Los Alamos National Security, LLC
Los Alamos National Laboratory
Los Alamos, New Mexico

Report from the Department of Energy
Voluntary Protection Program
Onsite Review
June 3-13, 2013

U.S. Department of Energy
Office of Health, Safety and Security
Office of Health and Safety
Office of Worker Safety and Health Assistance
Washington, DC 20585

Foreword

The Department of Energy (DOE) recognizes that true excellence can be encouraged and guided but not standardized. For this reason, on January 26, 1994, the Department initiated the DOE Voluntary Protection Program (VPP) to encourage and recognize excellence in occupational safety and health protection. This program closely parallels the Occupational Safety and Health Administration (OSHA) VPP. Since its creation by OSHA in 1982 and DOE in 1994, VPP has demonstrated that cooperative action among Government, industry, and laboratories can achieve excellence in worker safety and health. The Office of Health, Safety and Security (HSS) assumed responsibility for DOE-VPP in October 2006. Assessments are now more performance-based and are enhancing the viability of the program. Furthermore, HSS is expanding complex-wide contractor participation and coordinating DOE-VPP efforts with other Department functions and initiatives, such as Enforcement, Oversight, and the Integrated Safety Management System.

DOE-VPP outlines areas where DOE contractors and subcontractors can surpass compliance with DOE orders and OSHA standards. The program encourages a "stretch for excellence" through systematic approaches, which emphasize creative solutions through cooperative efforts by managers, employees, and DOE.

Requirements for DOE-VPP participation are based on comprehensive management systems with employees actively involved in assessing, preventing, and controlling the potential health and safety hazards at their sites. DOE-VPP is designed to apply to all contractors in the DOE complex and encompasses production facilities, laboratories, and various subcontractors and support organizations.

DOE contractors are not required to apply for participation in DOE-VPP. In keeping with OSHA and DOE-VPP philosophy, *participation is strictly voluntary*. Additionally, any participant may withdraw from the program at any time. DOE-VPP consists of three programs with names and functions similar to those in OSHA's VPP: Star, Merit, and Demonstration. The Star program is the core of DOE-VPP. This program is aimed at truly outstanding protectors of employee safety and health. The Merit program is a steppingstone for participants that have good safety and health programs, but need time and DOE guidance to achieve true Star status. The Demonstration program, expected to be used rarely, allows DOE to recognize achievements in unusual situations about which DOE needs to learn more before determining approval requirements for the Merit or Star program.

By approving an applicant for participation in DOE-VPP, DOE recognizes that the applicant exceeds the basic elements of ongoing, systematic protection of employees at the site. The symbols of this recognition provided by DOE are certificates of approval and the right to use flags showing the program in which the site is participating. The participant may also choose to use the DOE-VPP logo on letterhead or on award items for employee incentive programs.

This report summarizes the results from the evaluation of Los Alamos National Security, LLC, at the Los Alamos National Laboratory, Los Alamos, New Mexico, during the period of June 3-13, 2013, and provides the Chief Health, Safety and Security Officer with the necessary information to make the final decision regarding its continued participation in DOE-VPP.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

AD	Associate Director
ADBS	Associate Director for Business Systems
ADEP	Associate Director for Environmental Programs
ATOMICS	Allowing Timely Observation Measures Increased Commitment to Safety
BBS	Behavior-Based Safety
BLS	Bureau of Labor Statistics
CA	Contamination Area
CFR	Code of Federal Regulations
CMR	Chemistry, Metallurgy, and Radiological
CTS	Comprehensive Tracking System
CWI	CH2M♦WG Idaho, LLC
CY	Calendar Year
DART	Days Away, Restricted, or Transferred
DARHT	Dual Axis Radiographic Hydrodynamic Test Facility
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOP	Detailed Operating Procedures
EA	Exposure Assessment
EAP	Employee Assistance Program
EC	Experiment Coordinator
EP	Emergency Preparedness
ESH	Environment, Safety and Health
FCA	Facility Centered Assessment
FOD	Facility Operations Directorate
HCA	High Contamination Area
HPI	Human Performance Improvement
HSS	Office of Health, Safety and Security
IH	Industrial Hygiene
IMRB	Institutional Management Review Board
IWD	Integrated Work Document
IWM	Integrated Work Management
IWSST	Integrated Worker Safety and Security Team
JHA	Job Hazard Analysis
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
NA-00-LA	Los Alamos Field Office
MOV	Management Observation and Verification
MSA	Management Self-Assessment
MSS	Maintenance and Site Services Division
NAICS	North American Industry Classification System
NNSA	National Nuclear Security Administration
OJT	On-the-Job Training
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PAD	Principal Associate Director
POD	Plan-of-the-Day

PF-4	Plutonium Facility
PIC	Person-In-Charge
PPE	Personal Protective Equipment
RCT	Radiation Control Technician
RLUOB	Radiological Laboratory Utility Office Building
RWP	Radiological Work Permit
SEG	Similar Exposure Group
SIP	Safety Improvement Plan
SMART	Specific, Measurable, Achievable, Relevant, and Time framed
SME	Subject Matter Expert
STR	Subcontractor Technical Representative
TA	Technical Area
Team	HSS DOE-VPP Assessment Team
TRC	Total Recordable Case
VPP	Voluntary Protection Program
WMS	Work Management System
WSST	Worker Safety and Security Team
WOLVES	Worker Observations & Leadership Verifying and Ensuring Safety
WX	Weapons Physics

EXECUTIVE SUMMARY

Los Alamos National Security, LLC (LANS), is a partnership among the University of California, the Babcock and Wilcox Company, Bechtel National, Inc., and URS Corporation. On December 21, 2005, the National Nuclear Security Administration awarded LANS the contract to manage and operate the Los Alamos National Laboratory (LANL). The transition to the new contract was effective in June 2006. As part of its proposal, LANS established attaining Department of Energy (DOE) Voluntary Protection Program (VPP) Star status as a goal. In September 2009, LANS submitted its DOE-VPP application and the initial onsite assessment was conducted April 19-29, 2010. After that assessment, the Office of Health, Safety and Security (HSS) admitted LANS to DOE-VPP at the Merit level. As a Merit participant, LANS is required to have an annual assessment to determine whether it is making progress toward Star level. The first annual assessment was conducted in November 2011. This report documents the results of a progress assessment conducted June 3-13, 2013, and provides the HSS DOE-VPP Assessment Team's (Team) recommendation to the Chief Health, Safety and Security Officer regarding that application.

Accident and injury statistics for LANS are significantly lower than the average for comparable industry. LANS has shown significant improvement since the 2011 assessment in safety performance of both LANS and its subcontractors, indicating an improving safety management system. LANS monitors Total Recordable Case and Days Away, Restricted or Transferred performance for most of the organizations that perform work at the Laboratory. LANS should update recordkeeping personnel with new reporting and tracking information when it awards new subcontracts that are not subject to the reporting exemption.

LANL managers demonstrate significant improvement and acceptance of their role in achieving excellence in worker safety and health. Most managers are following a coaching and mentoring model with their applicable Worker Safety and Security Team (WSST), identifying and providing the necessary resources to pursue continuous improvement in safety and health, and encouraging worker participation in all aspects of the safety program. Managers are visible and accessible in the work areas, and use that time to establish effective relationships and open lines of communication with Laboratory personnel. The continued commitment of resources, despite overall budget reductions, demonstrates that managers value safety as contributing to the quality of science at LANL.

Employee involvement and participation in the LANL safety program has improved significantly since the last review and is becoming a strength of LANS' pursuit of VPP. Some groups continue to excel and take a much more active role than others. The managers' focus, coupled with employee participation, demonstrates a commitment to sustained improvement across the Laboratory. WSSTs have increased their visibility, provided value, and are gaining momentum daily. Behavior-Based Safety (BBS) and Human Performance Improvement (HPI) approaches are maturing and gaining acceptance, but some opportunities remain for improved participation and use of BBS and HPI across LANL.

Since the 2011 review, Worksite Analysis is continuing to mature and there has been continued improvement in the work control processes. The Team noted an improvement in the process and effectiveness of hazard identification across LANL; however, some vulnerability remains. Specifically, the use of subject matter experts or supervisors in lieu of worker participation for Integrated Work Document and technical procedure development has, in some cases, resulted in

less than adequate analysis for those activities. LANL needs to continue working toward a sustainable and effective industrial hygiene exposure assessment process across all Directorates for all applicable hazards. LANS has developed effective hazard analysis tools, but all areas of LANL need to fully implement and use the tools.

Methods of hazard prevention and control generally follow the appropriate hierarchy of controls, but in some cases production pressures and the lack of a "hands-on" approach to work planning result in less effective hazard controls or worker errors in implementing those controls. LANS needs to build on its successes in other tenets and encourage greater employee involvement in complex issues that have repeatedly occurred in the higher hazard facilities related to conduct of operations, work planning and control, criticality safety, and radiological controls and worker perceptions related to a safety conscious work environment.

LANL continues to improve safety and health training to ensure that employees can recognize the hazards of work and the work environment, and they can protect themselves and their coworkers. UTrain continues to be a powerful tool that supervisors access to verify worker training prior to the start of work, and notifies the worker and supervisor prior to the expiration of training. The emphasis of training infused at the Lujan Center after the ^{99}Tc contamination event aided in the reopening of the Center.

