

**Office of Enterprise Assessments  
Assessment of Work Planning and Control at the  
Lawrence Livermore National Laboratory**



**June 2017**

**Office of Worker Safety and Health Assessments  
Office of Environment, Safety and Health Assessments  
Office of Enterprise Assessments  
U.S. Department of Energy**

**Table of Contents**

Acronyms ..... ii

Executive Summary ..... iii

1.0 Purpose ..... 1

2.0 Scope ..... 1

3.0 Background ..... 1

4.0 Methodology ..... 2

5.0 LLNS Work Planning and Control Improvement Initiative ..... 2

6.0 Work Planning and Control Implementation ..... 7

7.0 Feedback and Improvement and Oversight ..... 13

    7.1 LLNS Feedback and Improvement ..... 13

    7.2 Livermore Field Office Oversight ..... 16

8.0 Findings ..... 21

9.0 Opportunities for Improvement ..... 22

Appendix A: Supplemental Information ..... A-1

Appendix B: Key Documents Reviewed, Interviews, and Observations ..... B-1

Appendix C: Deficiencies ..... C-1

## ACRONYMS

CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
DES	Description Document
DOE	U.S. Department of Energy
DPO	Differing Professional Opinion
EA	Office of Enterprise Assessments
ECP	Employee Concerns Program
eIWS	Electronic Integrated Worksheet
EOC	Extent of Condition
ES&H	Environment, Safety, and Health
FR	Facility Representative
FY	Fiscal Year
HCP	Hazard Control Plan
HVAC	Heating, Ventilation and Air Conditioning
IH	Industrial Hygiene
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ITS	Issues Tracking System
IWS	Integration Worksheet
JFLMA	Joint Functional Area/Line Management Assessment
JHA	Job Hazard Analysis
JMAP	Joint Master Assessment Plan
LFO	Livermore Field Office
LIMS	Livermore Integrated Management System Manual
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
MAS	Management Assurance System
NIF	National Ignition Facility
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
OPEX	Operating Experience
PAT	Pre-Analyzed Task
PEMP	Performance and Evaluation Management Plan
PER	Performance Evaluation Report
PIR	Periodic Issues Report
PPE	Personal Protective Equipment
PRO	Procedure
RCRA	Resource Conservation and Recovery Act
RI	Responsible Individual
RRP	Room Responsible Person
SME	Subject Matter Expert
SSO	Safety System Oversight
TQP	Technical Qualification Program
WCD	Work Control Document
WCI	Weapons and Complex Integration
WCRB	Work Control Review Board
WP&C	Work Planning and Control

**Office of Enterprise Assessments  
Assessment of Work Planning and Control at the  
Lawrence Livermore National Laboratory**

**EXECUTIVE SUMMARY**

The U.S. Department of Energy (DOE) Office of Worker Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of work planning and control (WP&C), and selected elements of the feedback and improvement program at the Lawrence Livermore National Laboratory (LLNL). EA also examined the DOE Livermore Field Office (LFO) WP&C oversight activities at LLNL. Lawrence Livermore National Security, LLC (LLNS) operates LLNL, and LFO provides Federal oversight. EA conducted this assessment January 23-26 and February 6-9, 2017.

This assessment focused on the potential effectiveness of the new LLNL WP&C program currently being instituted only within the three LLNL Directorates: Environment, Safety, and Health (ES&H); National Ignition Facility (NIF) & Photon Science; and Weapons and Complex Integration (WCI). Of the hundreds of work activities in the existing integration worksheet (IWS), at the time of this review, twenty activities have been completely transitioned to the new WP&C system utilizing the new WP&C tool.

**LLNS Work Planning and Control Improvement Initiative**

In 2013, LLNS embarked on a redesign of the existing IWS process which resulted from weaknesses identified in the LLNS extent of condition review of the 2013 Building 827 sulfuric acid accident and LLNS WP&C self-assessments conducted in 2012 and 2013, along with employee and supervisor feedback. Turnover of personnel (new hires and retirements) resulting in a loss of expertise was a secondary driver. The new WP&C system is a complete rebuild of the existing hazard based process to a new task based process, including implementation of a new computer-based WP&C tool. LLNS senior management has provided leadership and resource support for the redesign of the WP&C system, and continues to be directly engaged in the development and implementation.

The new WP&C process is promising and includes a number of significant enhancements appropriately targeted at the identified weaknesses. Implementation is at an early stage and much remains to be done. Overall, where applied, implementation of the new process has streamlined work documents and resolved a number of concerns with the existing process.

Early implementation of the new WP&C process also highlighted a few shortcomings such as the clarity of hazard control change or revision process, interface between the new and current system during transition, and linkage between and adherence to work documents. Engagement of line management to achieve buy-in, allocation of sufficient resources, and a detailed schedule with the remaining deliverables, assignments and timelines will be essential to ensure timely and enduring implementation.

LLNS management anticipates implementation for all new work activities by October 2017, along with each directorate developing a detailed multi-year transition plan to convert all existing work control documents to the new process. Not all WP&C procedures have been approved, and a number of implementation issues require resolution. LFO and the LLNS Corporate Office identified a concern with limited resources being applied, and recommended that LLNS better identify and apply the resources required to deploy, implement and sustain, and the need for communications regarding the new WP&C system.

## **LLNS Feedback and Improvement**

The LLNL contractor assurance system routinely collects, tracks, and trends performance data related to work processes. The lessons learned program is generally well organized and distributes lessons learned throughout the Laboratory.

LLNS has not developed overarching goals (what success looks like), objectives, and key metrics to assess its performance as it begins to analyze the results of implementation of the new WP&C process. The joint functional area/line management assessments include review of lessons learned, but they lack an activity-level review of the implementation of lessons learned during preparation or modification of work control documents. There is inconsistent worker involvement in development of the new work control documents and lessons learned actually used during initial work control document preparation or modification are not currently being documented.

## **LFO Oversight**

LFO has appropriate processes in place for Federal line oversight and is transitioning to an oversight methodology that is integrated with the Laboratory's oversight processes, including assessment planning and performance, and issues tracking. In addition, LFO has a well-qualified and technically competent staff, and for the most part, has implemented an effective Facility Representative program. LFO has demonstrated a strong commitment to improving WP&C, including assigning a WP&C lead. The WP&C lead actively oversees the implementation of the new institutional WP&C process, including developing key outcomes for the award fee process. Some concerns with LFO oversight include discrepancies in the LFO Differing Professional Opinion procedure and with the LFO oversight procedures, and the lack of approval of the LLNS CAS description document.

## **Recommendations**

EA recommends LLNS consider the following to facilitate timely and enduring implementation of the new WP&C process;

- Developing a resource-loaded schedule for timely implementation of the new WP&C process across the Laboratory.
- Developing a formal Communications Plan to include;
  - a strategy to engage senior management to obtain their buy-in of the new process, and to share the added value and lessons learned in the implementation process.
  - a strategy to obtain buy-in from employees and line management in all LLNL Directorates of the new process.
- Developing a strategy to ensure the WP&C process contributes to capturing knowledge base (informal processes, feedback, and lessons learned) related to specific activities.

**Office of Enterprise Assessments**  
**Assessment of Work Planning and Control at the**  
**Lawrence Livermore National Laboratory**

## **1.0 PURPOSE**

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the new work planning and control (WP&C) process, selected elements of the feedback and improvement programs, and DOE Livermore Field Office (LFO) oversight activities at the Lawrence Livermore National Laboratory (LLNL). The onsite portions of this review were conducted January 23-26 and February 6-9, 2017.

EA performed this independent assessment at LLNL in consideration of the Deputy Secretary's response to the Defense Nuclear Facilities Safety Board (DNFSB) letter and technical report (DNFSB/Tech-37) that included, in part, a commitment to enhance Federal oversight of activity-level WP&C. Additionally, the WP&C program assessment is within the broader context of EA's targeted assessments of programs at DOE sites that have high-consequence activities or whose performance may present significant risks in accordance with DOE Order 227.1A, *Independent Oversight Program*.

## **2.0 SCOPE**

EA conducted this assessment in accordance with the *Plan for the Office of Enterprise Assessments Assessment of Work Planning and Control Program at the Lawrence Livermore National Laboratory*, January - February 2017. This assessment evaluates the implementation of the new WP&C program at three LLNL Directorates: Environment, Safety, and Health (ES&H); National Ignition Facility (NIF) & Photon Science; and Weapons and Complex Integration (WCI). This assessment also includes evaluation of elements of the Lawrence Livermore National Security, LLC (LLNS) feedback and improvement program, as well as the DOE National Nuclear Security Administration (NNSA) LFO processes for oversight pertaining to WP&C activities.

## **3.0 BACKGROUND**

During 2012 and 2013, a number of WP&C issues had been identified by LLNS management, staff and workers as a result of the LLNS extent of condition report from the 2013 Building 827 sulfuric acid accident, internal safety culture reviews, WP&C self-assessments (conducted in 2012 and 2013), Work Control Review Board (WCRB) worker input teams, and feedback from the LLNS training working group. Collectively, these inputs and reviews, concurred that the existing integrated work system (IWS) approach to WP&C was cumbersome, labor and paper intensive, not worker friendly, and not particularly helpful for getting work done in the field in the most efficient and safe manner. More specifically, the existing IWS process was hazard based and not-tasked based, had resulted in the implementation of different and inconsistent controls across the Directorates for the same hazards, and did not acknowledge workers' training and competency in work control documents. In parallel to these self-identified WP&C issues, new ideas with respect to WP&C from across the DOE complex were emerging and being consolidated by the Energy Facilities Contractor Group, leading to the publication of the current *DOE Work Planning and Control Handbook*. In 2013, as a result of these events, and the numerous self-identified WP&C issues, LLNS senior management provided leadership and resource support for the redesign of the WP&C system, and continues to be directly engaged in the development and implementation of the new WP&C process.

LLNL is located on a one-square-mile site east of Livermore, California. LLNL also operates a remote experimental test site, called Site 300, situated approximately 15 miles southeast of the main site. LLNS is the prime management and operating contractor at LLNL, and is a partnership of the University of California, Bechtel, Babcock & Wilcox, URS, and Battelle Memorial Institute, in affiliation with the Texas A&M University system. LFO provides Federal oversight of LLNS.

#### **4.0 METHODOLOGY**

EA implements the independent oversight program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. Organizations and programs within DOE use various terms to document specific assessment results. In this report, EA uses the terms “deficiencies, findings, and opportunities for improvement (OFIs)” as defined in DOE Order 227.1A. DOE line management and/or contractor organizations must develop and implement corrective action plans for deficiencies identified as findings. Other important inadequacies not meeting the criteria for a finding are also highlighted in this report and are summarized as deficiencies in Appendix C. These deficiencies should be addressed consistent with site-specific issues management procedures.

As identified in the assessment plan, this assessment considered requirements related to the new LLNL WP&C process, and includes work activities within the explosives program. The criteria guiding this assessment were based on selected objectives, criteria, and lines of inquiry associated with activity-level WP&C contained in DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, Appendix D, *Activity-Level Work Planning and Control Criterion Review and Approach Documents with Lines of Inquiry*.

