Office of Enterprise Assessments
Targeted Review of Work Planning and Control and Biological Safety at the Los Alamos National Laboratory

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Acronyms

AD	Associate Directorate
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
BSL	Biological Safety Level
BSO	Biological Safety Officer
CAS	Contractor Assurance System
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CRAD	Criteria, Review, and Approach Document
DESO	Division Electrical Safety Officer
DNA	Deoxyribonucleic Acid
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DSO	Deployed Security Officer
EA	Office of Enterprise Assessments
ES&H	Environment, Safety and Health
FCA	Facility Centered Assessment
FOD	Facility Operations Director
FR	Facility Representative
FY	Fiscal Year
HHS	Department of Health and Human Services
HRL	Health Research Laboratory
IBC	Institutional Biosafety Committee
ICAM	Issues and Corrective Action Management
IH	Industrial Hygiene
ISM	Integrated Safety Management
IWD	Integrated Work Documents
IWM	Integrated Work Management
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LO/TO	Lockout/Tagout
MSL	Materials Science Laboratory
MSS	Maintenance and Site Services
MST	Materials Science and Technology
MST-7	Engineered Materials Group
MST-8	Materials Science in Radiation and Dynamics Extremes Group
MST-16	Nuclear Materials Science Group
NA-LA	Los Alamos Field Office
NIH	National Institutes of Health
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
ORPS	Occurrence Reporting and Processing System
PAD	Principal Associate Directorates
PIC	Person-in-Charge
PFITS	Performance Feedback Issue Tracking System
PM	Preventive Maintenance
POD	Plan of the Day
POW	Plan of the Week
PPE	Personal Protective Equipment

R&D	Research and Development
RLM	Responsible Line Manager
S&H	Safety and Health
SME	Subject Matter Expert
STO	Science and Technology Operations
TA	Technical Area
TFF	Target Fabrication Facility
TQP	Technical Qualification Program
UI	Utilities and Institutional
WO	Work Order
WP&C	Work Planning and Control

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EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted a targeted review of activity-level work planning and control at the Los Alamos National Laboratory (LANL). The onsite portions of this review were conducted from June 15 to 18 and July 13 to16, 2015. LANL's primary missions are to develop and apply science and technology to ensure the safety, security, and reliability of the U.S. nuclear deterrent; reduce global threats; and solve other emerging national security challenges. LANL is managed and operated by Los Alamos National Security, LLC (LANS) with oversight by the Los Alamos Field Office (NA-LA).

EA's review of activity-level work planning and control at LANL focused on research and maintenance in select departments, as well as the associated LANS assurance and NA-LA oversight processes pertaining to work planning and control. The activity-level work planning and control review at LANL was part of a broader EA targeted review of activity-level work planning and control across DOE that partially addresses a DOE commitment to the Defense Nuclear Facilities Safety Board to enhance Federal oversight in this area. This review also included the first EA targeted review of biological safety programs.

Overall, LANS has established the fundamental elements of work control processes at LANL to adequately identify activity-level work scopes and analyze and control hazards. Managers; supervisors; researchers; craft; and environment, safety, and health personnel were experienced, knowledgeable of assigned work activities, and interacted with each other in a professional manner. Training requirements and qualifications are well defined, and LANS staff members interviewed were current on their training requirements.

Since the last DOE independent oversight review in 2008, LANL has made significant progress in research work planning and control, particularly with respect to industrial hygiene exposure assessments and the controls for chemical fume hoods in the departments reviewed. In most cases, observed research work was performed within the work scope boundaries and controls described in the integrated work documents, and hazards were adequately identified. However, some issues were identified with respect to maintenance activities performed on research equipment by the research staff, documentation of hazard analysis, integrating facility and general work area hazards and controls with job specific hazards and controls in work documents, validation of hazard controls through exposure monitoring and sampling, and a lack of rigor in identifying and implementing some hazard controls and in clarifying some requirements in the LANL integrated work management procedure pertaining to research activities.

For the most part, LANS Maintenance and Site Services workers performed most observed work in accordance with procedures, work packages, and required controls. Pre-job briefings were thorough, interactive, and tailored to the maintenance activities. While most work observed by EA was conducted in accordance with established controls and without incident, two events reportable under the Occurrence Reporting and Processing System occurred during the time of this review because of inadequate implementation of established controls. In one case, a Maintenance and Site Services work evolution resulted in an overhead electrical line strike (by a dump truck bed) because of inadequate implementation of several electrical safety and work authorization controls. In the other case, two LANS laboratory workers (not Maintenance and Site Services workers) performed what they considered minor maintenance on programmatic equipment involving electrical hazards under requirements for low hazard activities, but did not recognize the hazard level should have been categorized as moderate. Consequently, the activity

was conducted without the appropriate level of integrated work document and approval. Additionally, EA identified a few cases with unidentified hazards, insufficiently defined hazard controls, and/or performance of work outside of established controls.

For the observed biological research work, the integrated work control process adequately defined the work scopes, identified the appropriate hazards, and implemented the correct controls. The LANL Institutional Biosafety Committee along with the site work control process are designed to ensure that all funded biological research is reviewed, defined, and controlled within the safe operational limits established by Federal regulation. The Institutional Biosafety Committee members are required to review and authorize all Biological Safety Level 2, select agent and toxin, and recombinant deoxyribonucleic acid research through an application process prior to any laboratory activity. Overall, the reviewed aspects of the LANL biosafety programs are effective and comply with Federal regulations.

Overall, the LANS assessment process is documented, and LANS is performing some assessments related to work planning and control and is tracking and trending some internally identified issues. However, LANS has not performed specific assessments of integrated work management in the last 3 years and may not have the data required to make risk-informed decisions about the effective and efficient implementation of integrated work management. The metrics used to assess the integrated work management program health are based on lagging indicators and therefore not predictive of integrated work management performance.

Overall, NA-LA has adequate processes and procedures for the oversight of work planning and control, and has highly qualified and experienced technical staff. However, there is a significant shortage of staff in the Facility Representative Program (6 of 12 authorized positions are vacant). Also, NA-LA has not approved the contractor assurance system, which is required by DOE Order 226.1B, Implementation of Department of Energy Oversight Policy.

While the fundamental components of necessary activity-level work planning and control systems have been established and are functioning, LANL continues to experience safety-related events. Addressing the specific gaps identified in this assessment, greater management focus on consistent implementation of established processes, and enhancing organizational learning from specific events will serve to further improve LANL's safety program.

Office of Enterprise Assessments Targeted Review of Work Planning and Control and Biological Safety at the Los Alamos National Laboratory

1.0 PURPOSE

The U.S. Department of Energy (DOE) independent Office of Enterprise Assessments (EA) conducted a targeted review of the activity-level work planning and control (WP&C) and biological safety processes and activities at the Los Alamos National Laboratory (LANL). Los Alamos National Security (LANS) is the prime management and operating contractor at LANL. The National Nuclear Security Administration (NNSA) Los Alamos Field Office (NA-LA) provides Federal oversight of LANS. The onsite portions of this review were conducted from June 15 to 18 and July 13 to 16, 2015.

This targeted review is part of a larger-scale targeted assessment of WP&C across the DOE complex. EA selected this area for targeted review because of its importance to facility and worker safety and as part of the Deputy Secretary's commitment to enhance Federal oversight of WP&C, which is documented in a response to a Defense Nuclear Facilities Safety Board letter and technical report (i.e., DNFSB/Tech-37).

2.0 SCOPE

EA conducted this review in accordance with the *Plan for the Office of Enterprise Assessments Targeted Review of Work Planning and Control and Biological Safety Program at the Los Alamos National Laboratory*. This review was not intended to represent a full programmatic review of the site WP&C program but based on a sampling of data from four facilities selected within scope (i.e., Health Research Laboratory, Sigma Complex, Material Science Laboratory Complex, Target Fabrication Facility) and review of the Biological Safety program. To assess the performance of WP&C at LANL, EA reviewed the documented processes, including WP&C procedures, hazard analyses and controls, technical procedures, maintenance work packages, and other WP&C and biological safety documents; interviewed key NA-LA and LANS personnel; observed meetings; and conducted other data-gathering activities. EA focused on observing activity-level work in the areas of research and operations, maintenance, and biological research laboratories, including work authorization activities, pre-job or pre-evolution briefings, execution of work activities, post-job feedback, and contractor assurance system (CAS) activities. This review also included evaluation of NA-LA processes for oversight of the contractor's WP&C and biological safety activities.

3.0 BACKGROUND

EA's oversight program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements and the effectiveness of DOE and contractor line management performance in safety, security, and other critical functions as directed by the Secretary of Energy. The EA oversight program is described in and governed by DOE Order 227.1B, *Independent Oversight Program*, and a comprehensive set of internal protocols, operating practices, inspector guides, and process guides.

NA-LA oversees LANS and is responsible for administering the performance-based contract, executing assigned NNSA and DOE programs and conducting oversight of work performed at LANL in support of NNSA requirements and priorities. LANL's primary mission is to develop and apply science and technology to ensure the safety, security, and reliability of the U.S. nuclear deterrent; reduce global

threats; and solve other emerging national security challenges. This includes critical research to address biosecurity, bio-detection, mitigation and characterization, bioenergy, and public health surveillance solutions. For over 60 years, LANL has served as a research center in the world of science, technology, and engineering, and has made achievements that focus on safety, security, environmental stewardship, nuclear deterrence, threat reduction, operations, communications, and community involvement. Since June 2006, LANS – a partnership that includes the University of California; the Babcock and Wilcox Company; Bechtel National, Inc.; and URS Corporation – has held the contract for managing and operating LANL.

In August 2014, the White House responded to recent biosafety and biosecurity events around the country by ordering an immediate comprehensive review of all infectious disease research, biosafety and biosecurity procedures and protocols, inventories of culture collections, and increased attentiveness to ensure the safety of researchers and the public.

NNSA Headquarters coordinated the White House Biosafety "stand down" in conjunction with NNSA field staff to ensure that procedures, protocols, and inventories met regulatory requirements. LANS provided written documentation to NA-LA on September 15, 2014 regarding actions taken to address the immediate steps requested in the White House memorandum.

4.0 METHODOLOGY

EA's *Plan for the Office of Enterprise Assessments Targeted Review of Work Planning and Control and Biological Safety at the Los Alamos National Laboratory* identified the criteria to be used to evaluate WP&C, biological safety, contractor assurance and Federal oversight. In accordance with this assessment plan, EA focused on performance and implementation of site WP&C processes and evaluated performance weaknesses for potential causes. To assess the performance of WP&C at LANL, EA reviewed the documented processes, including WP&C procedures, hazard analyses and controls, technical procedures, maintenance work packages, and other WP&C and biological safety documents; interviewed key NA-LA and LANS personnel; observed meetings; and conducted other data-gathering activities. EA focused on observing activity-level work in the areas of research and operations, maintenance, and biological research laboratories, including work authorization activities, pre-job or pre-evolution briefings, execution of work activities, post-job feedback, and CAS activities.

The "Objectives" for the contractor work planning and control sections of this report were extracted from the Criterion Review and Approach Documents (CRADs) found in Section III of Appendix D of DOE G 226.1-2A. The "Objectives" for the CAS were extracted from the CRADs found in Section III of Appendix D of DOE G 226.1-2A and the Contractors Requirements Document in DOE O 226.1B *Implementation of DOE Oversight Policy*. The "Objectives" for the Biological safety program were based on lines of inquiry noted in CRAD 32-02, *Biological Safety Program*, and DOE Policy 434.1, A *Conduct and Approval of Select Agent and Toxin Work at Department of Energy Sites*. The "Objectives" for the DOE Field Element were extracted from DOE O 226.1B, *Implementation of DOE Oversight Policy*, and DOE Guide 226.1-2A, *Federal Line Management Oversight of DOE Nuclear Facilities.* Appendix A lists the EA personnel responsible for this review. Appendix B provides a detailed list of the documents reviewed, personnel interviewed, and observations made during this review, relevant to the findings and conclusions of this report.

This review included follow-up on selected previous findings from the *Inspection of the Environment, Safety and Health Programs at the Los Alamos National Laboratory* performed by EA's predecessor independent oversight office in January 2008. The 2008 review focused on a wide variety of topics including research and development, facility and maintenance work activities, the functionality of

essential safety systems, and contractor and federal feedback and continuous improvement systems. A number of areas reviewed during the 2008 review were outside the scope of the current work planning and control review. During this review, EA evaluated effectiveness of implementation of corrective actions for the 2008 report findings related to chemical fume hoods (Finding C-2) and worker exposure assessments (Finding C-6). The results of this follow-up are presented in Section 5.1 of this report.

5.0 RESULTS

The core of the WP&C process at LANL is the integrated work management (IWM) process defined in P300, *Integrated Work Management*. This process defines a graded approach for planning and executing work, and produces an integrated work document (IWD), or a set of facility or workgroup-specific work documents equivalent to an IWD. The IWD is intended to be worker-friendly by describing the work activity, identifying the hazards, and linking them to specific controls. Specifically, P300 requires a complete IWD to consist of Part I, *Activity-Specific Information*; Part 2, *Work-Area Information*; Part III, *Validation and Work Release Information*; and Part IV, *Post-Job Review*.

5.1 Research

During the review period, EA observed nine research activities within the Sigma Complex, Target Fabrication Facility (TFF), and Materials Science Laboratory (MSL). The LANL Materials Science and Technology (MST) Division, which resides within the LANL Experimental Physical Sciences Directorate, is responsible for each of these three facilities. The Sigma Complex is home to the LANL Metallurgy group and consists of four principal buildings, i.e., the Sigma Building, Beryllium Technology Facility, Press Building, and Thorium Storage Building. All Sigma Complex research activities that EA observed or reviewed (e.g., aqueous cleaning, electroplating and finishing, and rolling mills) were located in the Sigma Building. The TFF is home to the LANL Engineered Materials Group (MST-7). Research conducted within the TFF consists of polymer applied research, surface science and coatings, target design and fabrication, materials characterization and forensics, and various types of plutonium research. Research activities that EA observed in the TFF included surface science instrumentation, mechanical property testing, and the MST-7 Machine Shops. The MSL is home to the Materials Science in Radiation and Dynamics Extremes Group (MST-8). Research conducted in this laboratory consists of mechanical testing of materials, single crystal growth, and modeling of materials. The Materials Physics and Application Division also conducts research within the MSL. Research activities that EA observed in MSL included metallography, catalyst deposition on solid supports, and electrochemistry and furnace operations.

