assessed all of the functional areas of the LLNL emergency management program over the last three-year period.

LSO has included the emergency management program in the contractual performance measures that are contained in Appendix F of the University of California management contract, and emergency management performance is included in the criteria. Performance is reported regularly to LSO (and LLNL) managers, and early in 2004, LSO provided early warning of the potential for an unsatisfactory rating in 2004, which was subsequently confirmed in the annual performance rating. In response, LLNL initiated significant changes in the emergency management function, including the reorganization of the emergency programs organization, addition of new managers and personnel, revisions in procedures, and implementation of new management tools.

To summarize, LSO has established and implemented a comprehensive set of procedures governing its responsibilities for oversight and participation in the LLNL emergency preparedness program. In addition, the site office has received significant oversight support from NA-40. The LSO emergency preparedness program manager has prepared assessment management plans, including detailed assessment criteria in the most recent plan, and has coordinated these plans with the laboratory's emergency management program improvement activities. Readiness assurance activities, such as functional assessments and exercises, have also been utilized to provide feedback on LLNL performance. LSO has effectively followed the completion and closeout of corrective actions for identified deficiencies, particularly those associated with the previous OA inspection, and has demonstrated its willingness to re-open action items when the corrective actions could not be successfully validated. As result of these activities, LSO is cognizant of the issues identified by the OA team, although in a few instances, such as ERO training, LSO did not fully appreciate the extent of the weakness. In addition, LSO has utilized contract performance measures to underscore the importance of emergency management and to engage laboratory managers in addressing program shortfalls. However,

LSO has not formally assessed all of the emergency management functional areas at the required frequency. Additionally, the LSO training program does not include position-specific training and demonstrations of proficiency.

## E.2.2 LLNL Feedback and Improvement

The June 2002 OA inspection determined that LLNL was making progress in improving the emergency management program through implementation of OAK-driven program upgrade initiatives. LLNL had made some initial progress in developing an adequate set of emergency planning hazards assessments and had enhanced the staffing and expertise of the emergency programs organization. However, numerous instances were noted where weaknesses previously identified during self-assessment activities and past OA appraisals were either not captured or not effectively resolved. In addition, certain weaknesses in some of the program implementing procedures indicated that the quality control processes were not adequate to ensure that the acceptance criteria were consistently satisfied. Since then, LLNL has restructured the emergency programs organization to provide it with higher visibility and authority, has initiated changes to the LLNL feedback and improvement processes and their supporting tools, and has completed most corrective actions resulting from the June 2002 OA inspection. However, these actions have only been recently implemented. Consequently, progress in establishing an effective readiness assurance function for emergency preparedness has been limited, and weaknesses are evident in most components of the overall LLNL feedback and improvement process.

As described in Section E.2.1, a number of significant changes were made in the emergency preparedness program following the mid-year review of the 2004 Appendix F performance measures. The reorganization of the emergency programs organization and the addition of new managers have had high visibility within the safety and environmental protection directorate and LLNL as a whole. For instance, the directorate's associate director meets regularly with the responsible emergency programs managers. Additionally, LLNL has reevaluated the roles and responsibilities of the emergency preparedness management council and recently revised its charter with goals to facilitate higher-level, strategic direction to the program and improve ownership of issues and corrective actions. The new managers have taken action to identify and prioritize the significant number

of issues and initiatives to be included in the path forward, analyze the organization's processes in an effort to identify potential organizational improvements, and develop the management tools necessary for tracking the resulting actions. Though not yet complete, this effort should afford LLNL a better understanding of the complete path forward and improved management processes for overseeing the effort.

LLNL has plans and procedures that, with some exceptions, provide an appropriate degree of site-level guidance and direction for the emergency preparedness readiness assurance program. In particular, the LLNL ES&H manual establishes requirements for the performance of self-assessments and the identification and correction of issues affecting performance. The LLNL emergency plan addresses the appropriate readiness assurance activities, including performing annual assessments, preparing the emergency readiness assurance plan, identifying corrective actions in the exercise program, and tracking and closing issues. The self-assessment plan for the safety and environmental protection directorate also includes the requirement for an annual assessment of emergency preparedness. Finally, LLNL has an emergency plan implementing procedure that contains various instructions governing self-assessments and using the emergency preparedness tracking system, although this procedure lacks detailed, specific direction for performing self-assessments.