In addition, EA collected and analyzed data on LFO oversight and LLNS feedback and improvement activities related to the new WP&C process, and used elements of CRAD 45-21, *Feedback and Continuous Improvement Assessment Criteria and Approach - DOE Field Element*, and selected criteria and lines of inquiry associated with activity-level WP&C contained in DOE Guide 226.1-2A.

EA examined key documents, such as work packages, procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs and observed research, programmatic, and explosive manufacturing work activities, along with routine meetings, such as plan of the day and briefings. The members of the EA assessment team, the Quality Review Board, and EA management responsible for this assessment are listed in Appendix A, Supplemental Information. The documents reviewed, personnel interviewed, and observations made during this assessment that are relevant to the findings and conclusions of this report are listed in Appendix B, Key Documents Reviewed, Interviews, and Observations. Appendix C provides details about deficiencies. Overall, the EA assessment of the new LLNS WP&C program, and its early implementation in three LLNS Directorates, is provided in Sections 5.0 and 6.0 respectively, whereas Section 7.0 provides EA’s assessment of the effectiveness of both LLNS and LFO oversight of the new WP&C program.

#### **5.0 LLNS WORK PLANNING AND CONTROL IMPROVEMENT INITIATIVE**

*Objective:*

*The Organization has developed and approved WP&C processes to enable safe performance of work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-1) (Criteria #3 and 6)*

*The Organization has established a management and organizational framework for (1) initiating,*

*analyzing, planning, and approving activity level work and (2) authorizing, releasing, and safely performing activity level work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-4) (Criterion #5)*

The new LLNS WP&C process is described in LLNL Procedures DES-2012, *The LLNL Work Planning and Control Program*; POL-2010, *Work Planning and Control Policy*; and supporting procedures. The new WP&C process is a significant departure from the existing IWS process, and addresses the lessons learned from the Building 827 sulfuric acid accident, and a number of WP&C self-identified issues discussed in Section 3.0 as well as incorporates the good practices identified in the *DOE Work Planning and Control Handbook*, and its predecessor documents. The new WP&C process generates four types of work control documents (WCDs): a work permit for non-routine work activities; a work procedure for ongoing work activities where the sequence of the work steps is critical; a hazard control plan (HCP) for ongoing work for which a bounding work control document is appropriate; and a competent worker job hazard analysis (JHA) for work activities fitting completely within a competent worker program. All four types of WCDs are generated using a new WP&C Tool. Under the new WP&C process, all work performed at LLNL fits into one of five approval levels (ALs). The cornerstones of the new WP&C process, which are departures from the existing IWS process, include a restructured hazard analysis process, pre-analyzed tasks (PATs), competent worker qualifications, designated work planners and a work planner training and qualification process, and a new computer-based work planning tool. Each of these is discussed below.

As discussed in Section 3.0, an area of self-identified criticism of the existing IWS system is that the document is arranged by hazards, rather than grouping hazards under tasks, resulting in hazards and controls that were often repetitive throughout the WCD, not clearly or concisely connected to work tasks, and difficult for the worker to implement. EA concludes that the change in the new WP&C (task based) to replace the existing IWS (hazard based) hazard matrix with a Job Hazard Analysis (JHA) will resolve a number of these issues. The JHA involves breaking the work activity into tasks, and associated steps as necessary, to support hazard evaluation. It also involves analyzing each task or step to identify potential hazards and determine controls to safely perform the work. All JHAs have a similar structure as defined in a new procedure PRO-2031, *Writing a Job Hazard Analysis*. JHAs are integral elements of each of the WCDs previously described. The new JHA process is a significant departure from the old hazard and control analysis documented in an IWS, and includes a number of positive and distinctive attributes. A primary distinction is that the new JHA process is task based, linking all potential hazards and necessary controls with an identified task. This new process of hazard identification is now performed as a team exercise with all pertinent subject matter experts (SMEs) present, in lieu of independent and sequential SME reviews and approvals which was characteristic of the existing IWS process. In addition, in the new hazard analysis process, all SMEs and responsible individuals (RIs) collectively prepare a JHA that integrates all of the hazards and controls, and presents to the worker one integrated or collective set of controls for the complete task in a JHA-familiar format, segmented by engineering, administrative, personal protective equipment (PPE), environmental, and training controls. For example, in the existing IWS process, the hazards and controls associated with “solvent wipe cleaning” are described in four separate sections of the IWS, and sometimes repeated in other IWS sections. Worker inhalation and dermal exposure hazards to solvents and identification of applicable exposure hazard controls were described in the “Chemical Hazard” section of the IWS. The potential flammability hazards, and associated controls, are addressed in the “Fire Protection” hazard matrix. The hazardous waste hazards and controls associated with the disposal of solvent wipes are addressed in the “Hazardous Waste” section, and the hazards and controls of the solvents in the wipes being a potential environmental pollutant was addressed in a separate section under “Air Emissions”. In the new JHA process there is one work task, “solvent wipe cleaning” and one consolidated description of potential hazards and controls for this work task that encompasses all of the above.

Another criticism of the IWS process expressed by LLNS workers was that WCDs created by the IWS



process were too voluminous, contained excessive detail on low risk hazards and controls for which the workers had been trained, and failed to accentuate the higher risk hazards and controls. EA observed that in the new WP&C process, the presentation of hazards and controls in a JHA is more worker-friendly, less duplicative, and more focused on the important hazards and controls, since routine hazards and controls addressed in worker training and qualifications are excluded from the JHA. For example, the JHA included in the HCP for “Calibration and Repair of Industrial Hygiene [IH] Equipment” includes a task for “Maintenance and Repair.” For this task, routine low-risk hazards, such as slips, trips, and falls in the laboratory are excluded from mention in the HCP since a pre-condition for performing this work is that workers complete the General Worker training, during which such training about routine low-risk hazards would have been provided. Another positive attribute of the new JHA process is that the JHA has been expanded to include additional work activity information that is pertinent to performing the work, such as work scope boundary conditions, pre-requisites, emergency and pre-approval actions, and pre-job talking points.

A complaint of the existing IWS that was shared by workers, safety and health SMEs, and those involved in work planning was that there were common work tasks across all LLNL Directorates, such as lead soldering, which required the generation of a new hazard analysis each time the same task was performed. Although the activity often remained unchanged, each time a hazard analysis was prepared there was a variation in hazard controls for the same set of hazards. In response to these complaints, LLNS implemented the Pre-analyzed Task process or PATs in the new WP&C program which EA found to be a reasonable solution. A PAT, which is described in the LLNL Procedure PRO-2033, *Creating Pre-Analyzed Tasks*, is a JHA for well-bounded, commonly performed tasks, for which institutionally consistent controls can be specified. A PAT received reviews and approvals by the appropriate SMEs, and are used by work planners across LLNL Directorates in the generation of new work control documents (e.g., HCPs) without further review and approval. Approximately 200 PATs have been approved, such as the PAT entitled “Solder Items on a Bench Top Using Electric Soldering Irons.” In most of the work activities observed by EA, one or more PATs were incorporated into HCPs, providing a consistency of hazard controls for the same work task. For tasks that do not have a PAT or present hazards that have been identified but are not discussed in the PAT, a new or customized PAT may be incorporated to address the new hazard. In general, the use of general hazard analyses and PATs streamlines the HCP by excluding commonly understood general hazards and controls, allows for the worker to focus on less familiar hazards through the use of PATs, and enables consistency of hazards and controls for the same work task when applied across all LLNL Directorates.

A frequent criticism of the IWS process identified by workers through safety culture surveys, internal WP&C self-assessments, and training work groups, was the inability of the IWS process to “credit” workers for their work experience, training and competency in performing certain work tasks. Workers often complained that the IWS work documents needlessly contained hazards and controls for some work activities for which they were well experienced and knowledgeable through their experience and training. In responding to this criticism, LLNS developed and implemented the competent worker qualification program in the new WP&C process which EA found to be a positive attribute. To ensure that workers possess the competency necessary to perform certain work tasks safely, the new work control process incorporates formal worker qualification programs that build upon the base knowledge of a general worker program and consist of training courses, required reading, and on-the-job training where the worker demonstrates the skills, knowledge, and ability to perform certain work tasks safely (e.g., HVAC mechanic). These competent worker programs focus on ES&H requirements and the safe performance of work, and complement the LLNL longstanding skill-of-the-craft programs that focus on technical qualifications and work experience for specific equipment or operation (e.g., qualification as a journeyman-level carpenter). Competent worker programs are aligned with the individual rather than the work activity, and competency is awarded through approval by a mentor. Requalification is required on an annual basis. Currently, a worker competency program has been developed for 26 crafts or trades (e.g.,

carpenter, HVAC mechanic) and 5 programmatic work areas. As of February 9, 2017, 350 workers have been qualified in one or more competencies. Work control documents involving competent workers are streamlined by not restating those hazards and controls for which a worker has been qualified and validated as knowledgeable, allowing competent workers to focus on unique hazards and controls that are not commonly performed within the competency discipline. Workers are required to complete a wide variety of tasks outlined on a qualification card to become a competent worker. Qualification requirements also include both formalized and on-the-job training, including relevant topics such as general worker safety, lockout/tagout, ladder worker, scissor and aerial lift, confined space entry, and fire extinguisher training. The rigor of worker qualifications for routine work at Site 300 has increased with the establishment of a new Site 300 competent worker qualification program in accordance with the new WP&C program. This competent worker qualification is required of all workers who permanently or routinely perform work at Site 300 and allows removal of common low-risk hazards and controls for this type of work from work control documents.

An issue identified in both the 2012 and 2013 LLNS WP&C assessments was the lack of a consistent approach to preparing WCDs, since work planning in the IWS process was being performed by many LLNS staff including: safety officers, facility safety staff, and RIs with minimal training in the LLNS IWS process. To address this deficiency, in the new WP&C process, LLNS developed the work planner concept to ensure that all individuals assigned to prepare WCDs were provided the same information concerning the new WP&C process and that all new WCDs would be prepared by a qualified work planner as defined in PRO-2021, *Managing the Work Planner Qualification Program*. In the new work control process, work planners are required to lead the WCD preparation team, and must be trained and qualified. LLNS developed a formal work planner training and qualification program, including required reading, training, briefings by LLNL SMEs, and mentored on-the-job training, which addresses the fundamental elements essential to successful work planning. Based on a limited sampling of WCDs, EA found the format and content of the WCDs reviewed to be consistent using the new WP&C process.

Feedback from individuals responsible for preparing IWS work documents, as well as LLNS, safety and health staff, indicated that the computer-based tool for preparing IWS's (i.e., the eIWS computer-based system) was not user friendly, allowed only "free text" data insertion with few drop down menus, and was based on an outdated Oracle platform that allowed few software changes. As a result, in order to implement the new work control process, LLNS developed a new computer-based "Work Planning and Control Tool" that provides necessary resources to the work planner and RI when planning work. The new WP&C tool has been designed to replace several legacy tools and is based on tasks and not hazards, whereas the existing electronic IWS (eIWS) tool requires the worker to piece together the hazards and controls that applied to a specific work task. The new tool incorporates useful elements of the existing eIWS, such as links to the LLNL training records system and listing of authorized workers, while adding new features including documenting the results of pre- and post-job reviews. A significant improvement with the new WP&C tool is that it was designed concurrently with the new WP&C procedures and work flow, and leads the work planner through the steps consistent with the LLNS policy and procedures on work planning. The new WP&C tool also has a "feedback tab" for anyone to use when providing operational feedback on work processes under development or currently being used. The tab also provides access to the status of actions taken regarding feedback items submitted, so that workers who have submitted feedback can view the outcome of their feedback. In addition, the new tool also features a "pre-job tab" that can include items such as lessons learned or feedback from workers for use during pre-job briefings. In observing the use of the new WP&C tool, EA found each of these new attributes to be beneficial to the work planning process.