Within these facilities EA observed research activities; interviewed LANL management, research staff, and supporting Environment, Safety and Health (ES&H) and operations staff; and reviewed a wide variety of work documents, particularly IWDs. Each of the research activities observed were examples of an ongoing research project that had begun a year or more ago. The results of this review of LANL research activities are summarized in the following paragraphs and in Section 5.3, *Biological Safety Programs*.

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 G 226.1-2A; Appendix D; Objective WP&C2-1)

Overall, observed research activity work scopes were well defined in the "Activity Description/Overview" Section of Part 1 of the IWDs and satisfied the LANL requirements for a work description in P300, Section 3.1.1, *Define the Work*. For example, observed metallography research

involving the sectioning, mounting, grinding, polishing, and etching of small metal samples in Room B122 of the MSL matched the work description in the IWD for this research activity. Similarly, the work scope for observed research associated with the Electrochemistry and Furnace Operations in the MSL Materials Corrosion and Electrochemistry Laboratories was also well described in Part 1 of the IWD such that the dominant hazards could be readily identified. For each of the observed research activities, the elements of the research activities were sequentially defined and sufficiently described in the "Work Task/Steps" of the IWD such that most hazards could be identified.

P300 and SD100, *Integrated Safety Management System Description*, require that when defining the work scope, a single responsible line manager (RLM) must be designated to be responsible for the safety, security and environmental compliance of each work activity, and for activities involving multiple organizations, an RLM must be designated before the work begins. EA observed such a research activity involving multiple organizations in which the Nuclear Materials Science Group (MST-16) research staff was performing surface science experiments and investigations in the TFF under the responsibility and oversight of the MST-7 RLM. In this example, the research being conducted by MST-16 was well integrated with the MST-7 work practices and MST-7 management oversight. Although the research was conducted by MST-16 staff, the IWD was prepared, reviewed and authorized by the MST-7 RLM who in addition had required participation of the MST-16 research staff in routine meetings, annual IWD reviews, and work practices associated typically with only the MST-7 research staff.

In experimental research activities, the work scope for programmatic maintenance (i.e., maintenance performed by research staff or outside vendors on research equipment) is not always sufficiently defined in an IWD. As a result, hazards and controls cannot always be identified and work is not always appropriately authorized in Part 3 of the IWD. EA observed one IWD associated with the Rolling Mill Operations within the Sigma Building in which the programmatic maintenance tasks and limitations were well defined in the IWD. However, the Sigma Electroplating and Finishing IWD includes a task titled "Irregular Maintenance" for troubleshooting, testing, and maintenance on programmatic equipment within the Sigma Plating Shop which could involve a wide variety of equipment maintenance activities, none of which (including the associated hazards and controls) are specifically identified in the IWD. The IWD states that "a specific IWD may be required" for some of these programmatic maintenance activities, but provides no indication as to the type of programmatic maintenance that can be performed within the scope of this IWD or any limitations on programmatic maintenance. In a second example, the *Maintenance* section of the IWD for Electrochemistry and Furnace Operations in the Materials Corrosion and Electrochemistry Laboratories allows for laboratory equipment maintenance, and identifies the potential for electrical, pressure and mechanical hazards, but does not identify the specific scope of the programmatic maintenance or any limitations that would require a separate IWD. In addition, the IWD does not identify the type of work that could be performed as low hazard and would not require an IWD. For the programmatic maintenance performed in the Sigma Plating Shop, the IWD requires an activity specific pre-job work authorization for each maintenance activity as well as the completion of an IWD Part 3. However, for the Electrochemistry and Furnace Operations there is no mention of a pre-job work authorization requirement, implying that the existing IWD Part 3 has already authorized programmatic maintenance work, but without the specific programmatic work scope and hazards being defined. On July 9, 2015, a similar event occurred at LANL when two Laboratory workers had initiated troubleshooting as a low hazard activity and without a separate IWD while performing programmatic maintenance on a wire forming mill in the Sigma Building. The subsequent LANL investigation of the event concluded that an IWD should have been prepared for the programmatic maintenance work activity (See Section 5.2, *Maintenance*, for details). (See **OFI-LANS-RESEARCH-1**)

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 G 226.1-2A; Appendix D; Objective WP&C2-2)

For observed research activities, experimental hazards (e.g., chemicals, cryogens and compressed gases, ergonomic, electrical) were generally well defined and explained within the research IWD. For example, the IWD associated with Electroplating and Finishing in the Sigma Building extensively lists the potential hazards, how the hazards may evolve, and the likely consequences to workers should such hazards exist as well as the expected controls to prevent or bound the hazard.

P300 requires that, the RLM or designee (usually the Person-in-Charge [PIC]) determine the hazard grading level (low hazard, moderate hazard, or high hazard/complex) for each IWD. This hazard grading is identified on the first page of the IWD. The research activities that EA observed were classified as moderate hazard, with the exception of the Electroplating and Finishing activity in the Sigma Building (which was classified as high-hazard, but medium residual risk with controls). For low hazard activities, a formal hazard identification and analysis process and a complete IWD are not required. Furthermore, the threshold criteria for a "low hazard" classification is insufficiently defined in P300. As a result, some low hazard programmatic maintenance work has been performed without an IWD when required, as previously discussed. For moderate hazard activities, P300 requires that "a hazard analysis method such as 'what if' or Hazard Operability and Analysis must be performed to determine the hazards associated with potential accidents or incidents and how harm might be caused." However, P300 does not require that the hazard analysis be documented other than the names of the hazard analysis team being documented on the IWD and whether the hazard analysis method was "brainstorming" or "other." Of the eight moderate hazard activities that EA observed only one had a documented hazard analysis, i.e., the IWD for the MST-7 Machine Shops included a "what if" checklist that identified seven events that could result in worker consequences if not adequately controlled. Although P300 does not require the hazard analysis for a moderate hazard activity to be documented, interviews and a review of individuals who participated on the hazard analysis team indicated that the undocumented hazard analysis performed for some of these research activities does not meet the minimum requirements specified in P300 for a hazard analysis. For example, for a few of the research activities, the only hazard analysis conducted was a meeting of a few select staff to read the IWD, without the benefit of an ES&H subject matter expert (SME). (See **OFI-LANS-RESEARCH-2**)

Part 2 of the IWD identifies and describes the work-area hazards and controls, and is prepared and approved by the Facility Operations Director (FOD) or his or her designee. Part 2 forms were included in the research IWDs that EA reviewed, but were often incomplete, unclear with respect to requirements, or the coordination requirements were conflicting with respect to the LANL conduct of research. For example: (See **OFI-LANS-RESEARCH-3**)

- Several IWD Part 2 Forms indicated a requirement for work-area and/or site training but did not identify the training requirements (e.g., Electroplating and Furnace Operations IWD, Catalyst Deposition on Solid Supports IWD).

- Several IWD Part 2 Forms indicated a requirement for a Plan of the Day/Week (POD/POW), but the research activity was not part of the POD/POW schedule. In one case relating to metallography research being conducted in MSL, the IWD Part 2 Form indicated that "all programmatic work requiring an IWD must be scheduled and authorized in the Science and Technology Operations (STO) Division Plan of the Week (POTW)." This research activity was not scheduled on the POW, and based on interviews, is not required to be scheduled and authorized on the POW.

- Several IWD Part 2 Forms approved by the FOD had no requirements for "Entry or Coordination" although such requirements were applicable (e.g., work-area training). Furthermore, no work area hazards were indicated, although such requirements and/or hazards existed (e.g., IWDs in the TFF).

10 CFR 851, *Worker Safety and Health Program*, requires LANL to assess worker exposure to chemical, physical, biological, or safety hazards through appropriate workplace monitoring and documentation using recognized exposure assessment and testing methodologies. The LANL Worker Exposure Assessment program as defined in P101-32, *Worker Exposure Assessments*, has been designed to meet this requirement. The 2008 independent oversight review found that worker exposures to chemical, physical, or biological hazards had not been adequately evaluated, assessed, documented, or communicated in research activities and fabrication shop operations as required by 10 CFR 851. During this review, documented exposure assessments had been completed for each of the nine research activities that EA observed. In general, the exposure assessments (i.e., Health Assessment Survey Reports) identified the dominant potential worker exposures, and the assessment of the research activity exposure hazards was consistent with the research activity as described in the IWD. Overall, most of the exposure assessments were of good quality, the work description matched the description of work in the IWD, and the most significant exposure pathways were evaluated. However, there were two exceptions with respect to the quality of exposure assessments. In one example, EA observed research activities in three biosafety laboratories located within the Health Research Laboratory (HRL) where the IWDs identified potential cryogen and inert gas hazards, but the exposure assessments for these IWDs had not assessed the potential for an oxygen deficient atmosphere. Furthermore, the supporting oxygen deficiency calculations had not been performed. Following up on this EA concern, LANL performed the oxygen deficiency calculations and identified the need for additional controls to be included in the IWDs. In a second example, control methods described in the exposure assessments were often defined, but there was some inconsistency between controls identified in the exposure assessment and those in the IWD for the same research activity. For example, the personal protective equipment (PPE) requirement for the operation of the Bridgeport Milling Machine, as defined in the MST-7 Machine Shops IWD, is only safety glasses with side shields. However, for the same mill the exposure assessment identifies the PPE as safety glasses, nitrile gloves, laboratory coats, safety boots, and ear plugs. Furthermore, the exposure assessment for the milling machine recommends that workers wear hearing protection when using machine shop equipment, whereas the IWD states that "hearing protection is provided but not necessary." In April 2014, LANS identified several weaknesses in the LANL exposure assessment program and issued a noncompliance report with respect to 10 CFR 851.21(a)(2), *Hazard Identification and Assessment*. Weaknesses identified by LANS were in the areas of use of ES&H SMEs, accuracy and use of exposure assessment information, subcontract work planning, and hazard identification and control selection. (See **OFI-LANS-RESEARCH-4**)

Many of the research activities that EA observed involved hazardous chemicals within the confines of a chemical fume hood. Chemical fume hoods are an effective engineering control for chemical vapors, spills, and splashes, but the operators (i.e., researchers) and the environment where the hood is located can reduce the effectiveness of the hood as a control measure. These attributes include large equipment items within the hoods, sash height, operator height, obstructions in the baffles, cross drafts, variations in the hood ventilation system, and proximity of the research activity to the hood sash. Section 2.1.1 of American National Standards Institute/American Industrial Hygiene Association (ANSI/AIHA) Z9.5-2003 "American National Standard for Laboratory Ventilation", and Chapter 39 of the LANL Laboratory Industrial Hygiene and Safety Manual (IHSM), *Chemical Fume Hood and Inspection*, establish expectations for lab hood safety, including the use of exposure monitoring to ensure the effectiveness of lab hoods as a hazard control.

Based on the guidance provided in ANSI/AIHA Z9.5-2003, the effectiveness of a hood for a prescribed activity should be periodically validated by monitoring or sampling the operator for chemicals that will likely become airborne or splashed within the hood, particularly when highly volatile and toxic materials are involved. EA observed or evaluated two such research activities, one involving the use of methylene chloride which was routinely spilled in small quantities inside the hood during the research activity, and another involving the use of isocyanates in a hood during the processing of thermoset polymers.

Methylene chloride is an OSHA regulated carcinogen, and isocyanates were the focus of an OSHA National Emphasis Program in 2013 as a result of the serious health effects (including death) that some workers experienced. In the case of the methylene chloride, no exposure monitoring of the researcher had been performed, nor was it necessarily required by OSHA standard that applied to this activity (29 CFR 1910.1450), although expectations for exposure monitoring to determine a hood's effectiveness are delineated in ANSI/AIHA Z9.5-2001 and Chapter 39 of the LANL IHSM as previously discussed. LANL Industrial Hygiene performed additional monitoring to validate the effectiveness of controls following the initial EA visit. The results for methylene chloride were less than the detection limit. In the case of the isocyanates, exposure monitoring of the activity had been performed but at a different setting (i.e., local exhaust ventilation instead of a fume hood) and only as a short term exposure. LANL does not routinely monitor researchers who perform their research within a chemical fume hood to validate the effectiveness of the hood for a specific research activity, even if that research activity involves volatile and toxic chemicals. (See **OFI-LANS-RESEARCH-5**)

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 G 226.1-2A; Appendix D; Objective WP&C2-3)

For observed research activities, experimental hazard controls (e.g., engineering controls such as chemical fume hoods, PPE, and administrative controls and training) were generally well defined within the research IWD. For example, the IWD associated with metallography in MSL provides detailed controls for each task typically associated with metallography research, such as chemical and material use; cutting, grinding, and polishing; chemical polishing or etching; glassware; electro-polishing; flammable solvents; cryogens; and a section on general laboratory safety.

Another positive attribute with respect to observed hazard controls was the addition of a fourth column in Part 1 of each research IWD to list the training and qualification requirements for the work activity. The training and qualification requirements in reviewed IWDs were task specific and detailed. For example, in the Metallography IWD for Task B "General Chemical and Material Use," the training requirements were appropriate for the tasks and hazards listed in the IWD and included training plans for hazardous communications, waste generation, hydrofluoric acid first aid response training, and lead awareness training, as well as MST-8 facility safety orientation with the operation's PIC and an MST-8 metallography safety orientation.

One finding from the 2008 independent oversight review related to chemical fume hood procedures, testing, and user training indicated a lack of sufficient rigor and/or adherence to ensure that the hoods are operated in compliance with LANL's and the manufacturer's requirements and applicable ANSI standards (e.g., ANSI/AIHA Z9.5). Since the 2008 review, LANL has updated LANL Health and Safety Manual Chapter 39 on Ventilation (Chemical Fume Hood Testing), P101-16 *Local Exhaust Ventilation and HEPA Filtration Systems*, and has developed and issued a Self-Study Training Course on Ventilation: Fume Hoods (Course #48002). During this review, EA observed nine research activities within the MST Division, most of which employed chemical fume hoods as a primary hazard control. In each case, the chemical fume hood had been inspected and certified by LANL Industrial Hygiene; most IWDs cited the requirement for completing the training for fume hoods; and for eight of the research staff who were observed using or were authorized to use a chemical fume hood, all had completed the chemical fume hood training, including those who were working under an IWD where the hood training course requirement may not have been specified.