LANL is making substantial improvements in worker safety and health, encouraging additional employee involvement, providing resources, and demonstrating management commitment to excellence in safety and health. Innovations at LANL that address the leading causes of injuries, such as the slip simulator, widespread efforts to improve walking surfaces, and encouragement to workers to ask questions and pause or stop work if necessary, are resulting in significant improvements and preventing injuries. WSSTs are active, energized, and pursuing continued and sustainable improvement. In three tenets: Management Leadership, Employee Involvement, and Safety Training, LANS meets the expectations for a DOE-VPP Star participant, but needs additional improvement in the Worksite Analysis, and Hazard Prevention and Control tenets. LANL should revise the *Integrated Work Management Procedure,* P300, to reflect using hazard analysis to improve its graded approach to hazard controls, ensure the basis and assumptions behind a low hazard determination are captured for future reference during similar work, or if changes occur during the course of work. The Team recommends that LANS continue to participate in DOE-VPP at the Merit level while it addresses the remaining improvements.

TABLE 1

OPPORTUNITIES FOR IMPROVEMENT

Opportunity for Improvement	Page
LANL should update and provide reporting codes to recordkeeping personnel when it awards new subcontracts not subject to the reporting exemption.	**4**
LANL should consider performing an effectiveness review at some future date to verify the transformation met LANL goals and identify any unintended consequences of the transformation process.	**7**
LANL managers should place a high priority on determining the cause of the dissatisfaction among previous criticality safety engineers and implement corrective actions specifically to prevent recurrence of a similar environment in the future.	**7**
Senior Managers should consider creating metrics that monitor the progress of the goals established in SIPs and encourage better use of the data collected in the ATOMICS system.	**8**
Senior Managers should consider discretionary funding at the group level to help supervisors provide more immediate, positive reinforcement to workers and further improve visibility of recognition and rewards for safety.	**9**
LANL should work with the custodial services subcontract consortium to identify safety incentives that reward positive behaviors.	**10**
LANS should ensure that injury and illness recordkeeping procedures include criteria to record any restrictions imposed by supervisors.	**11**
The MSS WOLVES team should consider adopting the established processes, procedures, and analytical tools from the ATOMICS application to improve its effectiveness.	**15**
TA-55 managers should consider curtailing programmatic work in PF-4 during monthly WSST meetings to encourage greater participation by technical staff.	**17**
ADEP should strive to provide WSST participation opportunities to all employees, and further emphasize that workers should pause or stop work when they have safety concerns.	**17**

Managers at TA-55 should analyze the effects of chemical hazards on the engineered systems used for radiological hazards and address the apparent conflict of the operation and the hood posting in the current conduct of operations improvement initiative.	**20**
LANL should consider updating P300 to strengthen and clarify the use of workers and workers' representatives in combination with planners, supervisors/PIC, and SMEs during the development and revision of technical procedures and IWDs.	**21**
LANL should ensure that standing IWDs contain sufficient detail to define the entire scope of work and identify all applicable hazards, and the changes made to standing IWDs are properly recorded and captured.	**22**
LANL needs to continue working toward a sustainable and effective IH exposure assessment process across all Directorates for all applicable hazards.	**24**
LANL should revise P300 to reflect using hazard analysis to improve its graded approach to hazard controls, and ensure the basis and assumptions behind a low hazard determination are captured for future reference during similar work, or if changes occur during the course of work.	**25**
MSS should consider requiring walkdowns for semi-annual and annual preventive maintenance work until the feedback and postjob process is more robust and the PICs demonstrate a more comprehensive understanding of workscope changes.	**26**
MSS should find more effective methods to encourage and stimulate worker feedback on all jobs, and effectively communicate postjob comments and the resulting corrective actions to the crafts who originated the comments.	**26**
LANL should encourage the continued development, training of workers and use of JHA, WMS, and EA tools across all LANS Directorates.	**27**
LANL should expand and document the current housekeeping inspection program to meet DOE-VPP expectations for monthly general hazard assessments that cover the whole worksite quarterly.	**28**
LANL needs to ensure that production pressures to comply with negotiated agreements do not lead to errors by workers.	**32**
LANL needs to continue walking down procedures with a team of "hands-on" workers and SMEs to ensure procedures are workable, remove ambiguous language, clarify assumptions, and resolve the outstanding conduct of operations issues.	**33**
LANL needs to seek broader worker involvement in work planning, use WSSTs to help address conduct of operations issues, and allow workers to have a much larger role in defining corrective actions to issues.	**34**

LANL should evaluate current practices regarding hazard communication and contamination control associated with contaminated open-faced hoods in comparison with practices across the DOE complex, and consider making appropriate changes based on the evaluation.	**34**
LANL should develop a plan to convert the remainder of the Laboratory to the new Job Demands Evaluation form/process to ensure consistent and effective analysis of the workers physical and emotional readiness and to ensure supervisors do not ask workers to perform work they may not be able to perform.	**36**
LANL should update the training records and modify the UTrain database if necessary, to more readily provide accurate training status reports for all Laboratory personnel.	**39**

I. INTRODUCTION

Created in 1943 during the Manhattan Project, Los Alamos National Laboratory (LANL) was selected as the site to design and build the world's first nuclear weapons. Chosen for its isolation, limited access, and ability to use the surrounding canyons for explosive tests, the site was an ideal location for this work. Since its inception, the University of California, under contract to the U.S. Army, the Atomic Energy Commission, the Energy Research and Development Agency, the Department of Energy (DOE), and finally the National Nuclear Security Administration (NNSA) has managed LANL. In order to gain greater efficiency in the operation of LANL, as well as address longstanding safety and security issues, NNSA opened competition for the LANL contract in 2003. Los Alamos National Security, LLC (LANS), a partnership, including the University of California, the Babcock and Wilcox Company, Bechtel National, Inc., and URS Corporation, won the contract to manage and operate LANL, and completed transition in June 2006.

LANL covers over 40 square miles and is divided into multiple technical areas (TA) grouped and managed by location and function. The Santa Fe National Forest, Bandelier National Monument, the San Ildefonso Pueblo, and the towns of White Rock and Los Alamos border LANL.

The primary mission of LANL 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. For more than 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.

LANL uses a matrix structure with five Principal Associate Directors (PAD) sharing support resources. The PADs are: Science Technology and Engineering (PADSTE); Weapons Programs (PADW); Global Security (PADGS); Operations and Business (PADOPS); and Capital Projects (PADCAP). These PADs perform the primary missions of LANL. Each PAD has a number of Associate Directors (AD). These Directorates are further organized into Divisions and finally into groups. The PADs and ADs come from a variety of backgrounds that include longtime experience at National Laboratories; other facility operations; maintenance and construction, both nuclear and nonnuclear; and environmental stewardship (including waste management and environmental restoration).

As part of its winning proposal, LANS identified its commitment to achieving Star status in the DOE Voluntary Protection Program (VPP), and pursued that commitment actively after transition. In September 2009, LANS submitted its application for participation in DOE-VPP to the Los Alamos Field Office (NA-00-LA). NA-00-LA concurred with the application and forwarded the application to the Office of Health, Safety and Security (HSS) in October 2009. An initial onsite assessment was conducted April 19-29, 2010, and LANS entered DOE-VPP at the Merit level. The HSS DOE-VPP Assessment Team (Team) conducted the first annual Merit review in November 2011 and noted progress toward Star status, but identified several areas that needed improvement and recommended continued Merit status.

LANL is the largest of the National Laboratories. Initially covering a population of employees and subcontractors of approximately 14,000 people, current staffing levels at LANL are down to

approximately 9,600 personnel working at LANL on a daily basis. The personnel are a mix of PhDs, postdoctoral students, graduate and undergraduate students, technicians, engineers, crafts people, laborers, administrators, and support personnel. Thirteen separate unions represent the site's maintenance and craft workers, each of which signed a joint commitment letter endorsing its support for VPP at LANS.

Hazards at LANL run the gamut from routine hazards to those associated with operating Category II nuclear facilities. As such, workers can be exposed to standard industrial hazards, beryllium, nanoparticles, toxic and hazardous chemicals, radioactive materials, high-voltage electricity, confined spaces, explosives, high-energy particle beams, lasers, and a host of other hazards. Research and development work at LANL can expose workers to other unrecognized hazards or hazards that they do not fully understand.

As a Merit participant, the Team evaluates LANS' progress toward Star status annually. This report documents the results of the annual review conducted June 3-13, 2013. The Team consisted of 19 people, including DOE Federal employees from DOE Headquarters and two from other DOE site offices, and volunteer personnel from other DOE-VPP participating contractors. During the assessment, the Team visited many LANL facilities; conducted interviews with senior LANL managers, including the Laboratory Director, ADs, and Division Directors; observed work activities, including research, maintenance, and operations; reviewed revised policies and procedures and other documents; observed Worker Safety and Security Team (WSST) meetings, and had contact with many LANL personnel. This report documents the results of the Team's activities and provides the Team's recommendation to the Chief Health, Safety and Security Officer regarding LANS' continued participation in DOE-VPP.