Although the new WP&C process offers a number of improvements over the existing IWS process, it is in the early implementation stages and considerable challenges and work remains prior to full implementation. For example, of the 20 new WP&C procedures identified by LLNS, only 13 have been

issued. WP&C procedures yet to be developed include; scheduling and releasing work, planning facility and infrastructure work, planning subcontracted work, and completing the work screening process. Furthermore, only three LLNL Directorates have transitioned some work activities into the new WP&C system. More specifically, the NIF & Photon Science Directorate, while being one of the three Directorates actively in transition to the new WP&C process, has only transitioned 2 of 167 work activities into the new WP&C process. ES&H has 49 active IWS's, of which two have transitioned to the new WP&C process. The WCI 131 High Bay has 12 routine IWS work activities, of which two have transitioned to the new WP&C process. Although the LLNS new WP&C team has expanded from a staff of two in 2013 to nine at present, the magnitude of implementing this new WP&C process across all LLNL Directorates is significant. EA is concerned that with limited allocated resources, and an unclear level of implementation support from the LLNL Directorates, that meeting the LLNS implementation milestones of October 2017 for all new non-nuclear work activities is challenging, along with, developing a detailed transition plan to convert all existing work control documents to the new process. Concerns with progress on implementing the new WP&C process were also identified in the fiscal year (FY) 2016 LFO *Performance Evaluation Report*, where LFO notes that "LLNS remains challenged by the need for additional resources and funding to achieve successful implementation of the new process." Similarly, a WP&C review conducted by the LLNS Corporate Office in September 2016 identified a concern with limited resources, recommending that LLNS better identify the resources required from the various LLNL Directorates to implement the new WP&C system. A resource loaded implementation schedule for completing this task has not been developed and is needed. However, a diversion of the limited WP&C staff resources to prepare such a schedule may be counterproductive. LLNS Functional Management Review report of September 2016 also identified the need for a consistent, sustainable commitment by senior management that would then be communicated, flowed down to, and fully understood by all levels of the organization. (See OFI-LLNS-WPC-01.)

### **Work Planning and Control Improvement Initiative Conclusion**

As a result of the lessons learned from the Building 827 sulfuric acid accident, along with a significant number of concerns in the existing IWS process expressed in 2012 and 2013 by workers, safety and health staff, and line management through assessments, safety culture surveys, WCRB and training group worker input teams; in 2013 LLNS senior management directed that a new WP&C system be developed and implemented. In the subsequent years, LLNS has been developing a new WP&C process which is now being implemented in three LLNL Directorates for a limited number of existing work activities. The development of the new WP&C process has focused on resolving the myriad of concerns previously expressed by workers, safety and health staff and line management; and has resulted in a new work control process that is more efficient, worker centered, task-based and will provide greater consistency across the LLNL Directorates. LLNS has introduced positive changes in the work control process particularly with respect to the hazard analysis process, PATs, competent worker qualifications, a work planner training and qualification process, and a new computer-based WP&C tool. In addition, senior LLNS management continues to be directly engaged in the development and implementation of the new WP&C system.

Although a number of aspects of the new work control process are promising, implementation is at an early stage and has been applied to only a limited range of LLNL activities. Much remains to be done before the system is fully implemented, the most critical task being the allocation of sufficient resources and leadership and engagement of line management to ensure a timely implementation of the new WP&C process for all new work activities across the Laboratory by October 2017, along with each directorate developing a detailed multi-year transition plan to convert all existing work control documents to the new process.

## 6.0 WORK PLANNING AND CONTROL IMPLEMENTATION

At the time of the EA assessment, the new WP&C process had been implemented for only a few existing work activities and within only three Directorates; ES&H; NIF & Photon Science; and WCI. EA's assessment of the implementation of the new WP&C process, as provided in the following paragraphs, is based on EA's field observations and analysis of that preliminary implementation.

*Objective:*

*The scope of work is described in sufficient detail to allow the work planning process to identify hazards associated with the work and to develop necessary schedules, priorities, and work instructions. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-1)(Criteria #2 and 3)*

In the LLNS *Extent of Condition Evaluation* performed following the 2013 Building 827 sulfuric acid accident, one of the three root causes identified was that "because there were no clear boundaries, including a defined scope of work, workers were allowed to develop improvised solutions at each stage of the operations, relying on their collective expertise". Work documents generated in the new WP&C process (such as Hazard Control Plans or HCPs), which are replacing the existing IWS work documents, are more task centered rather than hazard centered as in the existing IWS process. Additionally, the work scopes in the HCPs are more descriptive of individual work tasks within a work activity, and the addition of "boundary conditions" for each work task has enabled work scope clarity for workers and their supervisors in identifying emerging or changing activities that would be clearly outside the scope of work to be performed. For example, the HCP for operating Class 3b and 4 lasers in the Zeus Laser Lab now includes boundary conditions (i.e., tasks that are outside the work scope) to include modifications to equipment, repairs and maintenance that require lockout/tagout, and work on custom-built equipment.

Another work scope enhancement of the new WP&C process involves restructuring and emphasizing job walkdowns and roundtables to incorporate an expanded group of SMEs, line management, workers, and work planners and requires their participation in identifying the work scope, hazards, and controls. Observed work planning roundtables and walk downs were effective in scoping planned work activities and identifying hazards, controls, boundary conditions and special precautions. For example, the walkdown in preparation for a new welding HCP at the Building 131 High Bay included all of the pertinent SMEs (IH, industrial safety, environmental, fire protection), as well as the RI and work planner. In addition, the work review team included an outside skilled observer to help identify potential issues with such work. In a second example, the desktop roundtable performed by NIF & Photon Science to review a new HCP for a laser lab included the appropriate SMEs and RI, and was structured and expedited through the use of the new work planning tool, which, unlike the existing eIWS tool, provides a work planning mechanism more aligned with the expected work document outcome. In another example at Site 300, the desktop roundtable performed to review explosive and non-explosive testing included 16 individuals from all of the necessary ES&H and work disciplines. In an observed weapon explosive and non-explosive testing roundtable, all of the related disciplines were present and actively participated in the issues involved in developing the HCP under discussion.

*Objective:*

*All hazards that could potentially adversely impact workers, the public, the environment, the facility, and its equipment are documented and analyzed for severity/significance. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-2)(Criteria #2, 4, 5, 7, and 8)*

EA reviewed 14 JHAs that were incorporated into either a HCP, competent worker qualifications, or PATs. The hazards identified were appropriate for the described work task, and the description of the

hazards and controls in the new WP&C process was more informative to the worker with respect to how the worker may be exposed to the hazard and the potential consequences of the hazard.

In WCDs reviewed, the new WP&C process has focused on process improvements to the writing of the JHA, incorporating new fields within the JHA (such as hazards and environmental aspects), and incorporating the JHA into the General Worker core curriculum, competent worker qualification programs, PATs, as well as specific work activities. JHAs developed through the existing IWS process have been re-written in the new WP&C process in a more user-friendly format, and for each hazard identified, the focus involved how the task presents the hazard to the worker and a description of the consequences. For example, the HCP associated with laser operations in the Large Area Tester laboratory includes a task associated with soldering items on a bench-top using an electric soldering iron. In the existing IWSs process, a hazard with this activity was simply identified as “lead hazards,” whereas in the new JHA, the hazard has been revised to read “Soldering with lead based solder can cause respiratory and ingestion hazards. Lead is a cumulative and reproductive toxin.”

*Objective:*

*Controls are identified and implemented that effectively protect against identified hazards and approved activity-level work control documents can be performed as written. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-3)(Criteria #2, 3, 4, 5, 6, 7, and 8)*

As discussed in Section 5.0, a positive attribute of the new work control process is the integration of all controls for a particular task within the JHA, rather than segmenting the controls by hazard and often duplicating controls. For example, the Building 131 High Bay welding operations HCP incorporates a JHA with a work task for using a plasma torch. For work with this task, the JHA identifies five hazards associated with plasma cutting involving exposure hazards to fumes, gases, and noise; fire hazards due to the plasma; and environmental waste hazards. To address these hazards, a suite of consolidated administrative, PPE, environmental/waste, and training controls are provided in the JHA to collectively address the IH, fire protection, and environmental hazards identified in the JHA. In the existing IWS process, the IH, fire protection, and environmental controls were presented in separate sections of the IWS, which some workers identified as confusing.

Another positive attribute of hazard control implementation in the new work control process is incorporating the most significant controls into the work document, in lieu of citing only the references for the controls, thereby requiring the worker to research the source documents to identify the appropriate controls. For example, in the wipe cleaning work activity, the new JHA for this task requires the SME and work planner to extract the most important controls from these documents and list them in the JHA for ease of use by the worker, instead of simply listing the reference documents (e.g., chapters of the ES&H Manual) from which the hazard controls could be identified.

All Site 300 facilities assessed displayed the appropriate fire symbols, the explosives and personnel limits for the building and bay/room, and any PPE required for the operation to be conducted. These signs were in compliance with the LLNL Master Explosives Safety Site Plan; were noted during the pre-job briefings per the HCP; and were complied with during all observed activities, with a temporary approved waiver provided for one additional observer allowed to be present during one specific operation observed. Site 300 HCPs were written in simple language, were clear and concise, and easy to understand. Workers appropriately used HCPs as activity-level work control documents, and they contained the information necessary for the safe execution of the work involved. The HCPs also contained “what-if” information concerning actions to be taken and equipment needed in the event an emergency occurred during the work activities.

Although EA observed a number of positive attributes in the new work control process with respect to the identification and implementation of controls, EA also identified a few areas of concern. In 3 of the 13 work activity observations, EA observed conflicting interpretations when implementing hazard controls in the new work control process. In the first observation, the HCP change process for modifying a pre-analyzed task was not clear among RIs and work planners, who had varying opinions concerning the level of SME review when modifying controls within an HCP. Second, although each of the observed work activities involved an HCP with either a procedure, operator aid, or a work instruction; RIs and work planners had some misunderstanding as to the criteria for when such documents should be referenced and/or incorporated into the HCP. Third, in some cases, the identification of best management practices in HCPs has resulted in confusion among RIs and workers as to whether such statements are HCP requirements to be followed, or guidance and OFIs.

In two cases, the lack of adequately defined WP&C terminology resulted in confusion among LLNS staff members interviewed in implementing some requirements of the new WP&C process. The term “pre-job briefing”, for instance, is interpreted differently among various work groups. In the IH analytical lab, pre-job briefings refer to both one-time reviews of HCPs performed upon the issuance or a major change in an HCP, as well as the work review performed prior to initiating a work activity. In the NIF & Photon Science Directorate, the Safe Plan of Action terminology is often used interchangeably with the pre-job briefing, although it was not clear to supervisors whether the requirements and expectations are the same.