Although most hazard controls are clear, and have been identified in IWDs or through postings and signage, EA noted two exceptions. For example, EA observed 0.5" rectangular steel bars being reduced to a smaller cross section by a small rolling mill in the Sigma Building. Although the activity is well

described in the Rolling Mill Operations IWD and was performed by skilled machine technologists and engineers, it is possible for the bar stock being compressed during the rolling mill operation to become a projectile. According to one of the machinists, this event occurred years ago with the larger rolling mill and the bar stock was ejected from the machine and propelled some distance across the room. Although this hazard of "personnel being struck by ejected material" is identified within the IWD, and some controls were described, the potential projectile path was not clearly indicated or safeguarded. Section 8 of ANSI B11.12-2005, *Safety Requirements for Roll-forming and Roll-bending Machines*, provides guidance on safeguarding requirements and awareness barriers, devices, and signs. In addition, the use of a push rod, as required in the IWD, is not always practical with long bar stock or other materials. However, there are no control alternatives to the push rod identified within the IWD. Furthermore, 29 CFR 1910.212(a)(3)(iii) indicates that special hand tools, such as a push rod, should not be used in place of other guarding requirements. In a second example associated with the IWDs for Aqueous Cleaning and Electroplating and Finishing in the Sigma Plating Shop, several tanks (e.g., rinse and nickel strike tanks) had been previously used with beryllium parts; however, the tank surfaces had not been surveyed for potential beryllium contamination, nor had consideration been given to the possibility of beryllium cross-contamination of subsequent non-beryllium parts being immersed in plating baths that had been used for beryllium parts. In contrast, tanks in the Sigma Plating Shop that may have been used for uranium parts are routinely surveyed for radioactivity, since clean parts that are immersed in these baths are required to be surveyed for radiological cross-contamination before the parts can be free-released from the plating shop. (See **OFI-LANS-RESEARCH-6**)

Objective: Work is conducted diligently in accordance with approved work instructions and within established controls. (DOE G 226.1-2A; Appendix D; Objective WP&C2-4)

According to P300, the RLM responsible for the work activity must authorize workers, including workers from other organizations, to perform work activities. The RLM's signature on the cover page of Part 1 of the IWD attests to the fact that the IWD has been properly prepared and that work will be performed within the ES&H/safeguard and security requirements and facility requirements as stated in the IWD. After interviewing several MST RLMs or their deputies and reviewing selective researcher training records, EA confirmed that the RLMs are directly involved in the review and approval of research activities and that individuals have completed the necessary training. Part 3 of the IWD is the Validation and Work Release (Form 2103). According to P300, the PIC must verify that the assigned workers are authorized and must attest to worker readiness by signing Part 3 of the IWD. P300 further indicates that the RLM, or the PIC if designated by the RLM, is responsible for determining whether each worker meets facility access requirements as defined in Part 2 of the IWD. However, the RLMs and PICs are not ensuring that Part 2 forms are completed. (See **OFI-LANS-RESEARCH-3**)

Of the nine observed research projects, research work was generally performed in accordance with the requirements and within the controls stated in the IWDs. One exception was the observation of workers size reducing steel stock in the Sigma rolling mills without the aid of a "pusher or other tooling to keep the hands away from the infeed" as required by the Rolling Mill Operations IWD. However, as previously discussed, in some applications the use of a push rod may not be the most effective hazard control. (See **OFI-LANS-RESEARCH-6**)

In a few cases, the P300 procedure provides insufficient detail with respect to work implementation requirements, as evidenced during work observations. For example: (See **OFI-RESEARCH-7**)

- Section 3.1.4.b of P300 addresses how and when changes to an IWD can be performed in the field and notes that the PIC may address minor changes with revisions to the IWD on the job site by lining out and/or adding text, initialing and dating the revision, and notifying all affected workers of the changes. For example, field changes made to the MSL IWD for Catalyst Deposition on Solid

Surfaces generally complies with these requirements. However, many of the numerous red ink hand changes to the Metallography IWD performed in MSL do not meet the requirements of P300, e.g., few of the changes are initialed or dated, and many of the changes are not changes to clarify or modify the text of the IWD but reminders of IWD issues that should be corrected during the next IWD review, such as "Add comment of postdocs" or "the description will be cleaned up on the next renewal."

- Few interviewed PICs and RLMs had an adequate understanding of the P300 requirements for "Standing" verses "Standard" IWDs, although each had assumed one or the other as indicated on the cover of Part 1 of the IWD. Requirements for Standing IWDs are provided in Section 3.3 of P300, but none of the examples of Standing IWDs are associated with research activities.

- As part of work execution, Section 3.1.4 of P300 requires the PIC to perform a pre-job briefing with the workers immediately before beginning any new work and to cover at least the questions listed on Part 3 of the IWD. Each IWD that EA reviewed had evidence of a pre-job briefing being performed, but in most cases the pre-job briefing was performed one to two years before the observed research activity. P300 lacks guidance for pre-job expectations associated with long term ongoing research projects, which form the bulk of most observed research activities.

Overall, most work scopes, hazards and hazard controls were identified and described in sufficient detail in the IWDs. For research conducted by more than one group, research activities were integrated and under the control of a single RLM and PIC. Since the last independent oversight review in 2008, progress in research WP&C is evident, particularly with respect to industrial hygiene exposure assessments and the controls for chemical fume hoods. Training requirements and qualifications are well defined in a column within each IWD dedicated to this purpose, and based on a sampling of training records, the research staff was current on their training requirements. Observed work was usually performed within the work scope boundaries and controls described in the IWDs. However, there were a few exceptions, particularly with respect to the documentation of programmatic maintenance work scope, hazards, and controls; documentation of hazard analyses; design and completion of IWD Part 2 forms for research; validation of hazard controls through exposure monitoring and sampling; the need for additional rigor in the identification and implementation of some hazard controls; and in clarifying a number of requirements in P300 as they pertain to research activities.

5.2 Maintenance

During the review period, EA observed seven maintenance activities within facilities associated with Sigma Complex, MSL, and the Health Research Laboratory (HRL). Within these facilities, EA observed pre-job briefings and maintenance activities; interviewed MSS management and line supervision, maintenance craft, and supporting ES&H and facility operations staff; and reviewed a wide variety of work documents, including IWDs. The maintenance activities observed included examples of corrective and preventative maintenance. Additionally, EA observed a number of meetings associated with the electrical line strike event and subsequent maintenance work pause, as well as a fact finding meeting associated with a programmatic maintenance event. The results of this review of LANL maintenance activities are summarized in the following paragraphs.

During the first week of the EA assessment, an MSS worker assigned to the Heavy Equipment/Roads and Grounds crew was driving a tandem dump truck with the bed extended and spreading gravel on the road at Technical Area 5. The bed of the truck contacted an energized 13.2 kilovolts overhead power line (hereafter referred to as the June 16, 2015 electrical line strike event). Following this event, LANS management paused all LANL Maintenance work while interim compensatory measures were developed. EA observed two meetings (one conducted by MSS Senior management and their Superintendents, and a

second meeting conducted with the MSS work execution manager and the craft) during the work pause. These meetings demonstrated good aspects of safety culture, including free and open dialog, worker engagement, mutual respect, and worker ability to raise concerns.

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.

The scope of activity-level maintenance work activities performed at LANL is generally well defined in maintenance procedures, work packages, IWD, and POD schedules. For example, IWD Work Order (WO)# 516741-01, *Crane Mechanical and Electrical PM*, and 519486-01, *Annual Crane PM Inspection and Certification*, clearly identified the purpose and scope for two preventive maintenance (PM) activities performed during the review, including hazards, controls, and steps required for lockout/tagout (LO/TO) of crane units. Similarly, the IWDs/work packages for 520448-01, *ACR-006 Return to Operation (Air Conditioner, Cool)* and 519478-01, *Mechanical/Electrical Elevator PM*, also adequately defined the work scope and steps necessary for implementing LO/TO and working within confined space.

In one observation, workers did not recognize a change in scope until the work was nearly halfway complete and questions were raised to the PIC as to why work activities differed from those described in the work package, by both EA and the MSS Superintendent observing the activity. This activity, 506611-01, to *Replace PC-1 and PC-2* (Condensate pumps and motors), was originally written to replace only the pumps and motors; however, when it was determined by the PIC that the entire unit would have to be replaced because replacement parts were unavailable, the work package was not returned to planning for revision. As work in the field progressed, additional equipment was introduced, requiring electrical workers to introduce an additional air gap (electrical disconnect) in the power supply to meet LO/TO requirements. Furthermore, additional ergonomic hazards (lifting/weight) associated with removal of the old unit and placement of the new unit had not been considered. When the removal work was completed, the superintendent requested the work planner assigned to the package to visit the job site. The package was then revised to include scope change. (See **OFI-LANS-MAINT-1**)

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.

The AP-WORK series of documents are designed to supplement P300 to provide specific methods and additional guidance for addressing P300 requirements for MSS Conduct of Maintenance. An expectation in AP-WORK states that personnel performing maintenance must be knowledgeable of P300 and AP-WORK requirements to ensure that work is performed in accordance with LANL requirements.

For observed maintenance activities, task specific hazards (e.g., hazardous energy, steam, electrical, etc.) were generally well defined and explained in work packages. For example, identification of hazards and requisite controls within the packages included identification of the hazards and the application of energy controls (e.g., LO/TO and use of PPE).

While work instructions identify hazards associated with the maintenance task, Part 2 of the IWD is intended to provide Area Hazards and Controls for MSS staff members whom the FOD has approved to conduct assigned tasks. Often, these IWD Part 2s are prepared months and sometimes over a year before the MSS task is actually performed, and are not reviewed prior to performance of work. As a result, EA identified areas where conditions had changed and/or deteriorated by the time the work was actually performed. Additionally, for some observed activities, IWD Part 2s were either incorrect, incomplete, or included too many generic hazards not related to the activity. For example:

- For Work Order (WO)# 506611-01, *Replace PC-1/PC-2*, the initial IWD Part 2 in the work package indicated potential for hazards associated with legacy radiological contamination within the facility and the need for LO/TO associated with the assigned task. However, the work area had free standing water and walking surfaces were slippery because of an oil/water mixture from an ongoing discharge from a steam blowdown line to a floor drain that overflowed. A nearby facility air compressor also generated an inordinate amount of noise in the work area. EA alerted the facility maintenance coordinator of these concerns, as well as potential for overhead hazards related to piping, and the IWD Part 2 was subsequently revised for the equipment installation portion of the task. Additionally, although not assigned to the work package, the Superintendent squeegeed the water back into the floor drain and placed absorbent materials around the discharge point and requested the craft to use hardhats. The Maintenance coordinator reset another facility air compressor, which decreased the ambient noise from the compressor in the work area. (See **OFI-LANS-MAINT-2**)

- For WO# 519478-01, *Elevator Mechanical/Electrical PM*, the initial IWD Part 2 identified hazards with potential exposures to legacy contaminants within the facility and potential chemical hazards within laboratory spaces and associated systems; however, Part 2 did not indicate hazards associated with the confined spaces the workers would be entering or the potential for energized and operative systems. During the pre-job briefing, when workers questioned a potential fall hazard associated with the unprotected opening while working on top of the elevator, the PIC appropriately paused the work and requested the fall protection SME to develop a fall protection plan. (See **OFI-LANS-MAINT-2**)

- For WO# 520448-01, ACR-006, *Return to Service*, the IWD Part 2 was prepared for all 14 Technical Area (TA)-35 buildings assigned to the FOD and identified the entire spectrum of hazards in those buildings, ranging from ionizing radiation to elevated work surfaces. However, the actual work being conducted was outside one of the facilities adjacent to a loading dock. The document did not adequately identify the work area-specific potential hazards, such as those associated with vehicular traffic, heat stress, energized systems, and potential for lightning in outdoor areas. (See **OFI-LANS-MAINT-2**)

Overall, Work Packages associated with WO# 506611-01, *Replace PC-1/PC-2*, contained basic information on hazards and controls that were necessary to properly perform the assigned tasks. However, this package did not identify the noise hazard or requisite controls necessary to address impact noise generated when workers repeatedly struck the steel steam pipe unions (four connections ranging in size, hit multiple times each) with the back of pipe wrenches. Based on interviews with workers and the PIC, older installations occasionally require mechanical striking to loosen rusted or otherwise bound pipe union connections. The tool selected was also inappropriate for the job because the wrench metal could fail. Additionally, the inappropriate use of tools by craft workers (i.e., use of a wrench as a hammer) has been used as lesson learned examples within the DOE complex. A subsequent discussion with the PIC indicated that better suited tools, such as a hammer, were available. (See **OFI-LANS-MAINT/IH-3**)

Objective: Controls are identified and implemented that effectively protect against identified hazards and approved activity-level work control documents can be performed as written.

Overall, controls were identified and workers appropriately implemented identified hazard controls in accordance with LANL requirements. Observed implementation of hazard controls included the application of energy controls (e.g., LO/TO and use of PPE in WO# 506611-01, *Replace PC-1/PC-2;* WO# 520448-01; ACR-006, *Return to Service;* WO# 516741-01, *Crane Mechanical and Electrical PM*; and WO# 519486-01, *Annual Crane PM Inspection and Certification*). Each WO contained the following:

- hold points for LO/TO placement and removal verification,
- warning within procedures for electrical shock and arc flash hazards,
- sequenced LO/TO orders (sign off "Attachment B") where applicable,
- Facility Electrical Hazard Analysis Record (which not only provides shock and arc flash hazard determinations and boundaries, it stipulates PPE required to safely perform described work steps).

As discussed previously, controls to address ergonomic/lifting hazards associated with WO# 506611-01, *Replace PC-1/PC-2*, were not addressed in the initial work package. Additionally, the PIC and workers were unaware that there was a maximum weight they were allowed to lift without mechanical assistance or help from other workers. When requested by the superintendent to revise the work package, the planner informed the PIC that there was a fifty pound lifting limit for individuals. To address this limit, the unit was disassembled for removal. Additionally, the work package required revision to address that the new replacement unit would require use of material movement equipment and more than one individual to set the unit into position.