II. INJURY INCIDENCE/LOST WORKDAYS CASE RATE

Injury Incidence/Lost Workdays Case Rate (LANS)					
Calendar Year	Hours Worked	Total Recordable Cases (TRC)	TRC Incidence Rate	DART* Cases	DART* Case Rate
2010	17,887,815	141	1.58	47	0.53
2011	18,287,359	165	1.80	45	0.49
2012	17,852,792	123	1.38	25	0.28
3-Year Total	54,027,966	429	1.59	117	0.43
Bureau of Labor Statistics (BLS-2011) combined average for NAICS** Code 5417, *Scientific Research and Development Services;* 5612, *Facilities Support Services;* and 5629, *Remediation and other Waste Management Services*.			2.21		1.11
Injury Incidence/Lost Workdays Case Rate (Subcontractors and Vendors)					
Calendar Year	Hours Worked	TRC	TRC Incidence Rate	DART* Cases	DART* Case Rate
2010	2,240,518	41	3.66	19	1.70
2011	1,759,277	27	3.07	11	1.25
2012	1,841,013	15	1.63	7	0.76
3-Year Total	5,840,807	83	2.79	37	1.24
Bureau of Labor Statistics (BLS-2011) Average for NAICS** Code # 5612 "Facility Support Services"			3.70		1.90

* Days Away, Restricted or Transferred

** North American Industry Classification System

TRC Incidence Rate, including subcontractors: 1.71
DART Case Rate, including subcontractors: 0.51

The accident and injury statistics for LANS are significantly lower than the average for the comparable industry. LANL has shown significant improvement since the 2011 assessment in safety performance of both LANS and its subcontractors, indicating an improving safety management system. LANL effectively monitors TRC and DART performance for most of the organizations that perform work at the Laboratory. Per DOE Order 231.1B, *Environment, Safety, and Health Reporting*, LANL excludes some small and transient subcontractors from institutional statistics. LANS does not track the hours of work performed by those subcontractors, but does track injuries that occur. The DOE-VPP expectation is that compiled together, the TRC and DART case rates for all subcontractor operations for the last complete calendar year are at, or below, the latest published BLS rates for the NAICS code, which best match the predominant activity of subcontractor operations. Adding the injuries for these small and transient subcontractors to the statistics without the associated hours of work does skew the

statistic upward, but does not increase the TRC and DART case rates above the comparison statistic. Recordkeeping personnel were using a list of subcontractors that must be tracked that was dated 2009 and were not aware of any newer list. The subcontracting process does include reporting requirements for larger subcontracts, but does not provide that information to recordkeeping personnel. LANL should update and provide reporting codes to recordkeeping personnel when it awards new subcontracts not subject to the reporting exemption.

Opportunity for Improvement: LANL should update and provide reporting codes to recordkeeping personnel when it awards new subcontracts not subject to the reporting exemption.

III. MANAGEMENT LEADERSHIP

Management leadership is a key element of obtaining and sustaining an effective safety culture. The contractor must demonstrate senior-level management commitment to occupational safety and health, in general, and to meeting the requirements of DOE-VPP. Management systems for comprehensive planning must address health and safety requirements and initiatives. As with any other management system, authority and responsibility for employee health and safety must be integrated with the management system of the organization and must involve employees at all levels of the organization. Elements of that management system must include: (1) clearly communicated policies and goals; (2) clear definition and appropriate assignment of responsibility and authority; (3) adequate resources; (4) accountability for both managers and workers; and (5) finally, managers must be visible, accessible, and credible to employees.

In 2011, the Team determined that senior managers at LANL remained committed to achieving DOE-VPP Star status and were willing to provide workers with the tools and resources needed. That commitment was beginning to penetrate down through the middle managers and gaining acceptance by the workforce. Managers needed to be careful that their commitment and zeal for quick results did not disempower WSSTs or discourage WSSTs from seeking alternative solutions to longstanding problems. Managers needed to continue looking for frequent and visible opportunities to interact with personnel, and translate statements of commitment into palpable actions. LANL was making good progress toward meeting the expectations for DOE-VPP Star in the Management Leadership tenet.

It is evident that the Laboratory's senior management team exhibits a strong commitment to improve safety and operational excellence at the Laboratory. Without exception, managers interviewed by the Team recognize and understand the relationship between safety and the ability to perform the essential science mission in support of national security. That commitment begins with the Laboratory Director, who clearly acknowledges the need for strong worker and manager involvement and cooperation.

The managers' presence in the workplace has improved significantly since the initial 2010 VPP assessment. Most managers interviewed believe that manager visibility in the workplace is a positive influence. ADs and Division Directors interviewed during this assessment were engaging their workforce and reaping positive results. Management Observation and Verifications (MOV) is the primary vehicle for documenting management field presence. Most managers are required to complete at least one MOV per month. Most managers not only meet this requirement but also complete many more undocumented MOVs and include field workers and subject matter experts (SME) during their observations. Many managers actively seek out members of WSSTs to accompany them while performing MOVs. This mentoring and coaching of WSST members helps managers gain additional input from WSST members regarding potential workplace concerns. LANL developed guidance cards as a job aid for managers while performing MOVs in about 30 different subject areas. The guidance cards provide relevant information in subject areas to help make MOVs more valuable and focus on target areas of concern.

Without exception, managers demonstrated respect and value for the WSSTs during the interview process. Managers believe that WSSTs make valuable contributions to the improvement of safety and culture. Managers were enthusiastic and proud of improvements made over the past few years, crediting WSSTs and employee involvement. Most senior

managers reported observing improvement in the conduct of WSSTs because of mentoring and coaching instead of directing or managing. This was evident during WSST meetings where WSST chairs were comfortable controlling the meetings rather than deferring leadership to senior managers that were present. Managers acknowledged that their support for WSSTs is critical to WSSTs' success. Some Directorates have developed written expectations for managers to collaborate in the WSST process.

Managers effectively incorporate safety and health aspects into long- and short-term planning. For example, old glovebox designs caused ergonomic issues and injuries at TA-55. Managers at TA-55 recognized the need for more aggressive ergonomic analysis and engineering controls in the design of new gloveboxes or redesigning existing gloveboxes. Because of the successes of operational modifications generated by the facility's ergonomist, TA-55 now includes ergonomic analysis into the planning for design changes and other proposed glovebox modifications.

LANL continues to be a complex and highly matrixed organization, which has been the source of some confusion regarding responsibilities, authorities, and priorities for resource allocation. In an effort to better align its resources and establish Environment, Safety and Health (ESH) as an organization that supports the Laboratory's mission, LANL is in the process of transforming ESH to a new model for effectively allocating ESH resources. Under the new model, ESH resources no longer report directly to a functional supervisor at the institutional level. Instead, LANL deploys personnel to a functional manager within the ESH Directorate. The functional managers then support a specific area or program within the Laboratory. The alignment of these functional managers mirrors the Facility Operations Directorate (FOD). The AD is responsible for assigning personnel necessary to meet the needs and priorities of the particular Directorate. In several cases observed by the Team, this model allows ADs to tailor ESH support to address their specific concerns. For example, the AD for Business Systems (ADBS)and the Applied Engineering, and the Technology Division Leader, both identified ergonomics as a significant risk to their personnel, and are funding an ergonomist to work directly with their personnel to resolve ergonomic issues. LANL believes this change will improve communication, provide risk-based staffing with the support of the AD, and improve staff training and qualification.

Four divisions, reporting directly to the ADESH, provide the core programs and services needed to establish and implement a consistent safety management system across the Laboratory and support the deployed organization. This model deploys SMEs with approximately 25 percent of their time funded at the institutional level. Deploying the SMEs on a part-time basis allows them to become users of their programs, better understand the effects of core requirements on research programs, and improve the core program effectiveness and efficiency.

The overall transformation of the ESH organization began in August 2012 to change the way ESH does business with a renewed focus and partnership on enabling the safe execution of programmatic goals and achieving mission success. As part of the transformation, LANS will establish baseline performance measures where adequate measurement systems exist, and implement appropriate measurement systems in the environments that do not currently assess performance to goals. LANS will measure both quantitative and qualitative data, then review and act upon that data to determine when goals are met and address issues in a timely and responsive manner. LANS will implement a control plan to sustain the improvements. LANL should consider performing an effectiveness review at some future date to verify the transformation met LANL goals and identify any unintended consequences of the transformation process.

Opportunity for Improvement: LANL should consider performing an effectiveness review at some future date to verify the transformation met LANL goals and identify any unintended consequences of the transformation process.

While LANL has sufficient safety and health staff and effectively integrates them into the various processes across LANL for nearly all safety disciplines, there is a serious shortage of criticality safety engineers. This shortage developed over the past 2 years, and is of concern to LANL, NNSA, and the Defense Nuclear Facilities Safety Board (DNFSB). The NNSA Criticality Safety Support Group, a complex-wide group made up of criticality safety professionals, performed a review of the LANL criticality safety program that resulted in several significant recommendations for improvement of the LANL program. The majority of criticality safety engineers who were in the LANL criticality safety group 2 years ago have left the group through voluntary separation processes and transferred to other positions within or outside LANL. This left the group with only two fully qualified nuclear criticality safety engineers. LANL managers are pursuing an NNSA-approved corrective action plan that addresses the issues raised in the reviews, and are accelerating the actions to restaff the group with qualified individuals. However, the published corrective actions do not address the reasons why such a large group of these safety professionals departed. Managers and workers gave the Team anecdotal evidence of significant distrust of managers and dissatisfaction with work processes and priorities that led many in the group to want to leave. Several workers and managers believed there were still several key personnel at TA-55 that placed a higher priority on mission than safety or at least gave that perception. In a safety culture survey administered by LANL earlier in 2013, over 27 percent of the TA-55 nonmanager workers could only agree to a moderate extent or less that they could raise safety issues without fear of retaliation. Additionally, over 48 percent of this same set of workers could only agree to a moderate extent or less that a high level of trust exists in their organization. While LANL has not had the opportunity to fully analyze the latest safety culture data, there is enough evidence to warrant actions beyond those in the corrective action plan and address the reasons for the dissatisfaction in the previous group of criticality safety engineers. LANL managers should place a high priority on determining the cause of the dissatisfaction among previous criticality safety engineers and implement corrective actions specifically to prevent recurrence of a similar environment in the future.

Opportunity for Improvement: LANL managers should place a high priority on determining the cause of the dissatisfaction among previous criticality safety engineers and implement corrective actions specifically to prevent recurrence of a similar environment in the future.