In some work activity observations involving the new WP&C process, hazard controls of an HCP were confusing or conflicting, missing, or could not be followed as documented in the HCP. At the Building 131 High Bay machine shop, the HCP requires workers to wear ear plugs when “using powered hand tools or when working in an area posted for noise hazards.” The health hazard communication posting on the entry door to the shop indicated that “a high noise hazard was present in the area.” There were no other noise postings in the machine shop, and it was not clear what noise source the communication posting on the door was referring to or when workers should wear hearing protectors. In another example, the HCP for the A-Lab includes a boundary condition for the task associated with preparing and analyzing radioactive samples, stating that “work with mixed fusion products” is prohibited. Although the statement most likely should have read “mixed fission products,” the WCD provided no guidance for how workers should identify whether a sample contains mixed fission products or how the boundary condition could be validated, although during the pre-job briefing the work supervisor stated that an HP should be contacted before accepting samples with mixed fission products. A third example involves a missing HCP control that was identified during a work observation in the IH analytical lab. For this work activity, a work procedure supplemental to the HCP was used. The work procedure includes a work control that, when transferring dry sample media that is potentially contaminated with beryllium, this activity must be performed within a chemical fume hood. Although prior IH monitoring had indicated a minimal worker exposure potential, the work control of using a chemical fume hood was not incorporated into the administrative requirements of the accompanying HCP. Section 3.2.5.1 of DES 2012 requires that hazard controls, actions, and reminders be communicated to workers in a clear and user-friendly format. **(Deficiency)**

*Objective:*

*Work is conducted diligently in accordance with approved work instructions and within established controls. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-4)(Criteria #2, 3, and 5)*

RIs, authorizing individuals, and workers provided EA with feedback that the implementation of the new WP&C process has been an improvement over the existing IWS process. EA interviewed RIs from NIF & Photon Science, WCI, and ES&H and they expressed that the new process has streamlined their work

documents, and the resulting hazards and controls are more specific and informative when performing the work. Mechanical technicians in the Building 131 High Bay expressed similar positive comments. Discussions with supervision and workers at Site 300 indicated that both groups believe that the new process will assist in the execution of their work and improve explosives safety.

EA observed several effective WP&C mechanisms for authorizing work activities within the new WP&C process. Each of these mechanisms, which existed prior to the new WP&C process, has been modified for incorporation into the new WP&C process. For example, the Building 131 High Bay update briefing conducted each Monday morning provides an effective mechanism to identify upcoming work activities, de-conflict work activities, and authorize work. In another example, at the NIF & Photon Science Building 165, where workers often work alone, facility management has provided a daily facility condition status board that is reviewed by workers on a daily basis as an element of pre-job briefings or self-briefings and work authorization. The daily Site 300 plan-of-the-day and -week meeting reviews each of the over 400 listed operations to determine those that will be conducted each day, and the RI for each operation verbally indicates whether the operation will be conducted and provides any extenuating circumstances for review by those whose operations are affected. This communication allows all concerned to evaluate the impacts, interactions, and any safety concerns involving their operations and others noted on the plan.

Based on work observations, the new work control tool has enabled pre-job briefings to focus on the hazards and controls that may be of greatest consequence when performing the work activity. For example, the pre-job brief for laser work at the Zeus laboratory used the pre-job briefing notes generated from the new WP&C tool to remind workers of the most significant hazards and controls identified in the work document.

Under the new WP&C process, workers and their supervisors were alerted to non-standard conditions that occurred during execution of the plans and understood and executed their stop work authority as necessary. For example, during observation of the cutting propellant machine fines operation at Site 300, the worker stopped the operation prior to cutting the propellant due to the discovery of discoloring on the packaging materials and the cutting tray by the propellant machine fines. This issue was appropriately referred to the Explosives Safety Committee for investigation and resolution.

At Site 300, work performed under the new work documents was executed in accordance with the new HCPs. Each observed RI and worker was Site 300 qualified and possessed the appropriate Explosives Handler Certification. Execution of work under the revised HCPs followed the details of the HCPs and associated supporting documents (e.g., explosives peer review forms). In the observed instance where the operation generated explosives waste, appropriate disposable wet collection materials were correctly positioned and monitored. Appropriately marked containers were present for removal of the waste upon completion of the process, as described in the HCP.

EA identified one concern with application of the new WP&C process to explosives operations at Site 300. The new process does not provide written guidance on the verbalization and execution of the procedural steps in the HCP each time a repetitive process is executed. While performing explosives work activities, the HCP is read aloud word-for-word and line-by-line in some instances, but in other instances only portions are read, and at other times, there is no verbalization of the HCP at all. As a result, it is unclear whether the plan must be verbalized each time a repetitive operation is performed, at the first performance of the operation each work day, or at the first performance conducted for a repetitive operation spanning several work days.

Additionally, EA observed at Site 300 the lack of a well-defined interface between HCPs that have transitioned into the new WP&C process and supporting WCDs that remain in the existing IWS system.

Of the five new HCPs for explosive handling that EA reviewed, two included one or more tasks involving the transportation of explosives, which is currently performed under the existing IWS process. In these HCPs, hazards and controls for transportation overlapped between the new HCP and the existing IWS, and the procedures did not always interface well.

Although the requirements in most HCPs were followed as written, one example was observed when workers were prone to interpret HCP control requirements based on their operational experience rather than follow the HCP as written. When observing a sample collection activity at the sewer monitoring complex, a worker did not wear chemical goggles or a face shield when pouring a container of sewage, as required by the HCP to protect the worker from splash hazards. During this work evolution, EA observed the splash hazard and interviewed the worker and supervisor performing the work, who both stated that the magnitude of the splash hazard, in their opinion, did not necessitate chemical goggles or a face shield. As a follow-up, LLNS concurred that it was inappropriate for the WCD to allow operator discretion in the use of PPE. In the same work activity, one of the prerequisites for collecting samples was to “Barricade work area with DANGER/CONSTRUCTION tape, or otherwise control access to the area.” This prerequisite was not performed prior to sampling, and when questioned, the workers stated that this was an IWS to WP&C conversion error and that the use of barricades applied only to B193 operations and not to the daily sampling activity that was observed in B196. However, in both examples, workers did not pause work to modify the HCP prior to proceeding with their work. Furthermore, in both of these examples, workers and their supervision were unclear on the requirements for following or interpreting controls in HCPs as written, and were equally unclear on the threshold for pausing work when such controls could not be followed as written. Section 4.0 of POL-2010, *Work Planning and Control Policy*, requires workers to “perform work in compliance with work control procedures and documents,” and to “pause or stop work when conditions change and/or work cannot be performed in compliance with work control procedures and documents.” **(Deficiency)**

*Objective:*

*The WP&C processes are routinely evaluated by the organization’s contractor assurance system (CAS) and feedback and improvement processes, and lessons learned are adequately captured and incorporated into the planning and performance of ongoing and future work activities. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-5)(Criteria #1, 2 and 3)*

The new WP&C tool has enabled post-job reviews to provide and document feedback on the operations conducted; the existing IWS work planning tool does not have any provisions for feedback and improvement.

During observation of work activities at Site 300, and in the Building 131 High Bay, there was positive evidence that feedback mechanisms from the new WP&C process were in use and recommended actions were subsequently implemented in updated work processes. Workers and supervisors used feedback (e.g., obtained from an IWS feedback form generated during a previous Site 300 slurry coater vacuum filtration process) to make improvements which were subsequently incorporated into the new work process. During a post-job review for a work activity under the new WP&C process in the 131 High Bay, the work team identified a process improvement to label parts so as to eliminate confusion, and this feedback was documented in the post-job briefing. During an observed Site 300 Area Resource Conservation and Recovery Act (RCRA) inspection of waste drums, the RI used the new WP&C process to provide feedback regarding gaps on drum lid bands and the possible need to test tightness using a torque wrench. This feedback was captured by the RI for consideration during future RCRA inspections.

Post-job analysis observed by EA and performed in accordance with the new WP&C process often resulted in recommendations for process and HCP revisions from workers and supervisors, although EA



did not observe if the recommendations were implemented. For example, during the observation of the explosives waste inspection and transportation operation, a worker inspecting the vehicle provided a suggestion to revise the explosives transporting vehicle inspection form process to provide individual forms with vehicle-specific inspection tasks for each different vehicle type. The current form is somewhat generic in nature and covers multiple types of vehicles with differing inspection requirements. The new WP&C Process, DES 2012, specifies under roles and responsibilities that the RI “collect feedback from workers and others, through ongoing dialogue and work closeout reviews, and disposition as appropriate.” In this instance, the RI indicated that this suggestion would be formally provided to the transportation supervisor. Subsequent discussion with the transportation supervisor indicated that this suggestion would be evaluated and a written response provided to the RI for transmission to the worker. Also, during observation of the explosives waste storage weekly RCRA facility inspection, the worker noted that the HCP required checking the security of the locking device (a bolt with an attached nut), but no standard was provided as to what constituted a loose or tight locking device. This issue was discussed in the post-job analysis, and the RI indicated that a proposed change to the HCP would be submitted to include checking for a specific torque value securing the bolt and nut assembly.

### **Work Planning and Control Implementation Conclusion**

Overall, the implementation of the new WP&C process has streamlined work documents and resolved a number of worker and supervisor concerns with the existing IWS process as previously discussed. From work observations, EA found that HCPs are more descriptive of individual work tasks within a work activity, and the addition of new “boundary conditions” provided in each JHA enabled work scope clarity for workers and their supervisors in defining those activities that were clearly outside the scope of work to be performed. The hazards in reviewed JHAs embedded in HCPs, competent worker qualifications, and PATs were appropriate for the described work task, and the description of the hazards was more informative to the worker than the IWS hazard descriptions, particularly with respect to how the worker may be exposed to the hazard and the potential consequences of the hazard. Hazards and controls for similar work tasks were more consistent across various HCPs as a result of using pre-analyzed tasks. WP&C mechanisms for authorizing work activities, which have been adapted to the new WP&C process, were effective. EA also observed that pre-job work briefings and feedback and improvement mechanisms such as post-job reviews were enhanced through the use of the new WP&C tool. For the work observed by EA, the controls identified in HCPs were appropriate for the hazards identified and were effectively implemented, with few exceptions.

While there were many positive attributes when implementing the new WP&C process, hazard controls in some HCPs were confusing or conflicting to workers, or could not be followed as documented in the HCP. In addition, EA identified several problems with implementation of the new work process with respect to the HCP change or revision process; establishing and communicating criteria for incorporating procedures, work instructions, or operator aids into work documents; the use of best management practices in work documents; confusing WP&C terminology and in following WCDs as written. At Site 300, the new WP&C process does not provide sufficient written guidance in the need to verbalize procedural steps in an HCP each time a repetitive process is executed, and some work evolutions are unnecessarily complicated since work tasks have transitioned to the new WP&C process, whereas other tasks remain in the existing IWS process.