Following the June 16, 2015, electrical line strike event, LANL Maintenance management conducted a series of meetings with supervision and craft to discuss actions that could enhance worker safety. The restart process included implementing a pre-job briefing tool to increase worker engagement; introducing the concept of life critical elements into work packages; establishing hold points for those life critical steps; defining what each step; and communicating these items to planners, superintendents, and PICs. This process included a walkdown of thousands of WOs and was intended to give planners, superintendents, and craft an opportunity to work closely together to update and improve work packages. EA viewed these interim measures as an appropriate mechanism for the safe resumption of work.

Objective: Work is conducted diligently in accordance with approved work instructions and within established controls.

Readiness to perform work at LANL MSS is verified daily using POD schedules, POD meetings, end of the day meetings, and pre-job briefings. MSS work management personnel conduct a POD meeting each afternoon to review the scheduled work activities for the next day and again each morning to discuss any changed conditions. Maintenance work supervisors, PICs, or the maintenance superintendent hold pre-job briefings for all involved workers prior to commencement of maintenance work activities. The pre-job briefings provide workers with relevant facility information, safety topics, and assignment of jobs for the day. Additionally, following the most recent overhead line strike event, a pre-job briefing tool with five critical questions has been added to increase worker engagement. All observed pre-job briefings were well attended, detailed, and effectively communicated job assignments, support needs, and work priorities.

Workers performed most observed operations in accordance with activity-level work documents, written procedures, and required controls. Maintenance craft, industrial hygiene technicians, and radiological control technicians were experienced, knowledgeable of their assigned work activities, and interacted with each other in a professional manner. Craft associated with LO/TO activities were extremely well versed in the PPE required and various steps required to establish boundaries, implement LO/TO, and conduct zero energy verifications.

Following the June 16, 2015 electrical line strike event, the FOD Designee categorized the event as a failure to implement the prescribed hazardous energy controls for the work under Occurrence Reporting and Processing System (ORPS) reporting criteria. The Utilities and Institutional (UI) FOD held a fact finding meeting to review the event. Information collected at the fact finding meeting revealed that the controls to keep the heavy equipment at least 10 feet away from the overhead power lines and the use of a

spotter were not implemented for the work, which confirmed the initial event categorization. In addition, the ORPS notification stated that the pre-job briefing may not have adequately communicated the work requirements or expectations for the task that day. EA review of documents and interviews with the Accident Investigation Team lead also indicated that there was no intent to spread the gravel in the vicinity of the overhead power lines. Because the heavy equipment clipped the energized overhead power line during its operation and the potential for a serious personnel injury, the UI FOD categorized the event as a Near Miss under Group 10(3), Significance Category 3.

As stated previously, MSS paused all work in response to this and prior events, while compensatory measures to prevent recurrence were being developed. This limited the number of activities that EA could observe; however, EA did observe a series of meetings (conducted by MSS Senior management and their Superintendents) and a second meeting conducted with MSS work execution manager and the craft during the work pause. These meetings demonstrated good aspects of safety culture, including free and open dialog and worker engagement; managers (PICs, Superintendents, and Work Execution Managers) stressed the workers ability to raise concerns, and all individuals demonstrated mutual respect during all interactions. EA noted the following statements from those meetings:

- Reprogramming of funds has resulted in increased maintenance workload beyond the typical end of year rush which, coupled with staff reductions, has resulted in a routinely scheduled 5 day, 10 hour work week.

- At the Superintendents' meeting held during the work pause, the attendees (Superintendents) expressed concerns that foremen are spread thin, with many new foremen requiring additional PIC training. Additional comments included the need to engage craft in pre-jobs and "to accommodate increased work there has been a lot of unplanned minor maintenance, which really are not minor maintenance" as they include LO/TO, multiple craft, etc., as well as "We have to help by requiring additional supervision."

A second event occurred on July 9, 2015, when two Laboratory workers had initiated troubleshooting activities on a programmatic wire forming mill at Technical Area 3, Building SM-66. During the work, the equipment's cover was removed while the 380 Volt AC machine was in an electrically safe condition. After troubleshooting, electrical power to the equipment was restored. One worker pressed the power control button to turn on the machine, while the second worker monitored the meter. The workers assumed that this activity in the manner performed was low hazard work. After the work had been completed, a worker asked management to clarify when a work document is required. Management engaged the STO Division Electrical Safety Officer (DESO) to evaluate the work activity. The DESO evaluation determined that once a worker crossed the Limited Approach Boundary with the equipment energized and its cover removed, the work transitioned from low hazard to moderate hazard, requiring a hazard analysis and IWD. On July 15, 2015, the STO Acting FOD held a fact finding meeting to review the event. Based on the DESO evaluation results and concern with worker hazard identification when conditions of a work activity change, the STO Acting FOD re-categorized the event as a Management Concern, Significance Category 3 event. EA noted that an IWD is not required when programmatic maintenance is performed as low hazard work. (See **OFI-LANS-RESEARCH-1**)

Management conducted the fact finding meeting for this event in accordance with LANL requirements. However, some facility and operations personnel stated that the conduct of the fact finding meeting and events leading up to the fact finding were retaliatory and could impact future ability to come forward with observed deficiencies or self-reporting. EA subsequently discussed these concerns with LANS Management, including the need to be sensitive to the workers concerns related to the fact finding process.

Much of the observed LANS Maintenance and Site Services (MSS) activities adequately implemented LANL work control processes to identify activity-level work scopes and analyze and control hazards. For the most part, workers performed work in accordance with site procedures; AP-WORK-002, *Conduct of Maintenance (P-950);* written activity-level work documents (work packages); and other required controls. Managers, supervisors, craft, and ES&H personnel were experienced, knowledgeable of assigned work activities, and interacted with each other in a professional manner. Observed pre-job briefings were thorough, interactive, and tailored to the maintenance activities. While most work was conducted in accordance with established controls and without incident, one MSS work evolution resulted in the June 16, 2015 electrical line strike event and subsequent work pause (initiated by MSS Management), and one programmatic maintenance activity was conducted without appropriate level of IWD and approval. Both of these events resulted in ORPS reports. Additionally, EA identified concerns with unidentified hazards, insufficiently defined hazard controls, and/or performance of work outside of established controls.

5.3 Biological Safety Programs

Bioscience at LANL spans a broad spectrum of scientific research that includes seeking solutions to bioenergy, biosecurity, public health, and environmental science issues that impact both national and global interests. The LANL bioscience capabilities include 9 laboratory divisions and 13 laboratory groups that support biologists, chemists, physicists, computer scientists, theorists, and modelers. Multiple Federal agencies, academic institutions, and Cooperative Research and Development Agreements with industry provide the primary funding for bioscience research at LANL.

EA interviewed the NNSA Headquarters Industrial Hygiene manager, NA-LA safety and health (S&H) staff members, key LANS research staff members, managers, and SMEs who support the biosafety and biosecurity program, totaling 25 individual interviews. EA toured multiple facilities and observed ongoing research at 14 laboratories. EA also reviewed LANS documentation that supports the work control process, Institutional Biosafety Committee (IBC) application approval and authorization processes, and Bioscience Division program procedures, protocols, reviews, audits, and data requests.

Objective: DOE Authority and Responsibilities: All biological research performed by DOE or DOE contractors must comply with applicable DOE regulations and directives as well as other applicable Federal, state and local regulations. DOE Headquarters and field elements must assure that all biological related operations have been approved, authorized and compliant with regulatory requirements. EA CRAD 32-02 Biological Safety and Security (DOE P 434.1A, Conduct and Approval of Select Agents and Toxin Work at Department of Energy Sites)

NA-LA S&H staff is engaged with the LANL Biosafety program and routinely participates in the Institutional Biosafety Committee (IBC) activities; internal and external (Center for Disease Control and Prevention [CDC]) reviews; and emergency and security exercises to maintain operational awareness of onsite Biosafety programs. Annual biosafety program status is provided to the NA-LA S&H staff by the LANS Biological Safety Officer (BSO) and communicated to the NA-LA Field Office Manager as required by 10 CFR 851. The data includes biosafety accomplishments, etiological inventories, and status of the biological safety program.

Objective: Contractor responsibilities: DOE Site Contractor line management has established a biological safety and security program, including organizational structure and administration, to ensure effective implementation and control of all work with biological etiologic agents. EA CRAD 32-02 Biological Safety and Security (10 CFR 851 Appendix A, section 7)

LANL is currently authorized to perform BSL-1 and BSL-2 work, as defined in *Biosafety in Microbiology and Biomedical Laboratories*, 5th Edition (Department of Health and Human Services, CDC, National Institutes of Health). P101-15, Biological Safety, describes the biological safety program. LANL's biological research program has established an IBC to address DOE, Federal, state, and local requirements; promote worker safety, security, and health; and consider public safety in all laboratory activities, as required by 10 CFR 851 Appendix A, section 7, *Biological Safety*. The purpose of the IBC is to review and authorize all potentially biohazardous work activities to ensure that risks are identified and mitigated. The IBC is chartered by LANL management under the Bioscience Division and is supported by SMEs, including the LANS Biological Safety Officer (BSO), Deployed Security Officer (DSO), Emergency Coordinator, LANL Medical Director, Field Office representatives, and institutional ES&H staff members. P101-15 also defines the roles and responsibilities of the IBC and line organization responsibilities for submitting the research applications.

Readiness to perform biological research begins with the principal investigators developing the IBC application and the IWD form which are then approved and authorized by management as described in the LANL Biosafety Manual, Chapter 2, *IBC Procedure*. The IBC applications and corresponding IWD's are submitted to the IBC so the biological and laboratory safety elements of the projects can be evaluated. Information on pathogenic hazards, risk group identification, laboratory chemicals, equipment, staff training, staff technical proficiency, operational integrity, containment levels and controls, and facility safeguards is reviewed during the process. LANS staff developed and documented the IBC applications and corresponding IWD's for reviewed biological research activities in accordance with the process.

The IBC coordinates roles for LANL's site safeguards, security, and emergency management to address biological agents, emphasizing select agents and toxins as required by 10 CFR 851. The emergency coordinator and Bioscience Division staff plan and execute full participation emergency exercises. EA reviewed the emergency exercise plans for biological agents and the associated after action reports from 2012 to 2014 and found actions were recommended based on emergency planning and feedback to improve performance. However, these actions were not entered, tracked, and closed out in PFITS. The IBC also coordinates the role of the site medical director who provides medical surveillance/certifications for employees working with biohazards, performs examinations as required by the human reliability program, has engaged local medical facilities to provide emergency assistance, and implements an immunization policy for personnel work with biological etiologic agents.

EA reviewed the LANL Biosafety training program, including training procedures, training database, and training course materials. The required courses determined by the IBC and BSO and a review of the IWD hazards and risk were consistent with the research being conducted. A sample of researchers training was checked in the U-train database indicated these researchers had completed all training requirements. Finally, the IBC research application requires the principal investigator and staff members to have the appropriate knowledge, background, and training to conduct their research and ensure compliance with all biosafety and biosecurity regulations.

During an interview, several principal investigators described a weekly peer-to-peer meeting in the Bioscience Division that includes discussing experiments within the research proposals that will be performed the following week, similar to a POW. These meetings were described as effective in allowing the researchers to receive feedback from their peers, raise questions, and solicit ideas concerning the path forward of projects. Interviewees stated that this process allows the collective knowledge and experience from fellow researchers to stimulate creative, safe, and sound experimental procedures. They also noted that if any significant deviations arise from the original IBC application or IWD information, a "Change/Amendment Form" can be submitted to modify the research parameters and obtain IBC and BSO approval.

Work control is addressed by the Bioscience Division through procedures P-300, *Work Control*, and P-101-15, *Biological Safety*, and the LANL Biosafety Manual, Chapter 2, *IBC Procedures*. The IBC, FOD, Division manager, and researchers use these procedures to develop a work scope description and the IBC follows these to assess and authorize proposals and ongoing biological research. EA reviewed 11 IWDs and observed corresponding work activities and found that in general, work was well defined, conducted within the scope of these documents. Interviewed researchers recognized the importance of pre-job briefings as an important element of the work control process however, researchers implemented pre-job briefings with varied approaches. For example, some laboratory researchers asked staff members to develop their own operating procedure, which was then discussed and validated to ensure that all controls were in place; several researchers developed step-by-step desk instructions for either new employees or students and closely supervised staff until they were comfortable with the work being performed; and other researchers used their laboratory notebook to organize the work they were planning to perform. The researchers were consistent in setting up their experiment, gathering their equipment, and checking safety controls before conducting work. All principal investigators interviewed stated that working within established controls helped to ensure the safety of their staff and the integrity of their research. Although most IWDs were comprehensive, all but one of the IWDs identifying use of inert gases in laboratories did not initiate the appropriate exposure assessment or fully establish appropriate controls such as oxygen monitors or reduction of gas cylinder capacities. (See **OFI-RESEARCH-4**)

Objective: Implementation by DOE of the Public Health Security and Bio terrorism Preparedness and Response Act of 2002. Implementation sets the requirements for the possession, use, and transfer of select agents and toxins that have the potential to pose a severe threat to public health and safety. EA CRAD 32-02Biological Safety and Security (42 CFR 73)

Federal regulations associated with bioscience select agent or toxin research requires implementation of safety controls, security barriers, emergency plans, and medical surveillance to reduce threat to public health and safety. To further ensure that all biological research is accurately defined, 10 CFR 851, Appendix A section 7, requires that IBCs review all work with biological etiologic agents for compliance with applicable Federal regulations.

The LANL IBC and the P-300 work control process requires that all BSL-2 biological research is reviewed, defined, and controlled within the safe operational limits established by Federal regulation. The IBC application process requires review and authorization of all BSL-2, select agent and toxin and recombinant deoxyribonucleic Acid (DNA) research prior to any laboratory activity. The integrated work control process also requires the work scope to be defined, hazards to be identified, and controls to be in place.