For the past 3 years, LANL developed safety improvement plans (SIP) that identified value-added goals and objectives that support the LANL mission. These plans contain goals that generally address workers' empowerment issues and it is evident that workers, primarily through WSSTs, are helping to develop these goals. In fact, many WSSTs now develop and implement the goals based on actual performance and needs of the AD or Group. The Team observed many examples of positive goals that require specific actions and follow the Specific, Measurable, Achievable, Relevant, and Time framed (SMART) goal paradigm. Use of SMART goals has helped workers better understand the goals and their relevance. Many managers' performance appraisals now include goals focused on defined actions that improve safety (e.g., performance of MOVs, SIP goals).

LANL has developed a robust suite of process metrics that includes leading and lagging indicators. These metrics include an Executive Risk Register that provides a color-coded dashboard identifying those metrics considered vital to the success of the organization for each AD. For example, in the Safeguards and Security Directorate, a performance dashboard provides current information regarding the state of Security, Safeguards and Emergency Operations. Each of those areas is further subdivided to supporting components that contribute to the risk-basis of that area (i.e., for Emergency Operations: Wildland Fire Preparedness, Disaster Forecasting Capability, and Response Capability). This process provides an excellent management indicator to monitor the institutional risk contribution of each organization and its supporting functions. The Risk Register also includes "Quad Charts" that provide additional granularity for risk identification and analysis. The Quad Charts include a color designation consistent with the Risk Register and provide a statement that identifies the risk and the potential impact to LANL. An analysis statement supports the associated indicators to validate the risk, as well as an improvement path to move the indicator into "green," indicating desired performance and well-managed risk. A VPP self-evaluation matrix provides a visual one-page indicator that charts the 5-year progress in each of the five tenets of DOE-VPP. The chart includes a red/yellow/green coding system that provides trend data over the 5-year period.

The Weapons Physics (WX) Directorate is currently using an anonymous system for employees to evaluate managers. According to the Deputy WX Director, the quarterly evaluation gives the management team opportunities to address issues in the early stages before they become major problems. He advised that it was good to see how effectively his management style, worker engagement, and communication was working from the employee perspective.

Overall, the use of metrics throughout the organization was excellent. Managers have provided adequate resources to collect and maintain information so it remains timely and accurate. The Team identified some opportunities to improve analysis and use of behavioral data through the Allowing Timely Observation Measures Increased Commitment to Safety (ATOMICS) and SIP data that LANL is already collecting. For example, WSST action status, progress toward SIP goals, and data collected by the ATOMICS observations are available, but not consistently included in the majority of communication packages (Risk Register, dashboards, safety meeting packages, etc.) reviewed by the Team or readily visible to workers. ATOMICS metrics (percent safe behavior, contact rate, active observer rate, most at-risk behaviors) can be important leading indicators for managers to predict or prevent potential injuries. Managers understood that the information was available and could obtain it, but did not always use it to mitigate risks. In those cases, managers may not yet accept the value of these observations, but should more fully consider the predictive benefit of at-risk data. Senior managers should consider creating relevant metrics that monitor the progress of the goals established in SIPs and encourage optimal use of the data collected in the ATOMICS system.

Opportunity for Improvement: Senior Managers should consider creating metrics that monitor the progress of the goals established in SIPs and encourage better use of the data collected in the ATOMICS system.

Overall, managers hold Laboratory employees accountable for their safety performance. Some managers have taken it upon themselves to secure funding for employee incentives. The Team noted several examples of managers being highly creative to reward employees. For example, managers have included safety in their "OSCAR" awards, expanding the scope beyond what

used to be a reward reserved exclusively for production or process improvements. Other managers have used rewards during safety meetings to reward employees for successfully responding to safety meeting content questions to promote paying attention and comprehension. Most managers identified using spot awards as another means of providing quick recognition. One case in particular was extremely pertinent. In that case, the Laboratory Director described how he was meeting directly with craft workers in the Maintenance and Site Services (MSS) Division and asking them to speak up when they saw conditions that were not right. A few days later, a welder saw a glovebox ready for installation in the Plutonium Facility (PF-4) that he believed had a potentially flawed weld. Further investigation revealed that the suspect weld was flawed and the worker's willingness to speak up prevented installation of faulty equipment and allowed timely repair. When asked why he raised the issue regarding work not related to him, the worker stated, "Because Charlie [McMillan, the Laboratory Director] asked me to." The Laboratory Director awarded the worker with a Spot Award and was considering featuring the worker in a video for the Laboratory Web site.

Many examples of continuous improvements and safety awareness were noted during the assessment, such as: "on the spot" awards, safety messages on monthly table tents, LANL-Grams, All-Hands monthly meetings, a themed-safety celebration, and "Taking 2 4 U" safety campaigns (2 minutes to read safety bulletins). MSS has an incentive program, which provides special hardhats, gloves, and Leatherman® tools as a safety recognition effort. In addition, MSS has issued numerous spot awards to craftspeople for safe work. While these examples are good, on the recent LANL Safety Culture survey, nearly 50 percent of the respondents' answers to the statement, "Workers are recognized and rewarded for contributions toward improving a safe work environment," indicated they could only agree to a moderate extent (28.48 percent), slight extent (13.42 percent), or not at all (5.47 percent). In some cases, managers had difficulty identifying discretionary funding at the group level so that supervisors could provide immediate, positive reinforcement to workers. In those cases, discretionary funding was not readily available and was dependent on the resourcefulness of the manager to secure the necessary funding. Identifying resources at the middle levels and subsequently holding managers accountable for the efficient use of those resources may help LANL more effectively encourage safety improvement efforts by workers and first-line supervisors while empowering middle and lower level managers to be more proactive in their safety leadership. Senior Managers should consider discretionary funding at the group level to help supervisors provide more immediate, positive reinforcement to workers and further improve visibility of recognition and rewards for safety.

Opportunity for Improvement: Senior Managers should consider discretionary funding at the group level to help supervisors provide more immediate, positive reinforcement to workers and further improve visibility of recognition and rewards for safety.

Institutional, program, and facility level plans and procedures document managers' responsibility and authority. Although there have been significant budget shifts in the recent past and loss of some key personnel, managers have adjusted work schedules and work levels to enable work to be performed safely. Although there were some places where workers perceived a mission priority over safety, most workers believed managers' priorities and would stop work if they believed it to be unsafe. Further, managers acknowledged and accepted that they may have to defer or eliminate some work because of the current fiscal environment.

LANL managers may need to provide greater leadership to remove some real or perceived production pressures. LANL recently completed a safety culture survey, and shared the results with the Team. Approximately 22 percent of the respondents to the survey indicated their "manager clearly communicates that safety and production goals need to be integrated to ensure goals are safely achieved" to a moderate (16.63 percent) or slight (4.69 percent) extent, or not at all (1.63 percent). These results are consistent with some hazard control errors observed by the Team or caused operational occurrences (see Hazard Prevention and Control). Perceived production pressures can easily arise from managers, supervisors, and peers, whether warranted or not. Managers must continually reiterate and communicate at all levels that completion of work on schedule is never a reason to ignore hazard controls (procedures, postings, standard practices, etc.) and that stopping work to clarify requirements and prevent errors is always the best option.

LANL has implemented a rigorous process for ensuring subcontractors understand and meet the requirements of title10, Code of Federal Regulations, part 851, *Worker Safety and Health Program* (10 CFR 851). A standard set of requirements, Exhibit F, is included in all contracts. The requirements of LANL's Worker Safety and Health Plan are included in all subcontracts as part of Exhibit F. The subcontractor, the Subcontractor Technical Representative (STR), the Designated Purchasing Officer, applicable SMEs, and the Laboratory customer all work together to tailor the appendix as necessary for the particular subcontract. Subcontractors are required to prepare LANL-approved, site-specific safety and health plans to show compliance. LANL uses many subcontractors on a repeat basis, allowing LANL to take advantage of previous experience with a subcontractor.

One case identified by the Team could discourage subcontractor employees from reporting minor injuries. A consortium provides custodial services at LANL. Each employee of the consortium who works without an injury receives a monthly $50 cash bonus and a raffle ticket for a larger cash award. The consortium also has a semi-annual celebration for uninjured employees. The LANL STR is aware of the consortium's internal policy of providing this safety incentive. The LANL contract contains no language requiring or promoting this practice. The STR stated that the consortium is very timely in reporting injuries or incidents. The companies hold employees accountable to report injuries, and failure to report results in disciplinary action, up to and including termination. Employees interviewed understood the reporting requirements for injuries, and employees knew of one example when an employee did not report an injury that received immediate disciplinary action. The custodial services subcontract is not specifically part of DOE-VPP, and LANL has not found any significant deficiencies with classification and reporting of injuries during quarterly reviews of the subcontractors' recordkeeping. LANL should work with the custodial services subcontract consortium to identify safety incentives that reward positive behaviors, particularly, if outside observers or employees could perceive the current program as a disincentive to reporting injuries.

Opportunity for Improvement: LANL should work with the custodial services subcontract consortium to identify safety incentives that reward positive behaviors.

LANL has performed an integrated self-assessment targeted at the five tenets of DOE-VPP. LANL completed its annual VPP self-assessment for calendar year (CY) 2011 and CY 2012 in accordance with the DOE-VPP documents. Those assessments included evaluation of its progress toward Star status by evaluating the Opportunities for Improvement identified in the

2010 and 2011 reports, as well as new opportunities for improvement and safety goals for 2013. The elements of the annual evaluation process, along with the recently completed safety culture survey align well with the Safety Conscious Work Environment assessment required in 2013 by NNSA. Overall, the process used by LANL demonstrates an effective, integrated self-assessment process commensurate with expectations for DOE-VPP participation.