## 7.0 FEEDBACK AND IMPROVEMENT AND OVERSIGHT

### 7.1 LLNS Feedback and Improvement

*Objective(s):*

*The Organization has a feedback and improvement process that fosters learning from both internal and external operating experience and continuous improvement for activity level work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-5) (Criteria #1 and 5; feedback and lessons learned)*

*The WP&C processes are routinely evaluated by the organization's contractor assurance system (CAS) and feedback and improvement processes, and lessons learned are adequately captured and incorporated into the planning and performance of ongoing and future work activities. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-5)(Criteria #1-4; feedback and lessons learned)*

The LLNL lessons learned program is robust with respect to the collection and dissemination of lessons learned by the lessons learned coordinator. External and internal lessons learned are captured, documented, and distributed to parties within LLNL who are likely to find them useful with respect to the work they perform. EA reviewed 22 examples of lessons learned that were distributed within LLNL. The lessons learned program has an internal search tool available for use by anyone in the Laboratory who is researching lessons learned for work control document development (e.g., JHAs, HCPs, and pre-job briefings). The Hanford operating experience (OPEX) tool is also used at LLNL to access lessons learned from across the DOE complex.

The new WP&C process addresses expectations for capturing and implementing feedback obtained during a work activity, but it lacks clarity regarding expectations for use of applicable internal and external lessons learned during WCD development. The WP&C process, DES 2012, does not identify who is responsible for collecting and reviewing applicable lessons learned (internal and external) to be included in the WCDs. An existing but older document, (i.e., Identifying, Communicating, and Responding to Lessons Learned, PRO 0087) specifies these types of responsibilities for "supervisors," but does not identify responsibilities for specific roles, such as RI and work planner. EA interviewed RIs, work planners, ES&H team leads, and workers, and they expressed that they believe they have a role in identifying applicable lessons learned, but they provided different responses as to who is ultimately responsible for determining which lessons learned (internal and external) will be incorporated into a WCD. There is also no expectation in the (existing IWS or new WP&C) process to record lessons learned that were actually used in developing a specific work process. Although this is not a requirement, recording the lessons learned would save some time and effort for RIs and Work Planners who develop similar work processes in the future. **(See OFI-LLNS-FI-01)**

Corrective actions developed for Causal Factor 2 (regarding full implementation of the lessons learned process) for the Building 827 sulfuric acid accident consist primarily of reviewing lessons learned from past activities within LLNL. The corrective action process for this event involved review of a few sources of helpful information external to LLNL, but did not include lessons learned from industries within the United States that have extensive experience in scale-up processes, systems, and equipment that would potentially be of interest to LLNS. **(See OFI-LLNS-FI-02)**

The new WP&C process is of particular value during this time of transition of experienced workers retiring and the hiring of workers with less work experience to take their places. Additional emphasis is being placed on process documentation, and capturing feedback and lessons learned. However, some valuable anecdotal lessons learned are not always being captured for posterity. An example of this

occurred during an EA work observation at Site 300 involving a RCRA inspection of waste drums. The RI, who is near retirement, provided several verbal lessons learned that were valuable, but were not documented as part of the formal pre-job briefing or documented through the new WP&C feedback process. (See OFI-LLNS-FI-03)

*Objective(s):*

*The Organization has a feedback and improvement process (including lessons learned) that fosters learning from both internal and external operating experience and continuous improvement for activity level work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-5) (Criteria #2-4; CAS/ITS)*

*The WP&C processes are routinely evaluated by the organization's contractor assurance system (CAS) and feedback and improvement processes, and lessons learned are adequately captured and incorporated into the planning and performance of ongoing and future work activities. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-5)(Criteria #5 and 6; CAS)*

The LLNL CAS provides an integrated set of tools (e.g., issues tracking system (ITS) and the Institutional Assessment Plan), services (e.g., independent assessments on risk-based topics throughout the Lab), and processes (e.g., extent-of-condition reviews and effectiveness reviews) necessary to evaluate WP&C performance. Quarterly roll-up reports (e.g., 4<sup>th</sup> Quarter FY 2016 Report) prepared by the management assurance system (MAS) provide useful information for management to evaluate continuous improvement, track and trend work process issues, and maintain awareness of new lessons learned. The 4<sup>th</sup> Quarter FY 2016 MAS report also highlighted LLNS efforts to sustain continuous improvement through active process improvement efforts involving Six Sigma teams (i.e., 26 process improvements were completed and 35 more were planned).

LLNS initiated a redesign of the existing WP&C process in 2013. This action came about as a result of LLNS senior management responding to issues raised, in part, from the LLNS extent of condition review of the 2013 Building 827 sulfuric acid accident together with LLNS WP&C self-assessments conducted in 2012 (i.e., MSA, ITS ID No. 33219) and 2013 (i.e., JFLMA, ITS ID No. 34634). An example of an assessment of the new WP&C system implementation is the Functional Management Review conducted in September, 2016 by representatives of LLNS parent companies. This assessment provided observations on issues including inconsistent senior management support, additional resources needed, and the need for communications regarding the new WP&C tool and process. An additional follow-up Functional Management Review is scheduled for September of 2017 to assess progress of transition to the new WP&C process.

EA also reviewed six recent JFLMAs conducted in 2015 and 2016 and found that each contained sections on lessons learned operational experience. The JFLMAs concluded that experience from operational events was being captured, shared, and distributed throughout the Laboratory to drive continuous improvement, but there is no evidence of data collected and reviewed pertaining to lessons learned that are actually implemented (e.g., used in development or modification of work control documents). Further, they do not include activity-level review of implementation of lessons learned during initial preparation or modification of work control documents.

The effectiveness review of the corrective actions for the 2013 Building 827 sulfuric acid accident is planned for December 2017. Significant changes have been made to the equipment and engineering controls that are scheduled to be implemented for use in future pilot scale-up work in Site 300, similar to work being conducted when the event occurred in 2013. A planned action includes development of new WCDs for this work utilizing the new WP&C process.

The WCRB is an established (Charter dated January 20, 2017) real-time “steering committee” for implementing the various improvements to the LLNL WP&C process. Members of the WCRB are Directorate Work Control Managers and WP&C team members who are responsible for preparing, reviewing, and implementing the new WP&C processes within their Directorates. The WCRB is empowered to promote consistency and quality of the lab-wide implementation of WP&C.

Although LLNS tracks and trends performance data pertaining to WP&C implementation and overall Laboratory performance, they have not developed specific overarching goals, determined performance objectives, and selected key metrics for tracking Laboratory performance under the new WP&C process in order to assess whether the new process is achieving the success they desire.

*Objective:*

*The Organization has developed and approved WP&C processes to enable safe performance of work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-1) (Criteria #4 and 9 - worker involvement)*

The institutional guidance provided in the ES&H Manual, Volume I, Document 2.2 specifies that work planning teams “involve representative workers who have previously performed the planned or similar tasks, or will perform the task(s), in the hazards identification and analysis process...” Work observations and interviews demonstrated that workers were routinely involved in planning and improvement of work processes, but that the level of involvement was not consistent. DES 2012, *LLNL Work Planning and Control Program*, does not provide consistent guidance concerning worker involvement in WP&C work document development. In Section 3.1 of DES 2012, the new WP&C process makes no mention of workers as part of the hazard planning team, but they are “encouraged to participate” in the planning process. Under worker responsibilities in DES 2012, workers are to “participate in job walk downs and roundtable meetings as members of the planning team, provide input on how work is conducted and the utility and feasibility of specific controls.”

## **Feedback and Improvement Conclusion**

EA work observations and interviews with workers, line managers, and functional area managers indicated strong motivation to act on lessons learned and feedback collected during ongoing work and at the conclusion of work activities conducted under the new WP&C process. The lessons learned program is well organized and distributes lessons learned throughout the Laboratory. Lessons learned are not limited to those developed internally but include lessons learned from across the DOE complex as well as universities and industry. Personnel interviewed gave different responses regarding who is ultimately responsible for collecting, reviewing, and determining which lessons learned are implemented during development of a new work control document but all felt they had a role in identifying applicable lessons learned. There is also no requirement to document which lessons learned were actually used in development of a work control document. Such documentation would be of value for those developing similar work control documents in the future. The feedback tab provided in the new WP&C tool is designed to allow LLNS personnel to easily record and status feedback and is a good example of a user-friendly method of capturing and tracking feedback obtained during work process development or during the work activity.

The LLNS CAS program routinely tracks and trends performance issues related to work processes. Self-assessment findings have been used to identify improvements currently being implemented in the new WP&C process. Functional Management reviews have been used and continue to be used to assess transition to the new WP&C process. Recent JFLMAs contained sections on “lessons learned operational experience” but lacked activity-level review of implementation of lessons learned during preparation or modification of work control documents.

The WCRB is an established real-time steering committee for implementing and tracking the improved WP&C process. WCRB members are actively engaged in the process and are in the right positions to enable changes within their Directorates. However, LLNS has not developed overarching goals (what success looks like), objectives, and key metrics to assess its progress toward the Laboratory's definition of a successful outcome.

The new WP&C process is of particular value during this time of transition as experienced workers leave for retirement. LLNS does not currently have a strategy to define how the WP&C process can contribute to capturing knowledge base from these experienced workers (informal processes, feedback and lessons learned) related to specific work activities.

## **7.2 Livermore Field Office Oversight**

*Criteria:*

*DOE field element line management has established and implemented effective oversight processes that evaluate the adequacy and effectiveness of contractor assurance systems and DOE oversight processes. (DOE Order 226.1B)*

*Oversight processes are tailored according to the effectiveness of contractor assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities. (DOE Order 226.1B 4b (5))*

*The DOE field element has an issues management process that is capable of categorizing findings based on risk and priority, ensuring relevant line management findings are effectively communicated to the contractors, and ensuring that problems are evaluated and corrected on a timely basis. (DOE Order 226.1B 4b(4))*

LFO has processes in place for Federal line oversight, addressing assessment planning and performance, and issues management. LFO is transitioning to an oversight methodology that is integrated with the Laboratory's oversight processes. Currently, many of the governing procedures do not reflect the integrated process; however, they are in the process of being revised. The overall approach for LFO management is described in LFO Manual 414.1, *Integrated Management System Manual (LIMS)*, which combines the descriptions of the functions, responsibilities, and authorities; the field office's integrated safety management system (ISMS) description document; and the Quality Assurance Plan into a single management description document. LFO Manual 414.1 includes oversight planning and performance, and specifically addresses performing assessments in the area of WP&C. It also includes the authority and responsibility for issues management, evaluating Laboratory performance, the LFO institutional oversight of the contractor assurance system, and integrated safety management (ISM).

The new integrated oversight process involves the input of both the LFO and the LLNS functional area managers in the development of joint assessment planning products. A Joint Master Assessment Plan (JMAP) includes a risk-based assessment of performance, which is factored into the joint multi-year assessment schedule. The joint multi-year assessment schedule includes both risk-based and requirement-driven assessments over the upcoming five-year period. The joint master assessment schedule includes the planned assessments for the current year, assessment types, level of LFO participation, schedule, title, and scope. Per discussion with the LFO performance assurance manager, all functional areas are being transitioned to the integrated oversight model. The 2016 JMAP has not been approved. LFO has not yet approved the FY 2017 JMAP and is still working with the Laboratory to finalize the document. LFO Process 226.1, *Risk Based Oversight*, and Work Instruction 226.1.2, *Oversight Planning*, do not reflect

the new integrated oversight process.