Observations and interviews at multiple BSL-1 and BSL-2 research locations, including two select agent laboratories, indicated that principal investigators and their staff were knowledgeable and aware of the security, safety, and containment requirements necessary for the specific experiments being performed. All laboratory locations visited were properly secured and controlled by specifically assigned locks and keys to prevent unauthorized entry. Researchers and technicians conducted work with biological materials in certified biosafety cabinets, inventoried research materials and secured them when not in use, and collected all waste and deactivated it by autoclave or chemical methods.

Overall, the reviewed aspects of the LANL biosafety programs are effective and comply with Federal regulations. The BSO and IBC ensure that the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 requirements for researchers to possess, use, and transfer select agents and toxins are in place, risk assessments are routinely updated, and emergency and security planning is provided by support team staff.

In support of the Strategic Partnership Projects and the Laboratory Directed R&D process, the IBC and BSO, in conjunction with the NA-LA field staff review, are required to review and approve all submitted projects. The IBC chair and BSO review the proposal work scope to determine whether the project will fit in the safety and regulatory envelope established for the site. The NA-LA Field Office Manager signs off on the approved and funded projects.

The LANS Bioscience Division Deputy Director stated that LANS intends to replace several aging research facilities and consolidate pathogenic research in a standalone BSL-3 facility that is already constructed and located on laboratory property. The secured BSL-3 facility, which has never been operational, has a completed environmental impact statement currently with DOE Headquarters management. The BSL-3 facility has been engineered to minimize risk to workers, the public, and the environment with multiple containment controls and security barriers that meet CDC and National Institute of Health requirements.

Planning is also underway to replace the obsolete HRL facility so that more modern air quality controls, security upgrades, and safety enhancements can be provided to Bioscience Division research laboratories. The aging HRL facility and infrastructure, notably the inadequate ventilation and floor space, do not support the performance of many biological laboratory activities without additional compensatory administrative controls. Several scenarios were discussed by B Division management as possible near term solutions to replace the HRL facility, including utilization of the BSL-3 facility for BSL-2 research, construction of new facilities or additional partnerships with academic or research institutions outside the LANL campus.

5.4 Contractor Assurance

Objective: The contractor analyzes, tracks, trends internally and externally identified issues and concerns; evaluates this information against established performance objectives and expectations (i.e., measures and metrics); develops and implements corrective actions; and conducts effectiveness reviews to ensure continued improvements in the WP&C program.

The LANL Metrics Program is implemented by PD324, *LANL Metrics Program.* The purpose of the program is to allow effective monitoring and managing of organizational performance and to provide a transparency of management performance and actions for DOE and NNSA oversight.

The performance metric for IWM on the ES&H scorecard has a high base risk associated with the program and was given an institutional color of green for the third quarter of 2015, indicating the program was functioning properly. This metric does not adequately provide management with the information necessary to monitor and manage organizational performance as stated in PD324. The IWM metrics depend on lagging data (such as ORPS events; days away, restricted, and transfer case rates; and Injury/Illness data) that is trended by the IWM SME. This data does not provide management with an effective leading indicator-based Risk/Planning tool. (See **OFI-LANS-CA-1**)

LANS completed a comprehensive review of existing event and assessment-based performance feedback from 2007-2013. This included internal and external data sources such as DOE oversight reports, letters, and notices; FCA Directors independent assessments; Internal IWM focused assessments and gap analysis; ORPS data; Performance Feedback and Improvement Tracking System (PFITS) data; injury and illness data; and lessons learned. The issues were sorted by judging their relevance to the five ISM core functions (i.e., define the scope, identify the hazards, develop and implement the controls, perform the work, provide feedback and improvement). EA used a graph pictured in the assessment to estimate the number of issues listed under each IWM core function: define the scope (200 issues), identify the hazards

(200 issues), develop and implement the controls (220 issues), perform the work (180 issues), provide feedback (10 issues) and improvement (95 issues).

The review identified weaknesses that were consistently being cited over time. These weaknesses are still present and require a strategic and sustained focus to drive continuous improvements to reduce their prevalence in the work environment. LANS developed a *Strategic Plan for Improving Integrated Work Management* (FY 14–FY 18). The plan contains 6 Institutional Goals and 16 Institutional Objectives to improve IWM. The goals are to consistently and accurately identify all hazards associated with a work activity; accurately grade the hazard level of all work performed at LANL; consistently and accurately analyze identified hazards; consistently develop a complete set of risk-based hazard controls for identified hazards associated with work being performed; monitor IWM implementation and work execution such that improved and degraded performance can be detected; and consistently implement IWM across all organizations. However, there are no explicit dates and resources assigned in this strategic plan, nor metrics for effectiveness and progress is not tracked in the institutional system. The timeframes listed in the plan show 3 of 16 objectives as being complete. However, LANS has not defined the actions that completed the objectives nor measured the effectiveness of these objectives. (See **OFI-LANS-CA-3)**

Issues are managed through P-322-4, *Laboratory Performance Feedback and Improvement Process*. The Performance Feedback and Improvement process has four major elements: collect the performance feedback, management review and planning, execute improvements, and close and determine the effectiveness of the improvement. QPA-PA develops trending and analysis of the risk based upon record information entered into the PFITS.

There are four risk based systems that managers can use to manage issues. These are the Issues and Corrective Action Management (ICAM) used for feedback of the highest risk that meets the threshold of an issue; Performance Improvement Action Tracker (PIAT) used for feedback that needs to be tracked to closure but does not require the level of rigor in ICAM; Other Improvement Actions used to document feedback that is being handled with other laboratory processes; and Management Action used to track feedback of the lowest rigor. Organizations manage feedback through chartered management review boards established by Principal Associate Directorates (PAD) or Associate Directorates (AD).

EA reviewed four assessments performed by LANL over the last 5 years to determine whether findings and/or OFIs and subsequent corrective actions were tracked in the PFITS. The assessments were generally comprehensive, and the findings from these assessments were entered into the issue management system (i.e., PFITS). Not all findings had associated corrective actions. Specific details from each of the reviewed assessments are as follows: (See **OFI-LANS-CA-5**)

- The September 26, 2011, LANL assessment (PFITS 2010-1635, *Independent Integrated Safety Management/Integrated Work Management of Research and Development and Programmatic*) contained 65 findings, 68 opportunities for improvement, and 34 noteworthy practices. PFITS contains 171 records used to manage the identified issues for this assessment and the assessment referenced in the next bullet. This resulted in 138 corrective actions, 121 of which are closed, 9 remain open, and 8 have been subsequently deleted. Sixty-six records had no documented corrective action. The 47 findings referenced included deficiencies such as inadequate work scope, references out of date, inadequate pre-job briefings, skipped work steps, the use of expired work documents, not requiring the use of an industrial hygiene SME when needed, inadequate level of detail in work documents, and lack of worker recognition of an unusual condition (i.e., glove box pressure readings pegged in the negative range).

- The LANL June 18, 2012 assessment (PFITS 2010-1635, *Independent Integrated Safety Management/ Integrated Work Management Assessment of Maintenance Work, Construction,*

Drilling, Decontamination, and Decommissioning, Environmental Restoration) identified 36 findings, 46 opportunities for improvement, 6 observations, and 7 noteworthy practices.

- The October 22, 2014 LANL assessment (PFITS IAS-2013-599, *Radioactive Liquid Waste Facility Centered Assessment)* contained 5 noteworthy practices, 19 findings, and 49 opportunities for improvement (OFIs). PFITS contained 72 records used to manage the identified issues. This resulted in 72 corrective actions; 71 are closed and 1 remains open. Twenty records had no documented corrective action.

- The February 26, 2014 LANL assessment (PFITS 2013-242, *Utilities and Institutional Facilities Facility Centered Assessment*) contained 8 Conduct of Engineering findings and 1 Emergency Preparedness finding. PFITS contained 9 records used to manage the identified issues. This resulted in 9 corrective actions; 8 are closed and 1 remains open. The findings in this assessment identified deficiencies associated with not following procedures, not using proper documents, and program implementation.

The effectiveness of the LANS issue management system is greatly reduced when issues identified by the processes that feed into the system (assessments, ORPS etc.) are not analyzed and resolved in a timely manner or in some cases, not at all. Extended timelines between assessments also impede the effectiveness review process.

Objective: The Contractor Assurance System produces periodic scheduled and non-scheduled evaluations (e.g., self-assessments, independent assessments, management walkthroughs, etc.) of WP&C activities which identify issues, concerns and opportunities for improvement in the WP&C program.

EA evaluated the implementation of feedback and improvement program processes that are designed to ensure LANL compliance with WP&C requirement and guidance established by DOE. EA reviewed the scheduling of WP&C assessments, the results of these assessments, and the processes used to drive improvements in this process.

SD 320, *Los Alamos National Laboratory Contractor Assurance Description Document*, describes the LANL feedback and improvement processes. SD 320 describes the system design of the CAS, which consists of a performance based improvement cycle, processes for governance and oversight, mechanisms to ensure stability, and tools designed to manage risks.

The continuous improvement cycle consists of goals, metrics, assessments, and improvements. Governance is performed by LANS by monitoring the effectiveness of the CAS through the Business and Operations Committee. The LANS CAS captures the following types of information: LANL performance indicators; LANL internal performance reviews; third party assessments; shadow assessments of LANL assessments; observations of Management Review Boards; and corrective actions taken in response to transactional data, Facility Representative (FR) feedback, and audits from DOE and NNSA. System sustainability is based on the standard business model of deploying system/process experts to support program originations.

Weaknesses related to IWM were identified in two parts of the continuous improvement cycle: metrics (a lack of leading indicators) and assessments (3 year periodicity). (See **OFI-CA-1** and **OFI-CA-2**)

The LANL assessment program overview is described in PD328, *LANL Assessment Program*. The LANL assessment program implements part of the LANL CAS for managing and continuously improving performance. The primary elements of the assessment program are the performance assurance planning

cycle and generation/maintenance of the Integrated Assessment Schedule, management assessments, and independent assessments.

SD 320, *LANL CAS Description Document*, describes the purpose of Facility Centered Assessments (FCAs). The Management Review Board directs the performance of FCAs to conduct periodic, comprehensive, performance based reviews of work activities at key facilities across the Laboratory. The FCAs are conducted within the framework of major safety management programs. These multi-disciplined assessments evaluate facility implementation of Chemical Safety, Conduct of Engineering, Conduct of Maintenance, Conduct of Operations, Electrical Safety, ISM/IWM, Occupational S&H, Pressure Safety, Radiation Protection, and Waste Management requirements. EA reviewed the 2014 Radioactive Liquid Waste FCA and the 2014 UI FCA. EA only reviewed the results for Conduct of Maintenance and ISM/IWM in the 2 FCAs listed below because these areas align with the scope of this review.

Radioactive Liquid Waste Facility FCA October 22, 2014 PFITS No. 2013-559 FCA (14)-003.000

The conduct of maintenance section of this assessment contained CRADs relating to the master equipment list, post maintenance testing, the seasonal facility preservation plan, the activity based annual maintenance work plan, and the training program. These CRADs were completed using work observations, walkdowns, and document reviews. Conduct of Maintenance was given a green rating. The FCA's rating was appropriate based on the information presented.

The ISM/IWM section of this assessment did not contain any CRADs. This evaluation was based on the comprehensive review of existing performance feedback described earlier in this section. LANL considers the institutional weaknesses identified in the review to apply across LANL, including RLW. Action is being taken through the strategic plan (also described earlier in this section) which will impact IWM at RLW and the rest of LANL. Despite these opportunities for improvement, Integrated Safety Management (ISM)/IWM was given a rating of green. This section does not comply with guidance given for a FCA because it is not based on the review of work activities and is a holistic compilation of data with no evaluation of the issues. FCAs are designed to be comprehensive, performance based reviews of work activities at key facilities across the Laboratory. This section of the report did not meet that definition. (See **OFI-LANS-CA-4**)

Utilities and Institutional Facilities FCA February 26, 2014 FCA PFITS No. 2013-242 FCA (14)-001.000

The conduct of maintenance section of this assessment contained CRADs relating to PM, corrective maintenance, the evaluation of performance maintenance tasks, the interface between engineering and configuration management, operational interfaces, resources, and the maintenance backlog. This section evaluated processes by interview and document review. This section lacks the formality and detail to allow the reader to understand what documents were reviewed, and no maintenance activities were observed. This section did not include activity based reviews as defined by SD 320 for FCAs. (See **OFI-LANS-CA-4**)

The IWM/ISM section of this assessment contained CRADs that aligned themselves with the core functions of ISM, but by design, the only possibility to observe a work activity would have been to observe the PIC perform a pre-job briefing. This section did not include activity based reviews as defined by SD 320. (See **OFI-LANS-CA-4**)

Independent Integrated Safety Management/Integrated Work Management Assessment of Maintenance Work, Construction, Drilling, Decontamination and Decommissioning, Environmental Restoration, June 18, 2012 PFITS 2010-1635

This assessment focused on maintenance and subcontracted work and included the Principal Associate Directorate for Capital Projects and the Principal Associate Directorate for Operations. This assessment was performed using CRADs that evaluated all the elements of work management and included a sample of activities of work activities from each of the areas covered. This assessment evaluated each organization's compliance with the requirements of P300. This report identified 36 findings, 46 OFIs, 6 observations, and 7 noteworthy practices. The transmittal memo associated with this report stated that "The results of the review of 96 MSS work activities across FODs showed 95% of the CRADs were met which is considered effective implementation." Overall, this was an effective assessment that evaluated the elements of IWM by using performance observations and document review.

Independent Integrated Safety Management/Integrated Work Management Assessment of Research and Development and Programmatic Work, September 26, 2011

This assessment assessed the implementation of ISM and IWM at LANL. This assessment included selected LANS Directorates focused on programmatic work. The following PADs were included in the assessment: the Principal Associate Director for Waste Programs, the Principal Associate Director for Weapons Programs, and the Principal Associate Director for Global Security. The scope also included a comprehensive review and summary of three previous assessments, as well as a review of the deliverables associated with the *Moderate Hazard Research and Development (R&D) Safety Improvements Project Execution Plan*. These included the FCA for STO; the Moderate Hazard R&D Safety Improvements Directorate Management Assessment; and an Independent Effectiveness Evaluation of Moderate Hazard R&D Safety Improvements at LANL. The assessment was comprehensive, and the CRADs that were used assessed all elements of the IWM program. Sixty-five findings, 68 OFIs, and 34 noteworthy practices were identified.