Trained safety professionals and a robust reporting system support the injury/illness reporting process for LANL. Per LANL requirements, the supervisor of an injured employee is required to accompany the employee to the occupational health clinic. The system captures relevant data as soon as an employee and his or her supervisor arrive at the occupational medical clinic for treatment. LANL provides a computer terminal in the clinic office where the supervisor is required to enter all data regarding an injury to one of their employees. This step starts the incident investigation process and involves a professional trained in the requirements of 29 CFR 1904, *Recording and Reporting Occupational Injuries and Illnesses***,** to ensure proper recordkeeping in accordance with the regulation. In addition, LANL uses a Peer Review Committee to provide a consensus approach to injury classification. The committee reviews every injury and provides expert guidance to LANL regarding additional actions needed and final classification. One person interviewed by the Team that was responsible for keeping records was unaware that supervisory-imposed reduction or restriction of work is recordable. Specifically, if an employee returns to work without medical restrictions, but the supervisor decides to keep the employee away from certain work to protect him/her from further injury or to allow him/her time to further heal or rest, that becomes an employer-imposed restriction, and is recordable. LANS should ensure that injury and illness recordkeeping procedures include criteria to record any restrictions imposed by supervisors.

Opportunity for Improvement: LANS should ensure that injury and illness recordkeeping procedures include criteria to record any restrictions imposed by supervisors.

Conclusion

LANL managers demonstrate significant improvement and acceptance of their role in achieving excellence in worker safety and health. Most managers are following a coaching and mentoring model with their applicable WSSTs, identifying and providing the necessary resources to pursue continuous improvement in safety and health, and encouraging worker participation in all aspects of the safety program. Managers are visible and accessible in the work areas, and use that time to establish effective relationships and open lines of communication with Laboratory personnel. The continued commitment of resources despite overall budget reductions demonstrate that managers value safety as contributing to the quality of science at LANL. Focusing on safety culture issues, making funding available to lower levels of management for reward and recognition, and improving monitoring of SIP goals and behavioral data will help LANL continue its transformation. LANL managers demonstrate the leadership and excellence expected of a DOE-VPP Star participant.

IV. EMPLOYEE INVOLVEMENT

Employees at all levels must continue to be involved in the structure and operation of the safety and health program and in decisions that affect employee health and safety. Employee involvement is a major pillar of a strong safety culture. Employee participation is in addition to the individual right to notify appropriate managers of hazardous conditions and practices. Managers and employees must work together to establish an environment of trust where employees understand that their participation adds value, is crucial, and welcome. Managers must be proactive in recognizing, encouraging, facilitating, and rewarding workers for their participation and contributions. Both employees and managers must communicate effectively and collaboratively participate in open forums to discuss continuing improvements, recognize and resolve issues, and learn from their experiences.

In 2011, the Team determined that employee involvement and participation in the LANL safety program was improving. Some groups had taken a much more active role than other groups. Considerable leadership focus remained targeted at improving worker involvement. WSSTs, the primary vehicle for direct employee involvement, had increased their visibility and level of activity and provided an excellent opportunity for the employees and the managers to work collaboratively to identify and resolve safety issues. LANL was continuing to work on motivating a diverse group of employees from researchers to crafts to internalize safety at every step of the process by adopting an uncompromising desire to want to "do it right, every time, all the time," and being mindful about everyday "at-risk" behaviors. Initiatives to implement the ATOMICS program and Human Performance Improvement (HPI) approaches were maturing and gaining acceptance in certain areas, but still needed greater acceptance across LANL. LANL was clearly progressing toward the expectations of a DOE-VPP Star participant in the Employee Involvement tenet.

An essential aspect of worker involvement is the right and willingness of workers to stop or pause work when there is a question about their ability to perform the work safely. As in 2010 and 2011, nearly all workers interviewed by the Team were aware of their right to stop work. During a meeting with the MSS union stewards, the representatives agreed that there has been significant improvement since the last assessment regarding response to raising safety concerns or stopping work.

Interviews with employees indicate a tremendous pride of ownership and involvement with their safety and the safety of coworkers. As an example, this ownership and involvement was profoundly clear in discussions with workers preparing for explosive testing. The managerial support and worker dialogues observed indicate a deep respect for the hazards and a commitment to ensure, to the best of their ability, that no one is injured.

WSSTs, the primary vehicle for direct employee involvement, have seen a tremendous improvement in employee involvement since the last review. Currently there are over 100 Facility and Directorate level WSSTs at the Laboratory with an average composition of 7 people. That translates into approximately 7 percent of the Laboratory population actively involved with identifying and solving Laboratory issues whether within their work areas or Laboratory-wide. Since the creation of WSSTs at the Laboratory, most members serve for approximately 2 years. Membership is staggered to prevent replacement of the entire WSST every 2 years. The Laboratory estimates that over the last 4 years, over 1,500 personnel from the workforce have served as WSST members. The Laboratory is also benefitting from more worker participation in

facility assessments and preparation of work documents: more workers are actively engaged in identifying issues before they experience accidents or injuries, more workers are contributing to SIPs, and more workers are participating in observations and HPI initiatives.

The Integrated Worker Safety and Security Team (IWSST) is composed of a Chair, Co-Chair, Laboratory Assistant Director (WSST Management Champion), voting delegates from the 16 Associate Directorates, SMEs, workers, and managers. The IWSST meets every 2 weeks to address issues and coordinate assistance for Laboratory-wide solutions. Additionally, at the quarterly IWSST meeting, all members of the over 100 WSSTs are invited. The Team interviewed the outgoing IWSST Chairperson, the new Chairperson, and the new Co-Chair. All exhibited a passion and commitment to achieve improvements and were dedicated to fostering a safe workplace for all Laboratory employees.

The IWSST created a Web site to allow Laboratory employees access to information about WSSTs, safety topics, Facility-specific or Directorate-specific issues, issue status, and provide space where Directorate or Facility WSSTs can create their own Web space. The IWSST Chairperson told the Team that IWSST is promoting visibility of its members by wearing red IWSST shirts on Thursdays, and by placing yellow triangles on WSST members' office doors to identify IWSST delegates or WSST members and to promote their function as "lifeguards," not police officers. One of the annual events sponsored by the IWSST is the *WSST Fest*. This event provides a venue for WSSTs to present lessons learned and best practices from their organization and celebrate safety successes during the year. In addition to the established IWSST and the Facility and Directorate WSSTs, LANL is engaging students in a student WSST. The inclusion of a student-based employee representative group is unique and demonstrates LANL's efforts to improve employee involvement across the site. According to IWSST members, the first student meeting of 2013 was standing room only and moved to a larger venue to accommodate the approximately 50 people that attended.

The Team attended WSST meetings for MSS (one of the largest divisions onsite), TA-55, TA-53, WX Division, and Associate Director for Environmental Programs (ADEP) (two meetings). All WSST meetings began with a safety share that was personal or job-related. Each WSST sets its agenda based upon current events, site-wide issues, lessons learned, accident injury events, and division concerns. In addition, managers attend WSSTs to provide support and resources should they be needed. For example, the MSS WSST included a presentation concerning current air quality conditions from the Jemez fire advising employees with respiratory conditions, such as asthma, what they could do to minimize the effects of the smoke and particulates and to inform their coworkers of their susceptibility to breathing issues. This presentation showed employees how to find the air quality information on the LANL homepage. The LANL air quality information provides the 24-hour average of the air quality due to smoke from the fire.

The facility or directorate level WSSTs feed information and issues up to the IWSST, but have also effectively identified and addressed many issues and concerns. Issues and improvements that involved WSSTs include:

- The WX division WSST identified procurement delays for experimental equipment as a potential site-wide issue. These procurement and delivery delays result in engineers and managers developing compensatory solutions, usually under time constraints, in order to

meet objectives. The WX WSST is concerned that these compensatory solutions may overlook critical safety issues that the original design addressed.

- The MSS WSST evaluated pipe racks for loading and discovered that the material on the rack could be the source of a recurring environmental concern related to high levels of zinc in surface water samples.

- The MSS WSST is investigating bolts that sheared off on a JLG® lift and is sharing that information across LANL and the DOE complex.

- The ADEP WSST suggested using fruit to help augment liquids during heat stress intervals.

These examples are just a few of the many the Team found where employees, through their respective WSSTs, are involved in addressing solutions to improve safety and working conditions. The ownership and involvement exhibited by WSST members is truly exemplary and is becoming a significant strength of the LANL safety and health program.

Most issues addressed by WSSTs are immediate and specific, such as slip/trip/fall hazards, ergonomics, lighting, and other general safety hazards in the workplace. Now that WSSTs have learned to work effectively as teams to improve safety, they should be able to identify sustainable process improvements that address the more complex cultural issues LANL continues to deal with (see Worksite Analysis and Hazard Prevention and Control). For example, WSSTs may have better ideas and solutions to address conduct of operations and criticality safety at TA-55, work planning and control at the Los Alamos Neutron Science Center (LANSCE), radiological contamination events, or production pressures. LANL should continue to use the WSSTs to help resolve the issues discussed throughout this report.

Today, approximately 15 organizations and over 2,000 employees actively participate in LANL's Behavior-Based Safety (BBS) process. LANL first implemented its BBS program at TA-55 in 1999. Each BBS team consists of employees (observers), Chair and Co-Chair employee leaders, Champion and Co-Champions, and team facilitators. Managers support the BBS teams, but do not manage or direct their activities. Weekly employee team meetings occur, and managers provide resources if needed. The process is a no name, no blame observation process. Employees volunteer to be a team member. The observer uses a checklist during the observation process and asks permission from the observed individual before the observations take place. Employees also may receive safety concerns during or after the observation for resolution. Observers note safe and at-risk observations and have a conversation with their coworker providing feedback. The observer enters the observation data into the ATOMICS database for trending and tracking. The BBS teams review observation results, reports, and comments to identify actions needed to influence behavioral change amongst their peers. Reports and dashboards are also available to review at team meetings. The dashboard is a database LANL uses to gather BBS information and statistics. LANL also uses the dashboard in conjunction with the injury/illness data. Dashboards display information, such as contact rates by division, total observations, at-risk behaviors observed, and summaries.