Program self-assessments are another feedback and improvement component. As required by LLNL programs and procedures, LLNL has conducted annual self-assessments of the emergency management functions. These self-assessments have been, with a few exceptions, rigorous and critical, but they lacked defined evaluation criteria, and weaknesses identified during the assessments have not been systematically captured, addressed, or tracked to closure. Additionally, the 2002 and 2003 self-assessments did not result in any identifiable corrective actions. Moreover, corrective actions for the 2004 self-assessment, which was completed in September 2004 and identified many areas of recurring weaknesses from the previous self-assessments, were only recently entered into the issues tracking system. As a result, a number of longstanding weaknesses remain open, and many of the corrective actions have been assigned estimated completion dates in 2006.

The drill and exercise program is also expected to be used to foster program improvement. As discussed in Appendix D of this report, LLNL has implemented a drill and exercise program that, in part, is expected to

identify the corrective actions necessary to achieve continuous improvement in LLNL's ability to respond to emergencies. However, this inspection found that weaknesses and deficiencies identified during exercises have not been addressed by the timely preparation and implementation of corrective actions. For example, corrective actions for the fiscal year 2004 annual exercise, which was conducted in March 2004, have only recently been entered into the issues tracking system. Similarly, delays in completing after-action reports and identifying corrective actions were observed for the no-notice exercise completed in July 2004 and the county-wide exercise conducted in September 2004.

Subsequent to the 2002 OA inspection, LLNL initiated improvements to address shortcomings related to issues management. In particular, to provide an institutional and directorate issues management tool, LLNL developed and, in September 2004, implemented the information tracking system (ITS). The Safety and Environmental Protection Directorate also prepared a sitewide procedure governing the development and management of institutional corrective action plans. Implementation of these new processes for developing corrective action plans and managing issues using the ITS database has been delayed, primarily because of the need to make additional decisions regarding the level of issues to be entered at the institutional and directorate levels and whether the use of local tracking systems should continue. In addition, the emergency programs organization has experienced significant difficulties in entering and retrieving data from the system. As a consequence, approved corrective action plans and/or corrective actions for some emergency preparedness-related weaknesses have not, or have only recently, been entered into the system. These include the recently re-opened corrective actions related to the 2002 OA inspection, as well as the corrective actions noted above. Furthermore, actions related to past and current commitments made to LSO and corrective actions related to drills and exercises that would not be included in the institutional or directorate levels are not currently included in any tracking system.

Since the June 2002 OA inspection, LLNL has completed and implemented most corrective actions resulting from the identified findings. However, one corrective action, involving an OA ES&H finding (which required a review of the deficiencies identified in institutional and external audits and assessment from calendar year 1999 forward), was not adequately

addressed and closed. Verification and validation activities performed in early 2005 for the corrective action plan for this finding revealed that there was insufficient evidence to support closeout because some issues related to emergency management had not been resolved. Additional corrective actions were determined to be necessary, and these actions are not scheduled for completion until September 2005. The overall impact is that after a significant length of time, a number of corrective actions related to the 2002 OA inspection remain open.

**Finding #6: LLNL has not established an effective readiness assurance program that consistently identifies and addresses weaknesses in the emergency management program and implements timely corrective actions, as required by DOE Order 151.1B and DOE Order 414.1B, *Quality Assurance*.**

Finally, a longstanding weakness regarding the utilization and effectiveness of shelter-in-place protective actions remains unresolved. A finding from the 1999 OA inspection identified in part that emergency response procedures did not provide adequate guidance regarding protective actions. At the time, the default protective action was to evacuate LLNL blocks based on the footprint of the release. An investigative effort was under way in 1999 to determine the appropriate protective action response based upon building-specific factors, such as ventilation exchange rates and the ability to shut down ventilation systems in a timely manner. Currently, shelter-in-place is the default site protective action, and although general employee training is silent on the handling of ventilation systems, the protective action implementing procedure instructs sheltering personnel to close doors and windows and secure ventilation systems, if practical. However, the study referred to in 1999 was never completed; new studies are under way, but no milestone or issues management tracking item exists for their completion. Additionally, drill packages provide no evidence that facility personnel have ever been evaluated on their ability to implement shelter-in-place protective actions, although LLNL indicated that some actions are practiced. LLNL further indicated that not practicing the full shelter-in-place response, including manipulating ventilation systems, is intentional because there is uncertainty regarding the appropriateness of securing ventilation systems for buildings on site. Given the clear expectations documented in the protective action

implementing procedure, the policy of not practicing the full facility sheltering response is inconsistent with the concept of procedural adherence.