LANS has not performed any targeted WP&C assessments in the last 3 years. Instead, the IWM SME decided to focus available resources on developing and executing a strategic approach which included the comprehensive review and the resulting strategic improvement plan discussed earlier. Additional comprehensive IWM assessments would be expected to substantiate the weaknesses already identified. This approach addresses previously identified deficiencies; it does not evaluate the work being performed daily by LANS and does not identify current strengths and deficiencies or provide data for trending. The IWM assessment frequency is not specifically prescribed by DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, or DOE Guide 226.1-2A, *Federal Line Management of Department of Energy Oversight Policy*. No method is in place at LANL to determine the frequency of IWM assessments. (See **OFI-LANS-CA-2**)

The LANL *Strategic Plan for Improving Integrated Work Management (FY 14–FY 18)* schedule indicates that three of the sixteen objectives were completed in FY14; however, LANL has not documented completion nor measured their effectiveness. (See **OFI-LANS-CA-3**)

Overall, LANS is tracking and trending internally identified issues from previous assessments; ORPS; days away, restricted and transfer case rates; and Injury/Illness data and is using this data to structure a plan (*Strategic Plan for Improving Integrated Work Management* (FY 14–FY 18)). However, the effectiveness of this plan is not being measured. LANS assessments previously identified in this report contain corrective actions; however no effectiveness reviews were performed on closed corrective actions. LANS has not recently been performing periodic scheduled and non-scheduled evaluations of WP&C activities, and WP&C activities have not been a part of the LANS Integrated Assessment

Schedule. Due to the infrequency of assessments and the lack of effectiveness reviews for plans and assessment findings, LANS is not ensuring continued improvement in the LANS Integrated Work Management Program.

LANS Bioscience Division Biological Research Feedback and Improvement

The ability of LANS to perform research with potentially hazardous biological materials greatly depends on how the work scope is defined, how the risks are identified and mitigated, and how workers implement the controls to protect the public, the environment, their coworkers, and themselves. Bioscience Division managers stated that they consider feedback and improvement processes as important to determine if the controls are effective, the procedures or regulations are working as intended, or the elements of the biosafety and biosecurity can be improved. In the research environment they consider peer to peer discussions that occur weekly as an important feedback mechanism to stimulate ideas, consider safe solutions to problems, and use the collective experience of the investigators to advance their ideas.

Federal regulations require that routine inspections be conducted to retain the site's certification to use, store, and transfer select agents and toxins. For example, the CDC performs a certification inspection every three years and provides feedback to management on their compliance with 42 CFR 73. The CDC inspection team noted that some of the security and biosafety plans needed to be updated to reflect new requirements. LANS addressed the issues, and the CDC granted the certification for the use and possession of select agents and toxins.

The U.S. Department of Transportation (DOT) inspects the site's documentation for packaging and shipping hazardous wastes. DOT also reviewed packing, shipping, and labeling of select agents and toxins; training records and procedures; hazmat security plans; and emergency response planning as required in 49 CFR 173. There were no violations from the 2014 DOT inspection, however, suggestions were made to improve shipping labels and packaging group designations for DOT shipments.

In accordance with 10 CFR 851, Appendix A 7 (a)(2), LANS annually provides a status on the inventory of biological etiological agents, the status of the LANL biological safety program, and related accomplishments from the past year. LANS submits a status summary to NA-LA for further distribution to NNSA Headquarters.

The LANL Biosafety Manual procedure on annual inspections specifies the practices, processes, and requirements for biosafety inspections at LANL. The inspection, completed by the BSO, provides a detailed checklist for each category of risk (BSL-1, BSL-2, BSL-3, Biological Toxins, or Human Cell Line). The process provides feedback to the entire biosafety team including managers, staff, and SMEs. The BSO encourages RLMs, LASO safety staff, and managers to actively participate in the inspections. To date, the inspections have not resulted in any significant regulatory non-compliances. The Bioscience Division also gets feedback from support personnel, such as after action reports following emergency or security exercises or drills, although this feedback is not tracked in PFITS. (See **OFI-LANS-CA-5**)

In response to an August 2014 White House concern to Enhance Biosafety and Biosecurity in the United States, LANS initiated a stand down of LANL biosafety activities. The stand down provided an opportunity for LANS to complete a self-assessment of all policies, procedures, inventories, and practices within its biosafety and biosecurity program. LANS management encouraged researchers to think about best practices and long-term steps to enhance safety and security of research to minimize the potential for the loss or misuse of hazardous agents. The self-assessment did not result in regulatory non-compliances but feedback from the self-assessment identified suggestions for program improvements. The BSO cited examples of improvements under consideration such as the organization and indexing of biological inventory, consolidating biological safety manuals into one site manual, and excessing chemicals no

longer needed from the biological research laboratories. Although suggested improvements resulted from the self-assessment, the feedback and improvement items were not tracked in PFITS. (See **OFI-LANS-CA-5**)

5.5 Los Alamos Field Office Oversight

Objective: 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 O 226.1B)

NA-LA has procedures and processes in place for Federal line oversight, including assessments and issues management. The overall approach for NA-LA oversight is described in MP 00.08, *Implementation of Los Alamos Site Office Line Oversight*, which addresses use of the CAS and the conduct of formal assessments and operational awareness activities. Assessments include management self-assessments; external assessments (identified in this procedure as independent assessments); joint assessments; assessments of CAS; and assessments of contractor facilities, operations, programs, projects, etc. Other oversight includes operational awareness activities, report reviews, shadowing, and input to the evaluation of the contractor's performance. This procedure also addresses the process for developing an assessments schedule, issues management, feedback and improvement, and performance measures. This procedure was last updated in 2009, and includes outdated references such as the Maintenance Improvement Plan, Performance Based Incentives, and Assistant Manager for Safety Operations. (See **OFI-NALA-01**)

Other procedures and instructions related to oversight include WI 00.13, *Annual Assessment Planning*; MP 00.13, *Risk-Informed Oversight Planning*; MP 00.15, *Management Assessments for Federal Operations*; WI 00.04, *Assessment Shadow Activity Reporting*; MP 00.12, *Independent Assessment Process*; WI 00.14, *Federal Issues Management*; and WI 00.12, *Oversight Issues Reporting*. In general, these documents adequately define a management system for performing risk-informed oversight. The NA-LA CAS manager develops an annual assessment schedule in accordance with WI 00.13, but WP&C is not considered a functional area and is not addressed separately on the assessment schedule. WP&C assessments are included in the LANL/NA-LA Integrated Assessment Schedule. Assessments are conducted and documented, and issues are identified and tracked. However, EA identified problems with the issues management instruction in WI 00.12, including lack of a process for categorizing findings based on risk (DOE Order 226.1B) and reference to the Performance Management Team review, which is no longer performed. The issues management instruction also does not address the FR team process to transmit issues to the contractor. (See **OFI-NALA-01**)

NA-LA performed some oversight of the CAS. The NA-LA Environmental Projects Office conducted a self-assessment in 2013, and the Assistant Manager for National Security Missions conducted an assessment of the LANS CAS for project execution in 2012. Both assessments were thorough and addressed appropriate topics. The self-assessment identified a lack of guidance for CAS use within that organization and a resulting variance in the use and understanding of the CAS by staff. Additionally, as part of the assessment planning process (WI 00.13), each functional area manager is required to prepare a management system effectiveness summary (i.e., CAS review) on an annual basis. The FY 2014 management system effectiveness summary for the functional area of ISM, *Corporate Safety & Health SMP Oversight*, is a thorough analysis of the CAS attributes. The NA-LA CAS manager documented a review of the 2014 summaries and determined that there was "an inconsistent understanding of what CAS is meant to be. It is also apparent that the NA-LA staff's level of engagement with CAS varies significantly." The NA-LA oversight processes include an evaluation of the CAS primarily through staff assessments as part of their functional area reviews. Also, NA-LA annually approves the contractual performance evaluation plan, which is an element of the CAS system. Although some oversight of CAS

is being performed and documented, NA-LA has not approved the LANL CAS as required by DOE Order 226.1B. (See **F-NALA-01**)

Objective: Field elements should conduct formal oversight assessments of the contractor's WP&C programs. These assessments should include evaluation of the contractor's activity level WP&C Program Definition as well as regularly scheduled evaluations of the WP&C Program Implementation. Field elements should ensure a comprehensive set of routine operational awareness activities evaluating the effectiveness of contractor WP&C activities is identified, conducted, and documented. Each DOE Field Element should have an oversight schedule including activity level WP&C. (DOE Guide 226.1-2A)

Formal Oversight Assessments

NA-LA has conducted some oversight assessments of WP&C program implementation as part of the SMEs and FRs activities. The nuclear maintenance SME has developed a Maintenance Program Assessment Tracking and Planning schedule which outlines a triennial schedule for conducting assessments of the maintenance program, including WP&C elements. EA reviewed the most recent NA-LA assessment of maintenance procedures and work control, ASRP-F0-5.1.2013-509073, which addressed some WP&C elements including hazards identification and control, accuracy and use of work documents, and feedback and improvement. Overall, the assessment was thorough and identified appropriate issues; however, the evaluation of the assessment's Criterion 4, *Work documents; including instructions, procedures, and drawings; are accurate, clear, and can be followed*, was limited to a review of the computerized maintenance management system and master equipment list. EA also reviewed an NA-LA assessment report ASRP-FO-3.13.2014-565949, *Training and Qualifications of Maintenance Personnel*. The assessment included appropriate scope and criteria and resulted in two findings. A FR shadowed the Los Alamos Neutron Science Center IWM assessment in 2014 and completed the associated assessment shadow record form, although there was no narrative evaluation as required by the form. SMEs for other programs, including radiological protection and fire protection, have also conducted assessments addressing elements of WP&C.

The S&H SMEs, who also have been assigned programmatic responsibility for WP&C, include WP&C elements in their functional area assessments. EA randomly selected two of the assessments to review. The first assessment, *Process Hazard Analysis Effectiveness Evaluation*, ASM-SO-3.21.2014-567215, addressed hazard control selection and implementation in work control documents. The S&H SME shadowed this assessment and documented it on an assessment shadow record form. The shadow assessment record form includes an evaluation scorecard for assessment attributes and also requires a summary of assessment results, including a discussion of issues. A summary of the assessment was provided, but the issues were not discussed. A 2012 independent assessment of the lightning protection system was thorough and identified several issues with the lightening protection system, including scope of work, work package documentation, and training. The S&H SMEs were diligent about conducting and shadowing assessments of the S&H programs, but no evidence was presented about shadowing a WP&C program assessment. The integrated assessment schedule for 2015 includes a LANL WP&C assessment with a designated NA-LA S&H SME shadow.

NA-LA has not conducted an initial baseline assessment of the contractor's WP&C process. (See **OFI-NALA-01)**

Routine Operational Awareness

FRs provide daily oversight of WP&C activities in their assigned facilities, and issue an NA-LA FR Daily Report. A sample of four FR daily reports provided evidence of adequate daily oversight of WP&C activities including plan of day meetings, pre-job briefings, post-job reviews, and observation of work.

Additionally, SMEs also perform routine operational awareness activities. The S&H, maintenance, fire protection and radiological protection SMEs perform oversight of WP&C elements during their routine activities. The Safety System Oversight engineers provide additional oversight of WP&C activities for vital safety systems. The S&H SMEs attend weekly meetings with the LANL WP&C manager to obtain a status of the 5-year strategic improvement plan for WP&C.

The NA-LA ESH staff have been active in operational awareness of the Biosafety Program. They regularly participate in Biosafety operational awareness, public affairs (biosafety issues), emergency exercises and after action reports, IBC activities (nonvoting IBC committee member), external reviews (CDC, DOT, 851 annual, BSL-2 annual, White House Biosafety stand down), Strategic Partnership Project applications, and shadow assessments with the BSO.

Objective: Each DOE field element should identify WP&C oversight roles and determine who will perform the functions. Field element oversight programs typically include facility representatives and subject matter experts, and may include a lead for WP&C oversight. DOE Field elements should ensure that WP&C oversight results and performance data are analyzed, tracked, and trended by the WP&C lead or other assigned personnel. (DOE Guide 226.1-2A)

Two NA-LA SMEs are responsible for 75 S&H areas. NA-LA assigned programmatic lead responsibilities for WP&C to one of the two S&H SMEs. The documentation of this assignment is limited to the field office list of oversight for safety programs (dated November 1, 2012). The roles and responsibilities for the WP&C lead are not defined. The Integrated Management System Description, including Los Alamos Field Office Functions, Responsibilities, and Authorities, PLAN 00.14, was conditionally approved in February 2015. A self-assessment of PLAN 00.14 was completed in May 2015. Appendix 1 of PLAN 00.14 describes the field office functions, responsibilities, and authorities. The roles and responsibilities for WP&C are not included in the Assistant Manager for Operations S&H SME duties; however, the FRs are assigned responsibility for evaluating the effectiveness of WP&C. Although some tracking and trending of WP&C performance is accomplished through meetings with the contractor, review of assessment/operational awareness input, program health reports, input to the performance evaluation plan, etc., it does not meet the guidelines contained in DOE Guide 226.1-2A. (See **OFI-NALA-01**)

Objective: DOE Field Element has implemented an effective FR program. (DOE O 422.1)(EA CRAD 45-21)

NA-LA maintains a cadre of qualified FRs. NA-LA completed a self-assessment of the FR program in February 2015. The objectives and criteria were consistent with Appendix B, FR Program Assessment Guide, in DOE-STD-1063-2011, *Facility Representatives*. The self-assessment was thorough and identified 2 findings, 11 observations, and 12 OFIs. One of the observations was related to FR staffing levels. The FR standard also includes a process to determine adequate FR coverage (Appendix C in DOE-STD-1063-2011). The FR staffing analysis for 2015 indicates that 17 FRs are needed to cover13 Hazard Category 2 nuclear facilities, 4 Hazard Category 3 nuclear facilities, 11 High Hazard facilities, 12 moderate hazard facilities, and 7 low hazard facilities. NA-LA transmitted the annual Work Force Analysis and Staffing Plan Report to the chair of the Federal Technical Capability Panel in February 2015. The report indicated that 12 FRs were needed and that 10 were on board. The current NA-LA organization chart shows 7 FRs, one of whom has been on detail as the acting chief of staff for over a year and has not maintained his FR qualifications. Per discussion with the FR team lead, there are no current plans to fill the vacancies. Due to staffing shortages, FR coverage is limited to the nuclear facilities. Some additional support is provided by SMEs, and one former FR maintains qualifications and performs 40 hours per quarter of FR oversight. The current field office FR staffing level is 6 fewer than the requirement of 12 stated in the Work Force Analysis and Staffing Plan Report. (See **F-NALA-02**)

Per Work Instruction 06.01, FRs document operational awareness activities using the issues module of ePegasus (although MP 06.04 still references Attachment A). EA reviewed numerous examples of documented operational awareness activities, some including findings and observations related to WP&C. Several of the draft issues have not been finalized, even though they were initially identified more than 6 months ago. Additionally, NA-LA had not been performing safety management program reviews of conduct of operations as required by DOE Order 422.1. (See **OFI-NALA-01**)

The NA-LA technical staff members that EA interviewed are appropriately trained, experienced, and qualified, and participate in the Technical Qualification Program (TQP). The S&H SMEs responsible for the WP&C program have advanced degrees and are qualified in the TQP. The FRs are all current in the TQP process. The qualification records for a randomly selected FR included the appropriate documentation (i.e., General Technical Basis qualification card, the phase 1 and 2 FR position specific qualification card, the site specific qualification card, the documentation of the oral board, the written exam, and walkthrough with the site office manager). Recent continuing training included two presentations in March 2015 on DOE-HDBK-1211, *Activity-Level Work Planning and Control Implementation*, and DOE Guide 226.1-2A, *Federal Line Management Oversight of DOE Nuclear Facilities*. The associated training handouts covered the appropriate topics.