Worker Observations & Leadership Verifying and Ensuring Safety (WOLVES**)** is an MSS employee behavioral observation process designed to reward safe behaviors and discuss at-risk behaviors. It also builds teamwork and employee ownership of safe behaviors. The WOLVES program has been in place for a year. Senior Managers serve in a coaching role, remove barriers,

and provide resources. The WOLVES team met during this assessment and identified two issues: water availability at remote worksites for employees, and availability of sunscreen in the tool crib. The WOLVES process is maturing, but has not reached its full potential. The Team observed that some MSS employees are not aware of the WOLVES program. LANL could implement a more effective communication plan, provide better data analysis of the WOLVES team's observations to allow them to see successes and establish trends, and determine corrective actions or improvements using that analysis. Managers could coach the WOLVES Chair to help him establish a more active role in leading the meeting, develop leadership skills, and obtain employee engagement and ownership. The WOLVES team needs administrative support to capture actions, meeting minutes, and to distribute key correspondence. The MSS WOLVES team should consider adopting the established processes, procedures, and analytical tools from the ATOMICS application to improve its effectiveness.

Opportunity for Improvement: The MSS WOLVES team should consider adopting the established processes, procedures, and analytical tools from the ATOMICS application to improve its effectiveness.

LANL began using HPI techniques in connection with accidents, injuries, and occurrences several years ago. Since then, it has expanded into most aspects of work planning. The causal analysis process, MOV checklists, Person-In-Charge (PIC) expectations, critiques, and prejob briefings all incorporate aspects of HPI. Work planners receive training on HPI tools and concepts so they can better integrate awareness of error precursors into work packages. LANL uses "Learning Teams" to transfer useful information about every incident as a form of operational feedback and identify improvements through a collaborative learning model. The Learning Teams usually consist of four to five members who begin with a free-flowing dialogue that stimulates critical thinking. Learning Team members challenge each other and test the benefit of potential improvements. Asking four key questions gets a Learning Team moving in the right direction.

The four questions are:

- What is important for us to know about the event?
- What systems failed, and which worked?
- How is the organization managing the risk?
- What surprised us?

The Learning Team process is helping LANL make improvements when small things do not go as planned; recognizing those small problems may well be early warning signals of larger deficiencies. Several LANL organizations are using this concept to drill deeper into why the planning was not sufficient for the tasks. In many cases, those Learning Teams are able to extract a better understanding from those events, leading to a tremendous amount of insight into the well-being of the entire system. That insight allows LANL to understand if processes are truly effective, or need improvement.

In addition to WSSTs, ATOMICS, WOLVES, and Learning Teams, employees also participate in other safety committees. Examples included a Worker Safety Committee, a Criticality Safety Committee, a Glovebox Safety Committee, Radiation Safety Committee, Shot Review Committee, Explosive Safety Committee, and Explosive Storage Committee.

Employees also participate in MOV walkdowns, prejob walkdowns, work planning, procedure preparation and revision, lessons-learned discussions within work groups, and have the ability to submit issues either formally or anonymously.

The WX Division Leader demonstrated the value of worker participation with their managers during MOVs. The WX Division Leader invites workers to accompany him on his MOVs. He informed the Team that when workers are involved, he is confident that his MOV will address issues that affect worker safety. As a result of his visibility to workers, workers brought several issues relating to safety to his attention. In one case, a worker identified a hazardous material (depleted uranium) at a testing location that historical searches had not previously identified as present there. In another case, discussions with one of the health physics technicians indicated a potential initiator for fire and he was concerned enough to bring it to the attention of his managers. Although not part of his job function, the technician's observations were particularly relevant during the current drought and high fire danger the Laboratory is experiencing.

The ADBS described another example of worker involvement creating safety improvements. Prior to the 2011 assessment, the Directorate had experienced a very high rate of slips, trips, falls, and ergonomic injuries. To address the problems of at-risk behaviors leading to injuries, the AD initiated a "Pedestrian Safety" observation program. He developed a checklist of at-risk behaviors during walking, and the checklist was made available to all ADBS employees through the Directorate homepage. He asked each employee to make two observations a month. Employees could perform the observations anywhere, anytime, and did not require a conversation with the observed person. The intent was to raise the observer's awareness of at-risk behaviors. The ADBS credited this program with a significant reduction in slips, trips, and falls. For example, over 14,000 entries were made from June 2012 through April 2013, with 682 employees participating; for 10 months straight, there were no recordable slips, trips, or falls. There has only been one recordable slip/trip/fall incident between April 2013 and the present. The ADBS recently initiated a similar program encouraging employees to identify their own symptoms of ergonomic stress (flexing muscles or fingers, expressing discomfort) using a computer-based self-evaluation. The program has a 98 percent participation rate of Directorate employees. Based on the results, employees are being prioritized for an ergonomic evaluation. These efforts, combined with a dedicated ergonomist for ADBS, are significantly raising employee awareness of safety, and leading to sustainable improvements in safety performance.

In two cases observed by the Team, LANL is experiencing difficulty providing all workers an opportunity to participate on WSSTs. The Team observed the WSST meeting for TA-55 and observed good attendee participation and interest. While the TA-55 WSST includes technicians on their official membership listing, the majority of the attendees at the WSST meetings consisted of administrative support staff. Managers are attempting to balance the WSST meetings with better participation of technicians. The AD for Plutonium Science and Manufacturing (ADPSM) cited staffing levels, work schedules, and the time constraints associated with leaving the secure areas of PF-4 as primary reasons that more technicians do not participate in the WSST meetings. Managers at TA-55 should consider reviewing the model used by CH2M♦WG Idaho, LLC (CWI) at the Idaho Cleanup Project. CWI managers curtailed programmatic work during employee safety team meetings so interested workers could attend the safety committee meetings. This provided workers the opportunity to contribute to the safety successes at CWI without any loss of productivity. CWI managers credited the improved employee involvement with increased productivity and significant schedule gains despite the

periodic curtailment of work. TA-55 managers should consider curtailing programmatic work in PF-4 during monthly WSST meetings to encourage greater participation by technical staff.

Opportunity for Improvement: TA-55 managers should consider curtailing programmatic work in PF-4 during monthly WSST meetings to encourage greater participation by technical staff.

In Area G, employees working swing or night shifts expressed concerns about representation on WSSTs. Employees identified possible solutions, including a member of the WSST staying over until the nightshift began its shift, giving them a report of what was covered at the WSST and to give them a chance to discuss any issues or concerns they have that the WSST could help them with. For example, the night crew was concerned that they had to stand directly underneath a gantry crane they used when lifting boxes. Although they could stand clear of the load, they stated that they had to stand directly underneath the crane to operate it because the control box cable to the crane was short, which they felt was not safe. Day shift crews did not express a similar concern, but the lack of communication or inaccessibility of the WSST for swing and night shift personnel may have limited the day shift crews' awareness of the issue. The Team is also concerned that swing or night shift workers had not stopped or paused work in light of this concern. ADEP should strive to provide WSST participation opportunities to all employees, and further emphasize that workers should pause or stop work when they have safety concerns.

Opportunity for Improvement: ADEP should strive to provide WSST participation opportunities to all employees, and further emphasize that workers should pause or stop work when they have safety concerns.

Conclusion

Employee involvement and participation in the LANL safety program has improved tremendously since the last review. Some groups continue to excel and take a much more active role than others. The managers' focus, coupled with employee participation, demonstrates a commitment to sustained improvement across the Laboratory. WSSTs have increased their visibility, provided value, and are gaining momentum daily. BBS and HPI approaches are maturing and gaining acceptance, but some opportunities remain for improved participation. The use of BBS and HPI across LANL has successfully turned Employee Involvement into a strength that meets the expectations for a DOE-VPP Star participant.

V. WORKSITE ANALYSIS

Management of health and safety programs must begin with a thorough understanding of all hazards that might be encountered during the course of work and the ability to recognize and correct new hazards. There must be a systematic approach to identifying and analyzing all hazards encountered during the course of work, and the results of the analysis must be used in subsequent work planning efforts. Effective safety programs also integrate feedback from workers regarding additional hazards that are encountered and include a system to ensure that new or newly recognized hazards are properly addressed. Successful worksite analysis also involves implementing preventive and/or mitigating measures during work planning to anticipate and minimize the impact of such hazards.

In 2011, the Team determined that LANL had completed modifications to the Integrated Work Management (IWM) process, but had not fully resolved the 2010 weakness of a systematic hazard analysis for work assumed to be low hazard. The maintenance organization had established a process that provided for an initial and ongoing comprehensive review and hazard analysis of low hazard maintenance work. Worksite inspections for safety and health hazards were improving through MOVs. In order to achieve Star status, LANL needed to apply a systematic, efficient approach to analyze all hazards, including periodic worksite inspections that involve more than just deployed safety and health staff. LANL also needs to continue with its efforts to improve and streamline the IWM process.