LFO WI 226.1.3, *Performing Oversight*, attachment 3, Guidance for the Assessment of Work Control, includes reference to the DOE Guide 226.1-2A CRAD and a WP&C assessment checklist available on a LFO SharePoint site. The WP&C checklist is an abbreviated version of the DOE CRAD and is effectively tailored to assessing WP&C implementation. This checklist is a valuable reference for performing WP&C assessments in the field. For the most part, WI 414.9.1, *Writing and Managing Assessments of the Livermore Field Office, Issues, and Corrective Action Plans in ePegasus*, adequately describes the process for tracking assessments and managing issues and corrective action plans in ePegasus. As noted in the LIMS, LFO is transitioning from ePegasus to the Laboratory's issues management system, ITS. WI 226.1.1(P), *Managing Assessments and Issues in ITS*, describes the new process. Both procedures include definitions for issues (the new process does not include weaknesses); however, the new process also includes an issue significance level that LLNS determines. The significance level determines LFO involvement in the concurrence/approval of the issue. The LFO procedure is silent on LFO's role in reviewing the significance level. The Red Team Self-Assessment of LFO Federal Issues Management System conducted May-July 2016 included a weakness that LFO does not have clear instructions on categorizing issues based upon priorities as required by DOE Order 226.1. LFO is in the process of developing corrective actions for the Red Team self-assessment, has identified issues management as a systemic deficiency, and has moved the issues management program to the Manager's Office.

LFO WI 226.1.4, *Issues Management*, adequately describes the management review process (periodic issues review) and monthly transmittal of issues to the Laboratory. EA observed an LFO Issues Review Council meeting with associated handout "January 2017 Issues for LFO Issues Review Council" (procedure references a Quality Management Council). This meeting included appropriate representation, and is an effective process for achieving consistency of expectations for issues across the LFO organizations. EA verified that the periodic issues reports (PIRs) are formally transmitted from the LFO Manager to the Laboratory.

In 2010, a Phase I and Phase II re-verification of the LFO and LLNL ISMS confirmed effective implementation. LFO reviewed and concurred with the 2015 LLNL ISMS declaration and effectiveness review, and LFO appropriately denied the Laboratory's request to go to a triennial schedule. The denial was based upon the Laboratory being in the midst of changing its WP&C system. The 2016 LFO self-assessment and effectiveness review of ISMS was completed in January 2016 and formally transmitted to the Laboratory November 2016 (16 months from the receipt of the LLNL ISMS declaration). LFO attributes the lengthy review period to the need to independently evaluate the request for a triennial schedule. LFO also approves the Safety Performance Objectives, Measures and Commitments that are submitted in accordance with the Department of Energy Acquisition Regulation clause on the integration of ES&H into work planning and execution. LFO appropriately approved the FY 2017 submittal contingent upon the addition of elements related to the cognizant system engineer program. LFO has not approved the LLNS CAS description as required by DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*. (**Deficiency**) LFO originally intended to approve the LLNS CAS system description through the NNSA affirmation process in 2012; however, this did not come to fruition.

Seven of the LFO procedures reviewed did not reflect the current organizational structure or oversight processes, and/or referenced deleted procedures (LSO Procedure 540.2, *Contractor Performance Evaluation Process*; LFO Procedure 226.2, *Operations Teams*, etc.). Per discussion with LFO management, the field office has identified the need to update its procedures and, in 2016, developed a Gantt chart/Excel spreadsheet listing LFO documents in need of update with planned start and finish dates. Most of the documents of interest to this EA assessment are currently starting formal review and comment; however, some are behind schedule. According to LFO, the LIMS is being replaced by 3

documents which are on the spreadsheet: the LFO Functions, Responsibilities, and Authorities, Quality Assurance Plan, and ISMS description. The Functions, Responsibilities, and Authorities document is currently awaiting LFO manager approval.

LFO's differing professional opinion (DPO) process is based upon the NNSA/Environmental Management (EM) supplemental directive SDG-442.2, *Differing Professional Opinions (DPO) Process*, which required site office managers to "Establish a DPO process that is consistent with DOE Order 442.2 for use by NNSA and EM Federal and contractor personnel under their authority." LFO WI-442.1, *Differing Professional Opinions*, was established in response to this directive; however, it inappropriately identifies the LFO Manager, who is not qualified as a senior technical safety manager, as the Final Decision Manager. This assignment of responsibility does not meet the requirement in DOE Order 442.2, which states that the Under Secretary assigns a DOE senior technical safety manager as the Final Decision Manager. **(Deficiency)**

LFO WI 442, *LFO Employee Concerns Program*, adequately describes the employee concerns program (ECP). The manager for the LFO ECP recently transferred to another field office. LFO has reassigned some of the duties on an interim basis to another employee, with the intention to permanently fill the position. LFO has conducted a self-assessment of the ECP annually for the past seven years, using a checklist and defined criteria. Posters are displayed throughout Building 311, with phone and email contact information. Employee concern files are kept in a locked cabinet. Training on the ECP was included in conjunction with DPO training in the September/October 2016 timeframe.

The LFO OPEX program is adequately described in procedure AMESH 210.2A. The LFO OPEX coordinator has over 30 years of experience as a safety engineer. EA reviewed two of the semi-annual reports which are generated by the OPEX coordinator and submitted to LFO and found the reports to be informative. The reports cover a variety of topics including LFO safety and preparedness, Federal Employee Occupational Safety and Health, current topics, LLNL and DOE lessons learned, injury and illness reports, occurrence reporting, Noncompliance Tracking System, and operational awareness. The OPEX coordinator also provided examples of lessons learned that she has distributed to LFO. A self-assessment of the LFO lessons learned program is included in the FY 2017 Integrated Assessment Schedule.

*Objective:*

*DOE Oversight processes must evaluate contractor and DOE programs and management systems, including site assurance systems, for effectiveness of performance (including compliance with requirements). Such evaluations must be based on the results of operational awareness activities; assessments of facilities, operations, and programs; and assessments of the contractor's assurance system. (DOE Guide 226.1-2A)*

*DOE field element line oversight program includes written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes and systems. (DOE Order 226.1B 4b(2))*

LFO has demonstrated a strong commitment to improving WP&C by assigning a WP&C lead to provide focus and continued emphasis; including WP&C as a functional area with assessments and oversight; interfacing with Laboratory personnel on the new WP&C process; establishing key outcomes for implementation of the new institutional WP&C process in the Performance and Evaluation Management Plan (PEMP); including guidance for assessment of work control in the LFO WI 226.1.3 procedure; developing a WP&C assessment CRAD and checklist; and assigning WP&C assessments for operational awareness.

LFO completed an assessment of the WP&C process for Site 300 in 2014 (ASRP-DP-3.26.2014-568237, *Functional Area Review of the Pilot WP&C Process for Site 300*). The review appropriately addressed WP&C processes, hazards identification analysis and control, work authorization and execution, and feedback and improvement. This assessment included interviews, document reviews, and activity observations, and identified 13 observations. EA reviewed two FY 2015 functional area assessments of WP&C. One assessment covered the first quarter of FY 2015, and the other assessment covered the entire FY. Both assessments included a comprehensive analysis of operational data, documents, and metrics. These assessments resulted in relevant recommendations for LFO and LLNS. LFO performed several additional formal assessments that appropriately addressed varied aspects of WP&C, such as configuration management, specific work activities, and corrective actions associated with equipment failures.

WP&C is a focus area for operational oversight. The Facility Representatives (FRs) perform most of the routine operational awareness oversight, and are assigned a monthly WP&C assessment. The FRs document their routine operational oversight in bi-weekly reports (once every two weeks). EA reviewed 14 bi-weekly reports, and found that they appropriately included WP&C oversight including plan-of-the-day meetings, plan-of-the-week meetings, work permit meetings, pre-job briefings, feedback and improvement, WP&C reviews, and work observations. FRs, safety system oversight (SSO) engineers, and SMEs also use the WP&C assessment checklist to further oversee WP&C.

Integrated oversight by the WP&C lead, FRs, SMEs, and SSO engineers has resulted in the identification of a significant number of issues. For the time period from 2010 through 2016, over 200 issues were identified. These issues included a deficiency related to the work authorization process and a deficiency for fire sprinkler obstructions, over 20 weaknesses, two strengths, and the remainder are observations. The issues were identified by LFO senior management, the WP&C lead, FRs, SSO engineers, a maintenance SME, and ES&H SMEs.

LFO's review of the CAS has transitioned from transaction-based independent oversight to a reliance on transparency and integrated oversight. A thorough review of elements of the CAS was performed as part of the LFO self-assessment of nuclear safety performance in July 2014. The June 2015 LLNS ISMS Effectiveness Review included an LFO representative and resulted in a comprehensive review of CAS. In FY 2016, oversight of CAS was limited to the Livermore ISM self-assessment. The FY 2017 joint master assessment schedule includes five joint assessments for CAS, none of which include LFO participation.

LFO has adequate processes in place to evaluate the Laboratory's performance and provide feedback. In addition to meetings and informal discussions, oversight results are communicated to the Laboratory through assessment reports, PIRs, interim feedback reports, and performance evaluation reports (PERs). Assessment reports and issues are transmitted to the Laboratory electronically, and the PIR is formally transmitted to the Laboratory. EA reviewed two PIR reports, both of which documented issues identified during the reporting period. The reports adequately described the issues (functional area, location, requirement not met, etc.). LFO has appropriately included the new institutional WP&C process as a key outcome in the PEMP. It is included in Goal 5, Operations and Infrastructure, which is assigned 25 percent of the available award fee pool. Interim feedback reports are issued every four months, and provide LFO's review of LLNS's performance measured against the PEMP. Interim feedback reports for period 1 and period 2 of FY 2016 address concerns with the Laboratory's ability to fully implement the work control improvement process by the end of the year. At the end of each year, LFO issues a PER, which rates the Laboratory's performance and assigns the fee accordingly. The PERs for FY 2015 and FY 2016 both expressed concern with the implementation of the new WP&C process taking longer than anticipated.



*Objectives:*

*The DOE field element has implemented an effective FR program. (DOE Order 422.1)*

*Maintain sufficient technical capability and knowledge of site and contractor activities to make informed decisions about hazards, risks, and resource allocation; provide direction to contractors; and evaluate contractor performance. (DOE Order 226.1B)*

LFO has a well-qualified and technically competent staff and, for the most part, has implemented an effective FR program. LFO Process 1063.1, *Facility Representative Program*, is generally consistent with DOE-STD-1063-2011, *Facility Representatives*, and describes their duties, responsibilities, and authorities. It specifically addresses WP&C oversight, including reference to the WP&C checklist available on the LFO SharePoint. LFO completed a determination of FR coverage, consistent with the DOE FR Standard, in January 2016, and identified the need for six total FR full-time equivalents. The FR staff includes two fully qualified FRs, one interim qualified FR, two FRs in training, and one newly hired FR. Once the staff is fully qualified, the LFO FR program will be sufficiently staffed. In lieu of an FR triennial self-assessment, LFO took credit for a Chief, Defense Nuclear Safety review in 2014, which assessed the LFO FR program. This assessment determined that the FR program implemented the requirements of DOE-STD-1063. The next triennial FR self-assessment is included on the FY 2017 LFO integrated assessment schedule for the third quarter.