Overall, NA-LA has adequate processes and procedures for the oversight of work planning and control, and has highly qualified and experienced technical staff. However, there is a significant shortage of staff in the Facility Representative Program (6 of 12 authorized positions are vacant). Also, NA-LA has not approved the contractor assurance system, which is required by DOE Order 226.1B, Implementation of Department of Energy Oversight Policy.

6.0 CONCLUSIONS

Overall, LANS has established the fundamental elements of work control processes at LANL to adequately identify activity-level work scopes and analyze and control hazards. Managers, supervisors, researchers, craft, and ES&H personnel were experienced, knowledgeable of assigned work activities, and interacted with each other in a professional manner. For research activities, most IWDs adequately identified and described in detail the work scopes, hazards, and hazard controls. For research conducted by more than one group, research activities were integrated and under the control of a single RLM and PIC. Since the last independent oversight review in 2008, progress in research WP&C is evident, particularly with respect to industrial hygiene exposure assessments and the controls for chemical fume hoods. Training requirements and qualifications are well defined and the research staff was current on their training requirements. Workers and researchers usually performed observed work within the work scope boundaries and in accordance with controls described in the IWDs. However, EA observed a few exceptions, particularly with respect to documentation of hazard analysis, design and completion of IWD Part 2 forms for research, enhanced exposure monitoring and sampling, additional rigor in the identification and implementation of some hazard controls, and in clarifying a number of requirements in LANL Procedure P300 as they pertain to research activities.

For the most part, LANS adequately implemented LANL work control processes for the observed MSS activities to identify activity-level work scopes and analyze and control hazards. Workers performed work diligently in accordance with Site Procedures AP-WORK-002, *Conduct of Maintenance (P-950)*, work packages, and required controls. Observed pre-job briefings were thorough, interactive, and tailored to the maintenance activities. Some observed meetings demonstrated good aspects of safety culture, including free and open dialog and worker engagement, and often stressed workers ability to raise concerns. Furthermore, all individuals demonstrated mutual respect during interactions. While most work was conducted in accordance with controls and without incident, one MSS work evolution resulted

in an overhead electrical line strike (by a dump truck bed), and subsequent work pause (initiated by MSS Management). LANS also conducted one programmatic maintenance activity without the appropriate level of IWD and approval. Both of these events resulted in ORPS reports. Additionally, EA identified a few cases of unidentified hazards, insufficiently defined hazard controls, and/or performance of work outside of established controls.

For the observed biological research work, the integrated work control process adequately defined the work scopes, identified the appropriate hazards, and implemented the correct controls. The LANL IBC along with the P-300 work control process are designed to ensure that all funded biological research is reviewed, defined, and controlled within the safe operational limits established by Federal regulation. The IBC members are required to review and authorize all BSL-2, select agent and toxin, and recombinant DNA research through an application process prior to any laboratory activity. Overall, the reviewed aspects of the LANL biosafety programs are effective and comply with Federal regulations.

Overall, the LANS assessment process is documented, and LANS is performing some assessments related to work planning and control and is tracking and trending some internally identified issues. However, LANS has not performed specific assessments of IWM in the last 3 years, and therefore may not have the data needed to make risk-informed decisions. The metrics used to assess the IWM program health are lagging indicators and therefore not predictive of integrated work management performance. Leading indicators, such as the program improvements goals of the *Strategic Plan for Improving Integrated Work Management (FY 14–FY 18)*, have not been used to determine whether performance in IWM is improving.

Overall, NA-LA has adequate processes and procedures for the oversight of work planning and control, and has highly qualified and experienced technical staff. However, there is a significant shortage of staff in the Facility Representative Program (6 of 12 authorized positions are vacant). Also, NA-LA has not approved the contractor assurance system, which is required by DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*.

7.0 FINDINGS

As defined in DOE Order 227.1, findings are significant deficiencies or safety issues that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. Findings may identify aspects of a program that do not meet the intent of DOE policy or Federal regulation. 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 227.1 to manage these corrective action plans and track them to completion.

NA-LA

Finding F-NALA-01: NA-LA has not approved the LANL CAS as required by DOE Order 226.1B.

Finding F-NALA-02: The FR program does not meet the requirements of the staffing analysis performed in accordance with DOE-STD-1063-2011, nor does it meet the requirements of the annual work force analysis required by the Federal Technical Capability Program. The site office has not developed a staffing plan to address the FR shortfall identified in these staffing analyses as required by DOE Order 426.1.

LANS

None.

8.0 OPPORTUNITIES FOR IMPROVEMENT

This EA review identified 17 OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are suggestions offered by the EA review team that may assist site management in implementing best practices, or provide potential solutions to minor issues identified during the conduct of the review. In some cases, OFIs address areas where program or process improvements can be achieved through minimal effort. It is anticipated that the responsible line management organizations will evaluate these OFIs and either accept, reject, or modify them as appropriate, in accordance with site-specific program objectives and priorities.

NA-LA

OFI-NALA-01: Consider increasing emphasis on oversight of WP&C:

- Update Federal oversight procedures (e.g., MP 00.08 and WI 00.12) as needed.
- Schedule and conduct formal assessments of WP&C at appropriate intervals.
- Update the Functions, Responsibilities and Authorities to include the roles and responsibilities for the WP&C lead, as well as tracking and trending of WP&C performance.
- Provide feedback to LANS as appropriate and work with LANS to approve the CAS.

LANS

OFI-LANS-RESEARCH-1: Consider revising P300 to provide requirements for addressing programmatic maintenance in IWDs, including expectations for documentation of work scope, hazards, and controls for such activities, and limitations when performing programmatic maintenance as low hazard work that does not require an IWD.

OFI-LANS-RESEARCH-2: Consider revising P300 to require a minimum level of hazard analysis documentation for moderate hazard research activities to include the date the hazard analysis was performed, hazard analysis participating team members and organization, method of hazard analysis used, results of the hazard analysis performed, adequacy of existing controls to mitigate the hazards, and action items or recommendations for additional controls. For high hazard/complex activities ensure that the documented hazard analysis meets the objectives of the LANL Hazard Analysis Handbook.

OFI-LANS-RESEARCH-3: Consider reassessing the applicability and intent of the IWD Part 2 Form with respect to research. Clarify and define the terms and boxes on the Part 2 Form. Ensure that RLMs and PICs agree with the completed Part 2 Forms before work release.

OFI-LANS-RESEARCH-4: Consider revising P101-32 and/or P300 to ensure that hazards and hazard controls identified in an IWD are consistent with the hazard and hazard controls identified in the industrial hygiene exposure assessment associated with that IWD, and that supporting references (e.g., oxygen deficiency calculations) and included within the exposure assessment.

OFI-LANS-RESEARCH-5: Consider implementing additional rigor in the LANL exposure assessment process to ensure sufficient sampling data for higher hazard chemicals, including sampling to validate the effectiveness of chemical fume hoods for controlling worker exposures to such substances.

OFI-LANS-RESEARCH-6: Consider reassessing the need for additional hazard controls and/or hazard control alternatives for push rods and potential projectiles being ejected from the Rolling Mills in the Sigma Building. Also reconsider the need for additional beryllium surveys for Plating Shop tanks that may have previously contained beryllium parts.

OFI-LANS-RESEARCH-7: Consider evaluating the adequacy of instructions and requirements in P300, specifically for the process for IWD field changes, Standing versus Standard IWDs, and Pre and Post Job Briefing requirements as they pertain to long-standing research activities.

OFI-LANS-MAINT-1: Consider revising the WP&C process to include that equipment changes should be screened by work planners for potential change in scope and that performance of final walkdown of work packages should be conducted as close (within reason) to the time the work is to be performed to capture changes in conditions or equipment procured, which could change hazards or otherwise change initial work plans.

OFI-LANS-MAINT-2: Consider revising the WP&C process, for preparation of IWD Part 2 (Form 2101), to require tailoring to work/area where work is being performed and to the specific hazards that could potentially impact workers due to collocated activities or conditions. Consider establishing a date or number of days prior to, but close to work release date, where changes in area conditions/hazards can be more accurately reflected on the IWD Part 2. Consider discouraging the consolidation of multiple facilities onto a single IWD Part 2 or discussing hazards in such a generic manner as to make the document of little use for the purpose intended.

OFI-LANS-MAINT/IH-3: Consider additional evaluation of area noise hazards as well as impact of additional noise introduced by work practices which have potential to generate high impact noise or elevate ambient area noise conditions. Consider use of methods such as perhaps by additional planner and Industrial Hygiene walkdowns or interviews with workers prior to task assignment.

OFI-LANS-CA-1: Consider using leading indicators (e.g., trends from assessments data, completed corrective actions, completed program goals) for the IWM metric.

OFI-LANS-CA-2: Consider using a risk-based method to determine a frequency for performing IWM assessments.

OFI-LANS-CA-3: Consider measuring the effectiveness of goals completed in the Strategic Plan for Improving Integrated Work Management (FY14–FY18).

OFI-LANS-CA-4: Consider ensuring that ISM/IWM and Maintenance Sections of FCAs are comprehensive and performance based as designed.

OFI-LANS-CA-5: Consider revising the appropriate feedback and improvement processes to ensure that findings or other significant feedback identified in assessments and reviews are entered into PFITS and have documented corrective actions.

Appendix A
Supplemental Information

Dates of Review

Onsite Review: June 15-18 and July 13-16, 2015

Office of Enterprise Assessments 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, Director, Office of Nuclear Safety and Environmental Assessments
Patricia Williams, Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Office of Emergency Management Assessments

Quality Review Board

William A. Eckroade
Karen L. Boardman
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Thomas R. Staker
Patricia Williams
Gerald M. McAteer
Michael A. Kilpatrick

Office of Enterprise Assessments Site Lead

Ron Bostic

Office of Enterprise Assessments Reviewers

Patricia Williams, Team Leader
James Coaxum
Kevin Horace
Joseph Lischinsky
James Lockridge
Marvin Mielke
Terry Olberding
Valerie Steele

Appendix B
Key Documents Reviewed, Interviews, and Observations

Key Documents Reviewed

LANL

ANSI B11.12-2005 *Safety Requirements for Roll-forming and Roll-bending*
Beryllium Awareness Self-Study #28340
Conduct of Maintenance (P950) Maintenance & Site Services Work Control, AP-WORK series
ESH-HA-Handbook-01, R.1; LANL Hazard Analysis Handbook
IWD# 6-3-1698-C243-C247-1, Rev #7, Electrochemistry and Furnace Operations in the Materials Corrosion and Electrochemistry Laboratories
IWD# 6-3-66-P100-4, Rev. #F, Electroplating and Finishing; 4/13/2015
IWD# 6-3-66-R100-15, Rev. #4, Rolling Mill Operations
IWD# 7-35-213-B122-1, Rev. #4, MST-7 Machine Shops, 8/7/2013
IWD# 8-3-1698-B122-1, Rev. #5, Metallography; 7/28/2014
IWD# MPA-11-03-1698-B220-3, Rev. #2, Catalyst Deposition on Solid Supports; 12/12/2013
IWD# MST-6-3-66-P100-5, Rev#5, Aqueous Cleaning; 5/11/2014
IWD# MST-7-35-0213-H2-11, Rev. #1, Mechanical Property Testing with the MTS Load Frame; 5/11/2015
IWD# MST-7-35-213-B20-11, Processing of Thermoset Polymers; 1/10/2013
IWD# MST-7-35-213-D17-7, Rev #0, Operation and Maintenance of Surface Science Instrumentation at TFF
LIHSM Chapter 33, Rev. 2, Carcinogens
LIHSM Chapter 39, Ventilation (Chemical Fume Hood Testing)
Mission, Facilities and Work Overview for MST Division; MST Division Leader; 6/15/2015
Occurrence Report Number: NA--LASO-LANL-PHYSTECH-2015-0004
Occurrence Report Number: NA--LASO-LANL-SIGMA-2015-0003
OST 402-00-00 Laboratory Industrial Hygiene and Safety Manual (LIHSM) Introduction
P101-16, Rev. 2, Local Exhaust Ventilation and HEPA Filtration Systems
P101-32, Rev. 1, Worker Exposure Assessments
P300; Integrated Work Management
PD103, Worker Safety and Health Program, Rev. 1
PD324, LANL Metrics Program
P322-1 Causal Analysis and Corrective Action Development, 3/12/15
P323-1 Operating Experience and Lessons Learned Process, 9/11/12
P322-4 Laboratory Performance Feedback and Improvement Process, 5/11/15
PD328 LANL Assessment Program 3/21/14
SD320 LANL CAS Description Document, June 2012
SD 330 LANL QAP, 5/11/15
Radioactive Liquid Waste Facility Centered Assessment (FCA), FCA (14)-003.00, October 22, 2014
Independent Integrated Safety Management / Integrated Work Management Assessment of Research and Development Programmatic Work, September 26, 2011
LANSCE Facility Centered Assessment, FCA (12)-002.00, January 10, 2013
Management Assessment Report – IWM TA-53, AOT and LFO Divisions, AOT-MA-14-001 RO 3-25-14
Parent Organization Functional Management Review R&D Work Control Pre-Job Brief November 26, 2012
Radioactive Liquid Facility Centered Assessment, June 14-25 2010
Radiation Protection Division – Work Control Implementation Review Summary Report, September 2013