Since the 2011 review of LANL, the core of the work planning and control process remains the IWM process defined in the *Integrated Work Management Procedure*, P300. 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 that LANL intends to be a worker-friendly document that describes the work activity, identifies the hazards, and links them to specific controls. Specifically, P300 requires a complete IWD to consist of Part I, *Activity-Specific Information;* Part II, *Work-Area Information;* Part III, *Validation and Work Release Information;* and Part IV, *Post-Job Review.*

Overall, the Team noted an improvement in the process and effectiveness of hazard identification across LANL. For example, improvements in the identification of hazards and controls at the Lujan Center are evident since the ^{99}Tc release in 2011. Interviews with the Lujan Center industrial hygienist who has been involved with work activities at Los Alamos Neutron Science Center (LANSCE) and/or Lujan Center over the past 10 years revealed her belief that during the past 1 1/2years, IWDs at the Lujan Center have improved, particularly with the identification of hazards and controls and greater involvement of management in field observations, including identification of worksite hazards.

LANL began performing Facility Centered Assessments (FCA) several years ago at the direction of the LANL Director under the sponsorship of the LANL Institutional Management Review Board (IMRB). The IMRB directed performance of FCAs every 3 years for each major FOD to measure and improve the performance of LANL program and facility work. LANL intends the FCA to provide a site-wide "snapshot" of the implementation of safety management programs and management processes within the assessed organizations. These assessments are generally comprehensive, and result in actions that improve safety program implementation.

LANL has an effective system to ensure new or changed facilities or processes meet safety requirements before authorizing operation. The process involves management self-assessments (MSA) or contractor operational readiness reviews. In the most recent example, the Radiological Laboratory Utility Office Building (RLUOB) completed its stage one transition from construction to office occupancy in September 2012. LANL has slated the stage two transition for later in 2013. Although not categorized as a nuclear facility, RLUOB underwent a prestart MSA to determine readiness for stage one (office occupancy) operations. This MSA evaluated both physical and administrative aspects of the operation and involved personnel from engineering, construction, safety, and health, as well as the program personnel assuming responsibility for the facility. The MSA generated several punch list items that LANL corrected and validated prior to releasing the facility for occupancy. An example of one such punch list item is the reconciliation of the placement of safety showers to meet Occupational Safety and Health Administration (OSHA) standards.

Section 3.1.1 of P300, *Define the Work*, states that work components must be defined in sufficient detail to identify and analyze hazards and the circumstances in which they could do harm. This generally requires planners to identify, define, and plan each of the tasks and work steps within an activity in order to mitigate the associated hazards. Of the wide spectrum of work activities reviewed by the Team, there was also a comparably wide spectrum of how well work documents defined the associated hazards. IWDs for general actinide research activities in the Chemistry, Metallurgy, and Radiological (CMR) facility, and uranium machining, foundry operations, powder processing and electron welding operations located in the Sigma 6 facility, were generally sufficient to bound the scope of work and risk, identify applicable hazards, and specify appropriate control strategies.

For some LANL facilities, such as TA-55, LANL defines most of the work in technical procedures. PA-AP-01016, *Technical Procedure Use and Development Process*, and PA-AP-01000, *Document Control Processes*, describe the TA-55 specific processes required by P300 that are used to perform the hazard analysis on activities covered by technical procedures. Specifically, PA-AP-01000 identifies Detailed Operating Procedures (DOP) as being equivalent to Parts I and II of an IWD. Technical procedures do not contain information equivalent to Parts III or IV of an IWD, as other facility-specific processes address these. DOPs and associated Radiological Work Permits (RWP) reviewed by the Team adequately identified the radiological hazards and documented the associated controls. For example, TA-55 relies extensively on engineered controls (building ventilation, gloveboxes, shielding, and hoods) for primary radiological controls. Where the engineering controls are not sufficient, LANL uses administrative controls, such as Radiological Control Technician (RCT) coverage and material limits. Finally, LANL uses Personal Protective Equipment (PPE) to provide the maximum protection to the workers.

While radiological hazard analysis appeared appropriate, nonradiological hazard identification and analysis is less effective. For example, the Team observed an operation to remove liquid samples through a hood at TA-55. The activity in the hood consisted of pipetting a sample dissolved in nitric acid into a container and placing a lid on top of the container inside the hood. Workers performed the operation in accordance with the procedure, and RCT activities were extensive and appropriate for the radiological hazard. However, a posting on the hood used for the operation stated “NOTICE: THIS IS A RECIRCULATING HOOD. NO CHEMICAL USE ALLOWED.” It further stated, “DO NOT USE FOR CHEMICALS OR GASSES - EXHAUST AIR IS RECIRCULATED. USE HOOD FOR PARTICULATE CONTAMINANTS ONLY.”

The activities in the glovebox involved handling open containers of samples that, according to the process engineer, contained approximately 1-molar nitric acid solution. The procedure did not address the presence of nitric acid in the hazard list, LANS could not identify a hazard analysis for open containers of nitric acid in the hood, industrial hygiene (IH) had not reviewed the procedure, and the presence of open containers of nitric acid in the hood did not comply with the hood postings. Nitric acid vapors in hoods and gloveboxes not rated for nitric acid use can lead to several failure modes, including degradation of ventilation system components or reaction with cellulose-based components of High Efficiency Particulate Air (HEPA) filters to form flammable or unstable compounds. Following this observation, the facility paused the operation for IH review. IH determined the operation was safe to continue from a personnel exposure perspective, and operations resumed. However, LANS did not evaluate the conduct of operations error (failure to follow the posting) or the engineering perspective of long-term exposure of the hood components to 1-molar nitric acid solution. Managers at TA-55 should analyze the effects of chemical hazards on the engineered systems used for radiological hazards and address the apparent conflict of the operation and the hood posting in the current conduct of operations improvement initiative.

Opportunity for Improvement: Managers at TA-55 should analyze the effects of chemical hazards on the engineered systems used for radiological hazards and address the apparent conflict of the operation and the hood posting in the current conduct of operations improvement initiative.

MSS defines work and identifies hazards and controls in IWD packages, which may be standing or task-specific. The Team reviewed multiple IWDs ranging from low, to moderate, to high hazard job-specific. With a few exceptions, the IWDs contained accurate task descriptions and facility-specific hazards. They also contained job-specific precautions/limitations/prerequisites, and listed appropriate information, such as craft training requirements and permit requirements. IWDs also listed general hazards associated with the particular job, along with appropriate engineering, administrative, and PPE controls. Hazards identified and controls specified were appropriate for the work. LANL maintained required project-specific documentation, such as ground disturbance permits or excavation inspection forms, in the packages. IWD packages with identified chemical hazards had the appropriate Material Safety Data Sheets available.

MSS has continued to improve the process defining work planning applicable to low hazard work since the 2011 review. The process for determining low hazard work requires that all low hazard activities must have a documented job hazard analysis (JHA), and workers must be capable of performing the task based on their defined training and skills. In addition, the FOD and Cognizant Maintenance manager must review and approve all low hazard MSS work. In support of this effort, MSS has developed the JHA manual that includes a comprehensive list of preanalyzed JHAs for low hazard activities. MSS reviews the JHAs and the associated standing IWDs at least once every 3 years to ensure the controls are adequate.

P300 requires that for moderate hazard activities, workers representative of those involved in the activity must be part of the hazard analysis. In many cases, planners use this statement to permit supervisors as representatives, rather than using workers, as an expedient method of planning work. Knowledgeable maintenance craft work execution superintendents (WES) are integrated with the work planners on scoping jobs. These nonmanagerial superintendents come from the craft ranks and are knowledgeable in their respective disciplines. MSS has 46 craft WES and

depending on the scope of work, multiple WES may be involved on any one project in concert with a planner. Workers interviewed by the Team reported this sometimes results in different understanding between planners, supervisors, and workers regarding specific work methods, hazards, and controls, which sometimes leads to work stoppages or events. Walkdowns of MSS multidiscipline craft jobs to define the workscope is often done using only one craft foreman of a specific trade to evaluate a job rather than utilizing a multiple-craft experienced foreman (or multiple craft workers) involved in the work task.

Similarly, workers can be more involved in operations work planning and technical procedure development. For example, workers and SMEs at TA-55 indicate that in some cases, workers are not involved at the onset of procedure development, resulting in missed hazards and processes not discovered until the workers actually walk the procedures down. PA-AP-01016 does not address using workers for the hazard analysis for moderate hazard activities; instead, it references use of technical SMEs. According to workers and safety SMEs, the technical SME used is typically not a worker, but the Operations Responsible Supervisor, who may not be the fissile material handler with "their hands in the glovebox" for a particular activity. While the supervisor may be somewhat knowledgeable of the processes in the glovebox, use of a supervisor may not fully meet the intent of P300 for use of workers representative of those involved in the activity in the hazard analysis. LANL should consider updating P300 to strengthen and clarify the use of workers and workers' representative in combination with planners, supervisors/PIC, and SMEs during the development and revision of technical procedures and IWDs.

Opportunity for Improvement: LANL should consider updating P300 to strengthen and clarify the use of workers and workers' representatives in combination with planners, supervisors/PIC, and SMEs during the development and revision of technical procedures and IWDs.

Workscope definitions were not sufficient in several standing and regular IWDs reviewed to ensure that planners, supervisors, and workers could readily identify the hazards and controls for the work activity. LANL develops standing IWDs per P300 requirements for repetitive work activities. These IWDs contain information similar to information contained in job-specific IWDs. Although the identification of workscope and hazards were generally satisfactory with respect to MSS standing IWDs, the Team noted some standing IWDs associated with programmatic or research activities that did not define all the pertinent hazards. For example, general hot cell maintenance at LANSCE Isotope Production Facility is performed under a Moderate Hazard Standing IWD (#IWD-IPF-1004, dated 5/24/12). The IWD includes a wide variety of maintenance work performed within the hot cell and in a radiation and contamination area requiring the use of a respirator. The "Activity Description/Overview" section of this approved IWD is blank. In addition, the IWD contains no specific description of the work task or steps associated with the observed pulling of a cable connected to a gamma detector within the hot cell, although the task involves a number of hazardous activities, such as decontamination of the detector cable within the hot cell. The PIC described the work activity during the prejob briefing, but there was no documented description of the task.