The current fully qualified and interim qualified FRs have appropriate technical backgrounds and extensive relevant experience. During observed facility walkdowns, all FRs had unencumbered access to their assigned facilities. The FRs demonstrated familiarity with the facilities processes, procedures, and personnel, and understood operations and systems including those that were important to safety. During the walkdowns, the FRs attended plan-of-the-day and plan-of-the-week meetings, work permit review activities, pre-job briefings, and other WP&C activities. The interviewed FRs were knowledgeable of their stop-work authority, and demonstrated an effective relationship with the Laboratory and DOE management. EA observed a monthly FR meeting with the LFO manager and other senior DOE management, during which the FRs effectively described current issues within their assigned areas.

The FR technical qualification and training program is adequately described in LFO Process 1063.1. EA reviewed the Phase 1 qualification card for the interim FR assigned to Site 300, a non-nuclear explosives test facility. The qualification card did not include a site-specific competency related to explosion safety, and did not include Site 300 in the facility-specific requirements (i.e., the facility-specific requirements only included the nuclear facilities). Additionally, one of the competencies had not been signed (review and approval of nuclear safety basis documents). LFO has subsequently signed off on this competency. The NNSA Quarter 1 FY 2017 technical qualification program (TQP) matrix and the LFO TQP Status Quarter 1 FY 2017, indicated that requalification for one of the FRs was originally due on September 30, 2015, was extended to February 27, 2016, and still showed as incomplete. Per discussion with the FR, the requalification was completed October 2016. The LFO and NNSA TQP trackers had not been updated. LFO took action to update the NNSA TQP status system in this case. The Annual Workforce Analysis and Staffing Plan Report (as of January 19, 2016) indicates that LFO is currently developing a plan to address a technical training position vacancy, either through reassignment or external hire. The recent 2016 LFO Biennial Review Report also identified issues with the Federal technical capability program. LFO is in the process of developing corrective actions for the 2016 LFO Biennial Review Report, and has identified the Federal technical capability program as a systemic deficiency and moved this program to the Manager's Office.

In addition to FRs, the SSO engineers and SMEs provide oversight of WP&C elements. LFO has a designated WP&C lead, who has provided focus and integration for the WP&C functional area. As the

functional area manager, the WP&C lead performs assessment planning, conducts formal assessments (discussed earlier), and evaluates the Laboratory's performance for the PEMP process. The Lead developed the WP&C assessment checklist, which is used by the FRs, SSO engineers, and SMEs. As the FR program manager, he ensures inclusion of WP&C in the operational awareness focus areas, assigning a monthly WP&C assessment to each of the FRs. He also oversees the implementation of the new institutional WP&C process, including interfacing with Laboratory personnel and developing key outcomes for the award fee process. The SSO program is appropriately described in LFO Process 426.1.1D. LFO conducted an SSO staffing analysis in January 2017, which concluded that the current staffing level of two is adequate. The staffing analysis was thorough, including the planned assessments and reviews. EA interviewed both SSO engineers and accompanied one on a walkthrough, and found them to be experienced and well qualified. Additionally, EA interviewed the maintenance SME and observed his interactions with the Laboratory at WP&C-related meetings. He has significant experience in the maintenance area and is also well qualified.

### **Livermore Field Office Oversight Conclusion**

Generally, LFO has appropriate processes in place for Federal line oversight, including assessment planning and performance, operational awareness activities, and issues management. LFO is transitioning to an oversight methodology that is integrated with the Laboratory's oversight processes. Processes to resolve employee issues include the ECP and the DPO, and the OPEX coordinator issues informative semi-annual reports. LFO has adequate processes in place to evaluate Laboratory performance and provide feedback, including PIRs, interim feedback reports, and PERs. LFO has a well-qualified and technically competent staff and, for the most part, has implemented an effective FR program. In addition to FRs, the SSO engineers and SMEs provide oversight of WP&C elements, resulting in the identification of a significant number of issues. LFO has demonstrated a strong commitment to improving WP&C, including assigning a WP&C lead to provide focus and continued emphasis. The WP&C lead and functional area manager have established oversight schedules and conducted formal assessments; assigned and integrated operational awareness activities; included guidance for assessment of WP&C in LFO procedures; developed a tailored WP&C assessment checklist; established key outcomes for WP&C in the PEMP; and evaluated the Laboratory's performance. Some concerns with LFO oversight include inaccurate oversight procedures, the lack of approval of the CAS description document, and LFO DPO procedure discrepancies.

## **8.0 FINDINGS**

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for EA appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 227.1A to manage these corrective action plans and track them to completion. In addition to the findings, deficiencies that did not meet the criteria for a finding are listed in Appendix C, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

EA identified no findings during this assessment.

## 9.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified some OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in appraisal reports, they may also address other conditions observed during the appraisal process. EA offers these OFIs only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

### LLNS

**OFI-LLNS-WPC-01:** With a significant work effort remaining for full implementation of the new WP&C system, consider developing a resource-loaded schedule to itemize and prioritize the remaining implementation actions and a process for managing change. This WP&C system implementation schedule should address the completion and issuance of the remaining WP&C procedures, transitioning of former IWSs in each of the LLNL Directorates into the new WP&C process, and the development of all categories of work documents (HCPs, procedures, and work permits). In addition, there is a need for a consistent, sustainable commitment by senior management to implementation of the new WP&C process that would then be communicated, flowed down to, and fully understood by all levels of the organization. Enlist leadership in the current roll-out phase to share the added value and lessons learned in the implementation of new WP&C process.

**OFI-LLNS-FI-01:** Consider recording lessons learned that were actually used in developing a specific work process. Recording the lessons learned used would save some time and effort for RIs and Work Planners who develop similar work processes in the future.

**OFI-LLNS-FI-02:** Consider benchmarking or reviewing lessons learned from U.S. industries that have conducted pilot scale-up research using hazardous chemicals, including explosives, for many years (e.g., DuPont and Dow Chemical) in addition to the corrective actions for Causal Factor 2 (regarding full implementation of the lessons learned process) for the Building 827 sulfuric acid accident, which consist primarily of reviewing lessons learned from past activities within the Laboratory.

**OFI-LLNS-FI-03:** Consider formally capturing lessons learned that apply to specific work evolutions and currently reside in the memories of highly experienced individuals before they retire from the workforce.

## **Appendix A Supplemental Information**

### **Dates of Assessment**

Onsite Assessment: January 23-26 and February 6-9, 2017

### **Office of Enterprise Assessments (EA) Management**

Glenn S. Podonsky, Director, Office of Enterprise Assessments  
William A. Eckroade, Deputy Director, Office of Enterprise Assessments  
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments  
William E. Miller, Deputy Director, Office of Environment, Safety and Health Assessments  
C.E. (Gene) Carpenter, Jr., Director, Office of Nuclear Safety and Environmental Assessments  
Kevin G. Kilp, Acting Director, Office of Worker Safety and Health Assessments  
Gerald M. McAteer, Director, Office of Emergency Management Assessments

### **Quality Review Board**

William A. Eckroade  
John S. Boulden III  
Kevin L. Dressman  
Thomas R. Staker  
Patricia Williams  
Gerald M. McAteer  
Michael A. Kilpatrick

### **EA Site Lead for LLNL**

Joseph E. Probst

### **EA Assessors**

Kevin E. Horace, Team Leader  
Terry B. Olberding  
James R. Lockridge  
Roby D. Enge  
Thomas F. Hall

## **Appendix B**

### **Key Documents Reviewed, Interviews, and Observations**

#### **Documents Reviewed**

##### ***LLNS***

DES-2012, *The LLNL Work Planning and Control Program*, August 2016

PRO-2021, *Managing the Work Planner Qualification Program*, January 2017

POL 2010-01, *Work Planning and Control Policy*, January 2014

PRO-2031, *Writing a Job Hazard Analysis*, October 2016

PRO-2033, *Creating Pre-Analyzed Tasks*, Draft

Overview of Governance Documents for Work Planning and Control

LLNL Power Point presentations to the EA Staff on the “LLNL Work Planning and Control Process”

Document # ISO130, *LLNL Electro-Optical Competent Worker Qualification Card*, July 2016

*High-Bay Update Brief (HUB)*, February 6, 2017

Institutional Charter CTR-1449 Rev. 06, Explosives Safety Committee, 11/03/2016

ISO320, Version 1.0.0, LLNL Work Planner Endorsement-Explosives Facilities, 08/2016

Explosives Peer Review (PR) 2959, Cutting MSP-1 Propellant (Renewal of PR 2959), 01/25/2017

WCI\_RHWM-HCP-AL3-EWTFCPX-0001, Treat Explosives Waste Generated at LLNL by Burning or Detonation, 1/18/2017

WCI\_RHWM-HCP-AL3-S300\_SITE-0001, Operate the Explosives Waste Storage Facility (EWSF), 1/18/2017

WCI\_WTE-HCP-AL2-874-0001, Machine and Fabricate Materials, Parts, and Fixtures to Support Weapons Systems Testing, 1/17/2017

WCI\_WTE-HCP-AL3-827CPX-0003, Measure Particle Size with the Fisher Sub-Sieve Sizer (FSSS), 1/17/2017

WCI\_WTE-HCP-AL3-827CPX-0001, Cut MSP-1 (C-740) Propellant Machine Fines, 2/2/2017

UCRL-AM-133867-VOL-2-PT-17.1-2011, ES&H Manual, Volume II, Part 17: Explosives/Firearms, Document 17.1, Explosives, 9/9/2015

UCRL-AM-133867-VOL-2-PT-21-21.42011, ES&H Manual, Volume II, Part 21: Transportation, Document 21.4, Shipping Explosives Offsite, 2/12/2008

UCRL-AM-133867-VOL-2-PT-21-2011, ES&H Manual, Volume II, Part 21: Transportation, Document 21.2, Transportation Safety Manual, Volume 2: Site 300, 5/26/2009

UCRL-AM-133867-VOL-2-PT-21-2011, ES&H Manual, Volume II, Part 21: Transportation, Document 21.2, Transportation Safety Manual, Volume 1: Main Site-Site 200, 4/8/2009

LLNL-AR-477111-REV-2, Facility Safety Plan S-300.8, Weapons and Complex Integration, WCI Site 300 Operations, Revision 2, 07/2014

LLNL-MI-714501, LLNL Explosive Safety Committee Meeting Minutes Compiled from February 2014 to October 2016, 12/12/2016

LLNL-MI-414619-REV-5, Site 300 Work Planning and Control Manual, 2/25/15

LLNL-AR-719363, LLNL Master Explosives Safety Site Plan Document, Revision 1 (Amended), 4/3/2013

NTS-LSO-LLNL-LLNL2014-001, Programmatic Non-Compliance with Topical Areas within LLNL’s WP&C Program

Extent of Condition Evaluation of an Uncontrolled Exothermic Reaction of LLM-105 Precursor Materials Resulting in Injuries that occurred Feb. 12, 2013 in Bldg. 827 at Site 300, LLNL-AR-643262, 7/31/2013

Corrective Action Plan-Site 300 Acid Splash Event, April 10, 2013

LLNL WSH Program Description (September 2015)