Facility Centered Assessment of LANL Science and Technology Operations (STO) August 31, 2011
FY14: LANL CAS Self-Assessment
SD100; Integrated Safety Management System Description Document with embedded 10 CFR 851
Worker Safety and Health Program
Ventilation Fume Hoods Self-Study #48002
Work Package Associated with WO# 503552-01, *Install New MCC-Q for L Building Entry*
Work Packages Associated with WO# 505773-05, *TA05 CREX-1 Water Land Apply From Pump Test*
Work Packages Associated with WO# 506611-01, to *Replace PC-1 and PC-2*
Work Packages Associated with WO# 516741-01, *Crane Mechanical and Electrical PM*
Work Packages Associated with WO# 519478-01, *Mechanical/Electrical Elevator PM*
Work Packages Associated with WO# 519486-01, *Annual Crane PM Inspection and Certification*
Work Packages Associated with WO# 520448-01, *ACR-006 Return to Operation (Air Conditioner, Cool)*
B Division Organizational Chart
DOE P 434.1A Conduct and Approval of Select Agent and Toxin Work at DOE Sites
Biosafety in Microbiological and Biomedical Laboratories 5th Edition
DOE Order 851, Appendix A, Section 7 Biological Safety
DOE Order 481.1D, Strategic Partnership Projects
42 CFR 73 Public Health Select agents and Toxins
7 CFR 331 Agriculture Select Agents and Toxins Possession Use and Transfer
DOE G 151.1-5 Biosafety Facilities Emergency Management Guide
Bioscience Biosafety Manual, Chapter 2, IBC Procedures
LANL Biosafety Manual Training Procedures
LANL Biosafety Manual Inspections BSL-2 checklist
IBC Application # 87
IBC Application # 126
P-101-5 Cryogens
P-101-16-Local exhaust ventilation
P-101-15 Biological Safety
P-101-19 Safety Signs Labels and Tags
P-101-24 Lasers
P-101-29 Working with Nanotechnology
P-300- Integrated Work Management
Emergency Operations Division:
EPHA for TA-43 HRL 1/2014
NOV 2012 HRL Exercise Plan
Nov 2012 HRL After action Report
Nov 2013 HRL Exercise Plan
Nov 2013 HRL After action report
Dec 2014 HRL Exercise Plan
Dec 2014 HRL After action Report
HSR 5 SAP-01, R12 Select Agents and Toxins Security Plan
Exhibit F for Programmatic Equipment maintenance and repair
LANL Biosafety Overview Projected slides 6/15/2015
Bioscience @LANL Overview slides 6/15/2015
Biosafety Lab Facts BSL-3
Protocol for running a sandwich assay for detection of a specific biomarker / no date no author
IWD B-10-43-1-127-2
IWD B-10- 43-1-127260-1
IWD B-10-43-1-160-1-1
IWD B-11-35-0085-2.1
IWD B-11-43-1-128-1

IWD B-11-43 1-1281251613140-1
IWD B-11-43-1-228239241-1
IWD 5339 TA-46-31-112,102c
IWD B-11-35- 85-Gen1.1
IWD B-11-43-1-242245247247A-1
IWD B-11-43-1-242245247247A-2 Revision #2.0
Bloodborne Pathogens –SS-11776,R1.2 Self Study Training
Principles of Biosafety Course 31701
Form B-526 Training Questionnaire
Designated worker Fire Extinguisher Course 15672
Biological Safety Status Report, CY 2014 ASM-OPS 5/27 2015
LASO File- Select Agent and Toxins Renewal Inspection 2013 (Inspection report, Inspection checklist, LANL response)
LASO File- White House Concern MEMO Aug 2014 (LANL Action Plan
LASO response to NNSA/HQ, LANL inventory)
IBC Agenda, 6/3/2015
IBC Meeting Minutes Sept 18, 2014
IBC appointment Letter, Re. committee member appointments, 2/27/2014
IBC Application (sample copy)
DOT Inspection LASO Shadow Report 7/1/2014 Focus on Biosafety
HRL EPHA Exercise LASO Shadow report 3/16/2015
Strategic Partnership Projects Package R-00480=15-0 LASO Review
BSL-2 Inspection Report 5/29/2015, 46-31-112-BSL-2 Operational Awareness
CDC Facility Inspection Report C20100913-1117 8/21/2013
LA Field Office, Safety and Health 5-year Risk Assessment and Oversight Approach FY2014-2018
LA Field Office, Work for Others (WFO) Program – Other Federal Agencies (OFA) 07/14/2014
LA Field Office, Work for Others Non-Federal Entity (WFO/NFE) and Cooperative Research and Development Agreement (CRADA) 07/21/2014
LANS Hazard Assessment Survey Report (Survey ID QL0905026) 06/22/2012
LANS Hazard Assessment Survey Report (Survey ID QL0906461) 06/04/2014
Bioscience Division Training Questionnaire B-FORM-526 Revised 04/2011
Bench Sheet Template: LANL Genome Center Bench Sheet for SOP-XXX, version X
Training and Reach-back Support for Genomics and Bioinformatics R-00271-15-0 – DOD 12-01-2014
Memorandum of Understanding (MOU) between the Department of Health and Human Services (HHS), Centers for Disease Control and Prevention (CDC), and the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Services (APHIS), and the United States Department of Energy 12-1001-0829-MU

NA-LA

MP 00.08, Implementation of Loa Alamos Site Office Line Oversight, R4, 12/18/2009
WI 00.13, Annual Assessment Planning, R1, 4/1/2014
MP 00.13 Risk-Informed Oversight Planning, R2, 4/25/2014
MP 00.15, Management Assessments for Federal Operations, R1, 5/22/2014
WI 00.04Assessment Shadow Activity Reporting, R4, 5/27/2014
MP 00.12, Independent Assessment Process, R2, 9/25/2014
WI 00.14, Federal Issues Management, R1, 9/25/2014
WI 00.12, Oversight Issues Reporting.R1, 5/22/2014
WI 06.01, Operations – Oversight/Surveillance Issues Reporting, R4, 5/20/2014
MP 06.04, Los Alamos Field Office Facility Representative Program, R3, 3/12/2014

ASM-EP-10.2.2012-469720, Los Alamos Field Office EPO Final Assessment Report, CAS Use and Application, 8/28/2013
Los Alamos Site Office, National Security Mission, CAS Assessment Project Execution, 12/10/2012
2014 Management System Effectiveness Summary for the functional area of Integrated Safety Management (ISM), Corporate Safety & Health SMP Oversight
Review of Management Effectiveness Forms for FY2014
Maintenance Program Assessment Tracking & Planning
ASRP-F0-5.1.2013-509073, Assessment Report for the Los Alamos National Laboratory Nuclear Maintenance Management Program, 07/2013
ASRP-FO-3.13.2014-565949. R0, Assessment Report for Los Alamos National Laboratory Nuclear Maintenance Management Program; Training and Qualification of Maintenance Personnel, 3/2014
ASM-SO-3.21.2014-567215, Process Hazard Analysis Effectiveness Evaluation, Assessment Shadow Record Form, 6/2014
ASM-SO-9.26.2012-467837, Los Alamos Field Office Independent Assessment Report Lightning Protection Systems, 5/23/2013
FY15 LANL Integrated Assessment Schedule
NA-LA FY15 Assessment Schedule
NA-LA FR Daily Report for 1/14/2015
NA-LA FR Daily Report for 1/20/2015
NA-LA FR Daily Report for 5/12/2015
NA-LA FR Daily Report for 6/1/2015
Site Office list of oversight for safety programs (11/1/2012)
PLAN 00.14, The Integrated Management System Description including Los Alamos Field Office Functions, Responsibilities, and Authorities, 2015.
Memo to Kimberly Davis Lebak from Lynn Maestas, subj: Transmittal of the FY 2015 Integrated Safety Management System Self-Assessment Report, date 6/1/2015
SME Team Strategic Performance Evaluation Plan (PEP) Feedback, FY15 Third Quarter S&H Input, 6/30/2015
Memo to Kimberly Davis Lebak from Daniel Carter, subj: Los Alamos Field Office Facility Representative Program Self-Assessment Report for Calendar Year 2015, date 6/18/2015
Memo to Karen Boardman from Kimberly Davis Lebak, subj: Los Alamos Field Office Work Force Analysis and Staffing Plan Report for Calendar Year 2014, date 2/26/2015
Memo to Kimberly Davis Lebak from Edwin Christie, subj: Facility Representative Staffing Plan for 2015, date 2/6/2015
NA-50 Approach to Safety Management Program Reviews, 5/2015
Various FR Issues
TQP Record for FR
Presentations in March 2015 on DOE-HDBK-1211, Activity-Level Work Planning and Control Implementation, and DOE G 226.1-2A, Federal Line Management Oversight of DOE Nuclear Facilities
LANSCE IWM Assessment 2014-1189, assessment shadow record form, 03/2014

Interviews

LANL
MST Division Leader
MST-DO Executive Advisor
DSESH-STO Team Leader
STO MSL Operations Manager
Acting Operations Manager TA-35
STO Work Execution Manager
Deputy FOD TA-35

MST-7 Deputy Group Leader
MST-6 Deputy Group Leader & MST-6 Team Lead
MPA-11 Deputy Group Leader
Team Leader for Deployed Services at TA-35
Sigma Plating Shop RCT
LANL Beryllium Assessment Team
LANL Industrial Hygienists for MSL, MST and TA-35
LANL Industrial Hygiene Ventilation Subject Matter Expert
Various LANL Research Staff, Engineers and Technologists in MST 6, 7, and 8 and MPA-11
Various LANL RMs and PICs in MST 6, 7, and 8 and MPA-11
Maintenance Manager
Maintenance Work Execution Manager
MSS Work Planning Leads and Coordinators
MSS Maintenance Job Supervisors/Forman/PICs
MSS Maintenance Superintendents
MSS Maintenance Workers
Various Facility Maintenance Coordinators
ADPM ES&H Manager
LANS Industrial Hygienist
SIGMA Radiological Control Technician
Accident Investigation Team Lead
NNSA/HQ Industrial Hygiene
LANL Biosafety officer
LANL IBC Chairman
LANL Deployed Security Officer
LANL Emergency Coordinator
LANL Medical Director
LANL PA-C
B division DDL
B Division Principal Investigators
B Division Laboratory Support Staff
B Division FODs
B Division Group lead
B Division Training Coordinator
LANL Industrial Hygiene Deployed staff
ISM Program Manager
Facility Operations Issues Management Coordinator /CAS SME
Conduct of Operations Program Manager
VPP Manager (WasteTek)
Operations Support Division Leader
ADESH Performance Assurance Lead
CHAIR of Deputy Associate Directors (DAD) Committee
Deputy Associate Director ES&H
Senior Occurrence Investigator
MRB Chair
Maintenance Manager
CAS SMEs

NA-LA

NA-LA Manager

NA-LA AM for Business Administration
NA-LA S&H SMEs
NA-LA FR Team Leader
NA-LA Maintenance SMEs
NA-LA TQP Program Manager
NA-LA SME Team Lead
NA-LA CAS Manager
NA-LA Strategic Partnership Projects Coordinator

Observations

IWD# MST-7-35-213-B20-11, Processing of Thermoset Polymers; 1/10/2013
IWD# 7-35-213-B122-1, Rev. #4, MST-7 Machine Shops, 8/7/2013
IWD# 8-3-1698-B122-1, Rev. #5, Metallography; 7/28/2014
IWD# MST-6-3-66-P100-5, Rev#5, Aqueous Cleaning; 5/11/2014
IWD# MST-7-35-213-D17-7, Rev #0, Operation and Maintenance of Surface Science Instrumentation at TFF
IWD# MST-7-35-0213-H2-11, Rev. #1, Mechanical Property Testing with the MTS Load Frame; 5/11/2015
IWD# MPA-11-03-1698-B220-3, Rev. #2, Catalyst Deposition on Solid Supports; 12/12/2013
IWD# 6-3-66-R100-15, Rev. #4, Rolling Mill Operations
IWD# 6-3-1698-C243-C247-1, Rev #7, Electrochemistry and Furnace Operations in the Materials Corrosion and Electrochemistry Laboratories
MSL Complex (MST 8, MPA 11, MPA CMSS, MPA CINT) Plan of the Week Meeting, 6/18/2015
516741-01, *Crane Mechanical and Electrical PM*
519486-01, *Annual Crane PM Inspection and Certification*
520448-01, *ACR-006 Return to Operation (Air Conditioner, Cool)*
519478-01, *Mechanical/Electrical Elevator PM*
506611-01, to *Replace PC-1 and PC-2*
Pre-Job briefings associated with work observed as well as work paused following event and/or worker questions during pre-job briefing
Facility Condition walkdown with Superintendents of areas with ongoing maintenance work at SIGMA, Materials Science Laboratory, Target Fabrication Facility, several MST work areas and the Health Research Laboratory
Meeting MSS Senior Management with Superintendents
Meeting Maintenance Work Execution Manager, Superintendents and Foremen with Craft Workers
Fact Finding for Occurrence Report Number: NA--LASO-LANL-SIGMA-2015-0003
Event Learning Team Meeting
Top 10 meeting