**Finding #7: LLNL has not determined all actions that must be taken by building occupants to effectively implement shelter-in-place protective actions, as required by DOE Order 151.1B.**

To summarize, LLNL has continued to make progress in improving the laboratory's emergency management program, has administrative procedures in place to address readiness assurance, and has continued to perform annual self-assessments of the program. The laboratory has implemented most of the corrective actions related to the previous OA inspection. In response to the LSO performance measure evaluation of emergency preparedness, LLNL has taken additional steps to improve the management, performance, and visibility of the emergency programs organization, and following their assignment, new managers have made progress in identifying and managing the actions necessary to further improve the program. However, LLNL has not yet implemented an effective readiness assurance function for emergency preparedness. Although LLNL's institutional documents on self-assessment, issues management, and corrective actions provide the framework for these activities, the emergency programs organization procedures governing readiness assurance activities lack the specificity necessary to adequately guide those activities. Self-assessment activities and exercise after-action activities have not led to timely implementation of corrective actions, nor have changes to the issues tracking systems led to timely improvement in the ability to track and close corrective actions. Further, while most corrective actions to address OA findings from the previous inspection have been addressed, the lack of an effective initial review of previous corrective actions led to the re-opening of one of the corrective actions and the accompanying development of an additional corrective action plan and extended completion date. Lastly, a concern regarding the ability of site personnel to effectively shelter in place, despite its designation as the default protective action, remains unresolved six years after being raised by OA.

### E.3 Conclusions

LSO continues to provide close, appropriate oversight of and direction to the LLNL emergency preparedness program and, as a result, had recognized

nearly all of the issues identified by the OA inspection team. LSO personnel are routinely engaged in review of important program documents and observation of emergency preparedness drills and exercises. Through participation in such activities as exercises and site training assist visits, LSO has been well supported by NA-40 in providing both direction and guidance. Overall, LSO oversight has been important in communicating expectations and encouraging improvements in the LLNL emergency preparedness program, which has continued to show improvement. Recently, LLNL has taken steps to reorganize the emergency programs organization and to improve its standing within the laboratory. Newly assigned managers have taken steps to identify the issues and actions affecting the emergency programs organization and to improve the work management processes and readiness assurance activities. These efforts, while appropriate, are too recent to have materially influenced many of the issues affecting readiness assurance, and previously-identified weaknesses in the laboratory's feedback and improvement processes remain. Improvements in the ability to identify and address weaknesses and deficiencies have not been timely, and only recently have self-assessment and exercise results led to identifiable corrective actions. Additionally, planned improvements to the systems for managing issues and corrective actions have just begun to be useful. Ultimately, sustained improvement in emergency management readiness assurance will require the continued focus and commitment of laboratory management.

### E.4 Ratings

A rating of EFFECTIVE PERFORMANCE is assigned to the area of NNSA line program management.

A rating of NEEDS IMPROVEMENT is assigned to the area of LLNL feedback and improvement.

### E.5 Opportunities for Improvement

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible NNSA and contractor line management and prioritized and modified as

appropriate, in accordance with site-specific programmatic emergency management objectives.

### Livermore Site Office

- Consider developing a resource-loaded assessment plan in order to complete the required program assessments over a three-year cycle. Specific considerations should include:
  - Identify assessments needed to address each of the emergency management program functional areas for each site/facility over the three-year cycle.
  - Integrate functional assessments with internal and external assessments and evaluated exercises.
  - Balance document reviews with assessments of field implementation of the documents.
  - Identify the resources needed to complete the assessment plan, and for activities that require outside expertise, identify how that expertise will be obtained.
  - Include the updated assessment plan in the emergency readiness assurance plan.
- Improve the effectiveness of the training program for LSO ERO members. Specific actions to consider include:
  - Review the ERO positions and identify the critical knowledge and skills required to perform the position-specific functions.
  - Compare the required knowledge and skills to the existing training opportunities, and identify whether or not additional reading, classroom training, or performance-based training is required.
  - Prepare and conduct the appropriate training.
  - Conduct performance-based evaluations of the ERO members as part of the initial assignment and annual retraining of the ERO.

### Lawrence Livermore National Laboratory

- Enhance LLNL's issues management and corrective action processes. Specific actions to consider include:
  - Expedite completion of the process to identify and prioritize emergency preparedness program improvement and corrective actions, and establish effective work management tools and processes.
  - Ensure that corrective actions for findings and weaknesses identified by site assessment processes are integrated and tracked with corrective actions resulting from external assessments.
  - Ensure that all oral and ERAP commitments made to LSO are captured.
  - Implement processes to ensure that both LLNL and LSO managers are appropriately apprised of the status of improvement and corrective actions.
- Enhance the effectiveness of the LLNL self-assessment process. Specific actions to consider include:
  - Expedite the review and approval of the draft self-assessment plan.
  - Consider issuing the draft self-assessment plan as an interim plan and test its effectiveness during the fiscal year 2005 self-assessment.
  - Review DOE Order 151.1B and DOE Guide 151.1-1 and include the requirements and guidance for the 15 essential program elements from these documents as the basis for the self-assessment plan.