LLNL Institutional Assessment Plans for FY 15, FY 16, and FY 17

ESH Manual 2.1, General LLNL Worker ESH Responsibilities, 5/14/2014

ESH Manual 2.2, LLNL Institution Wide Work Planning and Control Process, 6/21/2016

LL-2016-LLNL-14 (Roll-up Doors), 5/27/2016  
ISMS DES-0541, Rev. 11, 12/18/2015  
ISMS Effectiveness Review and Safety Performance Objectives, Measures and Commitments, 10/03/2016  
PRO 0042 06, Issues and Corrective Action Management, 5/01/2013  
PRO 0049 09, Institutional Assessment Plan (IAP), 10/07/2015  
PRO 0050 07, Internal Independent Assessments, 12/01/2015  
PRO 0051 06, Joint Functional Area Manager/Line Manager Assessments, 03/01/2013  
PRO 0052 07, Management Self-assessments, 02/24/2016  
PRO 0053 06, Performing Management Observations and Inspections  
PRO 0054 06, Assessment Quality Peer Reviews, 03/01/2013  
PRO 0069, Rev. 7, Institutional Metrics Management, 06/17/2016  
PRO 0076 02, Evaluation for Extent of Condition, 03/01/2013  
PRO 0077 06, Conducting an Effectiveness Review, 03/01/2013  
DES 0086 05, Operating Experience Program, 03/01/2013  
MAS Quarterly Report, 2016 Quarter 4, 12/08/2016  
MSA, ITS No. 33219, December 16, 2011  
Monthly Performance Review, 01/20/2017  
Functional Management Review on WP&C, September 13-22, 2016  
22 Sample Lessons Learned from FY 14, FY 15, and FY 16  
JFLMA, ITS No. 34634, September 30, 2013  
JFLMA, ITS No. 38212, March 25, 2015  
JFLMA, ITS No. 38214, June 5, 2015  
JFLMA, ITS No. 38215, October 1, 2015  
JFLMA, ITS No. 39659, September 25, 2015  
JFLMA, ITS No. 39664, March 8, 2016  
JFLMA, ITS No. 39662, September 7, 2016  
WCRD Institutional Charter, CTR-2011, Rev. 1, January 20, 2017

### ***LFO***

CAS JMAP and JMAS FY 17  
Facility Representative Qualification Card, Interim and Phase One  
FY 2016 Period 1 Interim Feedback Report  
FY 2016 Period 2 Interim Feedback Report  
Headquarters Biennial Review of Field Nuclear Safety Performance Final Report for LFO, 9/16  
LFO TQP Status Quarter 1 FY 2017  
MAP FY 15  
MAP FY 16  
NNSA Quarter 1 FY 2017 TQP Matrix  
Performance and Evaluation Management Plan FY 16  
Performance Evaluation Report FY 15 and FY 16  
Red Team Self-Assessment of LFO Federal Issues Management System conducted May-July 2016  
LFO P 226.1, *Risk Based Oversight*  
WI 226.1.1(P), *Managing Assessments and Issues in ITS*, R2, 02/16  
WI 226.1.2, *Oversight Planning*, R4, 09/13  
LFO WI 226.1.3, *Performing Oversight*, Rev 6, 3/15  
LFO WI 226.1.4, *Issues Management*, Rev 3, 9/13  
LFO WI 414.9.1, *Writing and Managing Assessments of the Livermore Field Office, Issues, and Corrective Action Plans in ePegasus*  
LFO P 426.1.1D, *Safety System Oversight Program*, 7/15

Letter to Albright from Davis, dated June 22, 2012, subj: Contract DE-AC52-07NA27344, Clause H-4, Contractor Assurance System, letter number COR-CA-5/18/2012-440600  
ASRP-FO-2.12.2013-494533, SSO review of NMTP Nuclear Facility Configuration Management Plan  
ASM-FO-10.10.2013-541579, SSO review of B332 Wall removal  
ASRP-DP-3.26.2014-568237, Functional Area Review of the Pilot WP&C Process for Site 300  
ASM-FO-10.2.2014-596482, LCON-2 Assessment  
ASRP-FO-3.25.2015-619270, *Performance Review and Analysis of Work Planning and Control for Quarter 1 of FY2015*  
ASRP-FO-6.24.2015-631134, FR Activity Observation/Surveillance, subj: 5-Year Review of IWS/SP #12277  
ASRP-FO-6.25.2015-631543, Activity Observation/Surveillance, subj: Unloading of the 10-160B Shipping Cask  
ASRP-FO-9.15.2015-642949, FR Activity Observation/Surveillance subj: Remove InstronPress  
ASRP-SI-11.19.2015-652724, Maintenance SME participation on JFLMA For Implementation of Nuclear Facility Maintenance  
Annual Workforce Analysis and Staffing Plan Report (as of 1/19/16) for LFO  
ASRP-SI-9.14.2016-695834, Maintenance SME assessment of corrective actions associated with roll up door failure)  
LFO Shadow Assessment Checklist dated 9/19/16 ITS 40479  
Letter to Gioconda from Williamson, dated Nov 1, 2016, subj: LFO Review of Lawrence Livermore Integrated Safety Management System Declaration and Effectiveness Review for 2015, letter number COR-FO-9/9/2016-695354  
January 2017 Issues for LFO Issues Review Council  
Integrated Assessment Schedule FY 15, 16 and 17  
LFO WI 442.1, *Differing Professional Opinions*, R2, 5/14  
LFO M 414.1, *Integrated Management System Manual*, R3, 05/16  
LFO WI 442, *LFO Employee Concerns Program*, R3, 8/15  
WI 226.1.1(P), *Managing Assessments and Issues in Pegasus*, 08/14

## **Interviews**

### ***LLNS***

Deputy Director  
Work Planning and Control Project Leads  
WCI Deputy Principal Associate Director for Operations  
LLNS Workers and Technicians  
Work Planners  
Responsible Individuals  
Authorizing Individuals  
Competent Workers  
Work Control Review Board Members  
Performance Analysis and Improvement Manager  
Institutional Quality Assurance and Assessment Manager  
Requirements, Metrics and Issues Management Manager  
Lessons Learned Coordinator  
Issues Tracking System Manager  
Subject Matter Experts (Lasers, Work Planning and Control, Industrial Hygienists, Fire Protection Specialists, Industrial Safety Engineers, Explosive Safety Engineers)  
ES&H Team #1 Lead  
Site 300 Manager  
Site 300 Deputy Manager

Controlled Materials Supervisor  
Explosives Safety SMEs  
Explosives Safety Engineers  
Explosives Waste Storage RI  
Explosives Waste Treatment RI  
Explosives Machining RI  
Explosives R&D RI  
Explosives Waste Storage Workers  
Explosives Waste Treatment Workers  
Explosives Machining Workers  
Explosives R&D Worker in Training

### ***LFO***

Field Office Manager  
Senior Technical Safety Advisor  
Assistant Manager for Operations  
Assistant Manager for ES&H  
FR Program Manager and WP&C Lead  
Maintenance SME  
FRs  
Operating Experience Coordinator  
Technical Qualification Program Manager  
SSO Engineers  
Performance Assurance Manager  
Contracting Officer  
Explosives Safety SME

### **Observations**

#### ***LLNS***

Large Area Tester Lab, NIF\_LSSE-HCP-AL3-165-0002 v:1  
Zeus Lab, NIF\_LSSE-HCP-AL3-165-0001 v:1  
Sewer Monitoring Complex Operations; ESH\_EFA-HCP-AL3-SMCPX-0001 v:1  
Calibration and Repair of Industrial Hygiene Instrumentation, ESH\_ASI-HCP-AL3-255-0001 v:1  
Prepare Samples & Standards for Analysis; ESH\_ASI-HCP-AL3-253-0001 v:1  
Site 300 Explosive Waste Storage Weekly RCRA Facility Inspection -Building 816 (Explosives Waste Storage Facility), WCI\_RHWM-HCP-AL3-S300\_SITE-0001, *Operate the Explosives Waste Storage Facility (EWSF)*, 1/18/2017  
Site 300 Work Observation -Explosives Waste Treatment (pre-job briefing only) -Building 845A (Explosives Waste Treatment Facility), WCI\_RHWM-HCP-AL3-EWTFCPX-0001, *Treat Explosives Waste Generated at LLNL by Burning or Detonation*, 1/18/2017  
Site 300 Work Observation – Fisher Sub Sieve Sizer – Building 827A (H.E. Research and Development) WCI\_WTE-HCP-AL3-827CPX-0003, *Measure Particle Size with the Fisher Sub-Sieve Sizer (FSSS)*, 1/17/2017  
Site 300 Work Observation – Explosives Machining – Building 807 (H.E. Machining), WCI\_WTE-HCP-AL2-874-0001, *Machine and Fabricate Materials, Parts, and Fixtures to Support Weapons Systems Testing*, 1/17/2017  
Site 300 Work Observation -Roundtable discussion for preparation of Hazards Control Plan for Building 836D (Engineering Test Facility)  
Site 300 Work Observation – Cut Propellant Machine Fines – Building 827E (H.E. Formulations), WCI\_WTE-HCP-AL3-827CPX-0001, *Cut MSP-1 (C-740) Propellant Machine Fines*, 2/2/2017



Site 300 Work Observation – Explosives Waste Inspection and Transport (pre-job briefing, vehicle inspection only) -Building 810A (Explosives Assembly Facility), WCI\_RHWM-HCP-AL3-EWTFCPX-0001, *Treat Explosives Waste Generated at LLNL by Burning or Detonation*, 1/18/2017  
Site 300 – Attended the daily Site 300 Plan of the Day and Week meeting (23, 24, and 25 January; 6 and 7 February)

***LFO***

LFO Oversight of WP&C  
Issues Review Council Meeting  
Monthly LFO Manager FR Interface Meeting  
Walkthroughs with FRs at Site 300 and Superblock facilities  
Walkthrough with SSO Engineer  
LFO WP&C Lead and Work Control Review Board Meeting  
Maintenance SME meetings with Laboratory

## **Appendix C Deficiencies**

Deficiencies that do not meet the criteria for a finding are listed below, with the expectation from DOE Order 227.1A that site managers will apply their local issues management processes for resolution.

### **Work Planning and Control**

- In three work observations involving the new WP&C process, hazard controls of an HCP were confusing or conflicting, or could not be followed as documented in the HCP. Section 3.2.5.1 of DES 2012, *The LLNL Work Planning and Control Program*, procedure, requires that hazard controls, actions, and reminders be communicated to workers in a clear and user-friendly format.
- In one work observations, hazard controls were not followed by ES&H workers as written in HCPs, and work activities were not stopped or paused when encountering hazard controls that could not be followed as written, contrary to the requirements of Section 4.0 of POL-2010, *Work Planning and Control Policy*.

### **Livermore Field Office**

- LFO has not approved the LLNS CAS description as required by DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*.
- LFO WI-442.1, *Differing Professional Opinions* (DPO), does not meet the requirement in DOE Order 442.2, which states that the Under Secretary assigns a DOE senior technical safety manager as the Final Decision Manager. The LFO procedure inappropriately assigns the LFO manager as the Final Decision Manager.