In addition, workers did not follow several work tasks/steps within the standing IWD or changed the steps (verbally) during the prejob briefing without a record of the change. P300 requires 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." However, for this work evolution, the PIC made changes to the standing IWD during the prejob briefing without recording the changes on the IWD or elsewhere. For example, step 3 of the IWD directed the workers to determine the radiation level within the hot cell by placing a survey meter inside a double plastic bag and sending it into the hot cell. Workers modified this step to use a teletector radiation instrument from outside the hot cell in lieu of a double-bagged survey meter from within the cell. Although workers preferred this approach because it reduced hazards to the workers and minimized the risk of contamination, the PIC did not document the changes to the IWD. Similarly, the RWP associated with this job did not clearly define the work scope in that the RWP did not specifically list the task to change out of the detector cable in the RWP-approved workscope. LANL should ensure that standing IWDs contain sufficient detail to define the entire scope of work and identify all applicable hazards, and the changes made to standing IWDs are properly recorded and captured.

Opportunity for Improvement: LANL should ensure that standing IWDs contain sufficient detail to define the entire scope of work and identify all applicable hazards, and the changes made to standing IWDs are properly recorded and captured.

10 CFR 851 requires that LANL assess worker exposures to chemical, physical, biological, or safety hazards through appropriate workplace monitoring, and document this assessment using recognized exposure assessment and testing methodologies. Procedure P101-32, *Worker Exposure Assessments,* and Chapter 45 of the IH manual define the LANL worker exposure assessment program to meet this requirement. The exposure assessment program includes initial or baseline surveys, periodic resurveys, and documented exposure assessments of all work areas or operations to identify and evaluate potential worker health risks. LANL uses the Comprehensive Tracking System (CTS) to track and document workplace exposures as part of this program.

LANL is collecting exposure assessment data in many areas to comply with 10 CFR 851 requirements. For MSS work, data reviewed by the Team was available by site hazards, and more recently, MSS initiated an effort to bin the data by similar exposure groups (SEG) or grouping exposure data by crafts. This effort has resulted in the creation of the craft-specific hazard assessment survey reports. The typical hazard assessment survey report contains a summary of hazard analyses, and a list of workers in that particular craft. In addition, the report contains supplementary information for each identified hazard, such as routes of entry, primary exposure forms, frequency and duration of exposure, engineering controls, PPE, and occupational exposure level. By relating hazards to specific crafts, LANL is creating an effective approach to establishing a hazard analysis database. Using this process allows work planners to access the database by craft as opposed to general hazards, thereby removing the potential to overlook craft-related hazards. To date, MSS has generated 25 SEGs and the effort is approximately 70 percent complete.

Some Directorates effectively document exposure assessments. For example, at the Dual Axis Radiographic Hydrodynamic Test facility (DARHT), experts with broad knowledge of their fields perform IH surveys. In the Science and Technology Operation Directorate, IWDs contained an exposure assessment document. At DARHT, the IH staff used the CTS exposure assessment process. The DARHT ESH group leader confirmed active management of the IH survey and sampling process for DARHT. Qualified IH and safety professionals have been conducting a number of comprehensive baseline surveys at the Environmental Restoration and

Waste Management facilities that include ergonomics, lead, and noise. Many groups conduct baseline and personal monitoring on a regular basis.

Although LANL has established program requirements and the CTS database and performed a significant number of exposure assessments site-wide, SMEs estimate they still need to perform a considerable number of additional exposure assessments. For example, LANL completed baseline exposure assessments for operations at Environmental Waste Management Operations facilities, but has only completed approximately 30 percent of the exposure reassessments, and 10 percent of the confirmatory sampling at Area G. While the subcontractor operating the majority of the waste remediation activities routinely conducts workplace monitoring in support of assigned tasks, it also estimates a similar 30 percent reassessment completion rate as well. At LANSCE, only one of four work activities sampled and observed had a documented exposure assessment in accordance with Laboratory procedures. At TA-55, although a variety of worker exposure data is available (e.g., sound level surveys and air sampling data), limited information has been entered into CTS in part due to potential security issues.

In another example, the Team reviewed a large activity to put a doorway into a shield wall in the LANSCE accelerator tunnel at TA-53. The IWD for facility maintenance was comprehensive in most aspects. The actual work was nearly complete, so the only maintenance work observed by the Team was some housekeeping involving movement of lead bricks. The IWD contained a Lead Control Plan addressing all lead work and included requirements for PPE, barriers, handling, and monitoring. In general, the plan was comprehensive. The maintenance workers followed the requirements of the plan. However, two elements of the plan were inadequate. First, the plan calls for IH to perform personal air monitoring, but IH did not perform any personal air monitoring for lead. The interview with the industrial hygienist indicated that because of the conservative PPE used (full coveralls, gloves, booties, and fullface air-purifying respirators); IH determined that air monitoring was not needed. However, procedure *Occupational Exposure to Lead*, P101-35, states:

> *All activities involving lead, or activities in locations where lead is present must be evaluated for the potential for worker exposure. An initial determination must be made to establish the level(s) of exposure as detailed in 29 CFR 1910.1025(d), Exposure Monitoring. This will be conducted as an Industrial Hygiene Exposure Assessment in accordance with P101-32, Worker Exposure Assessments.*

Regarding airborne exposure monitoring during lead activities, P101-32 states:

> *Exposure will be determined by personal monitoring in the worker's breathing zone. Exposure is that which would occur if the worker were not using respiratory protective equipment. Sampling results must be reported as the calculated 8-hr TWA and cannot be adjusted by the assigned protection factor of the respirator.*

In this case, the industrial hygienist's determination deviated from the LANL procedures.

LANL has recognized the deficiencies in implementing the workplace exposure program and identified the site-wide exposure assessment process as an area for improvement in the June 7, 2013, Risk Register and Executive Dashboard Notes. The SME associated with exposure assessments has also drafted an implementation plan to address the shortfalls in the exposure assessment program although the draft plan lacks formal management support and the identification of an implementation schedule or resources. LANL needs to continue working

toward a sustainable and effective IH exposure assessment process across all Directorates for all applicable hazards.

Opportunity for Improvement: LANL needs to continue working toward a sustainable and effective IH exposure assessment process across all Directorates for all applicable hazards.

P300 defines three levels of work related to hazards present: Low, Moderate, and High. The level of work dictates the type of documentation required and hazard analysis performed. Typically, a team consisting of a work planner, supervisor, SME, and workers walkdown each job prior to developing an IWD. In the 2010 review, the process flow for IWM defined in P300 also contained a graded approach to work planning based on the planners' assumption of the hazards associated with the work. However, work identified as low or routine is subject to facility-specific requirements, facility postings, coordination, and scheduling, and must apply work-area controls. In addition, low hazard work is controlled by other requirements that include worker qualifications, work orders, permits, activity-specific work instructions (expedited work), facility-specific training/access controls, and work control documents that provide for identification of colocated hazard identification and controls. The responsible line manager and FOD may also require a full IWD based on their review of the work activity, hazards, and controls. This approach, while understandable in its intent, may not fully document the inherent assumptions or any analysis that led to a low hazard determination and limited systematic inclusion of lessons learned associated with routine, low hazard work. The 2011 DOE-VPP review documented an opportunity for improvement in this area indicating that LANL needed to modify the P300 process further to ensure that hazard level decisions are based on an analysis that identifies and documents the inherent assumptions in that decision and then use that determination as the basis for the level of additional work planning required. Since the last two VPP reviews, progress had been made with respect to identification and categorization of low hazard work and documenting assumptions in arriving at a hazard categorization. This is particularly evident within the MSS Facility Work Control process. MSS has redefined low hazard minor maintenance with clearer and more concise processes, workflows, and definitions. In addition, MSS developed site-wide guidance for hazard analysis and controls for low hazard work in the MSS JHA manual.

Since the previous DOE-VPP reviews, the adoption of the LANL SIP by each Directorate has also been effective at targeting low hazard activities, particularly with respect to ergonomic injuries, walking and working surfaces, and injuries caused by being struck by objects. The Team observed a greater sense of ownership by the line organizations rather than just ESH in the past 2 years. The FODs are reporting a greater number of near-misses at lower reporting thresholds. In addition, there is a greater reliance in reporting of precursor events with respect to hazard identification and analysis.

However, LANL has much work remaining to improve the definition of low hazard work across programmatic activities at a number of the remaining Directorates. The most recent change to P300 retained the wording that permits a graded approach to hazard analysis rather than using hazard analysis to establish a graded approach to hazard controls. Per P300, the person making the determination that work is low hazard simply documents that determination by checking a box on the work control sheet without recording any other basis for the low hazard determination. For other maintenance operations, the process does not fully capture assumptions regarding work activities, specific hazard controls, worker qualifications, scope of work, or other

considerations that confirm or support that determination. If workers make a subsequent error, change work methods, or other critical consideration, the PIC and workers must confirm whether those changes fall within the initial low hazard work determination boundaries. At a minimum, P300 should be revised to incorporate low hazard work within the requirements associated with work activity changes. LANL should revise P300 to reflect using hazard analysis to improve its graded approach to hazard controls and ensure the basis and assumptions behind a low hazard determination are captured for future reference during similar work, or if changes occur during the course of work.

Opportunity for Improvement: LANL should revise P300 to reflect using hazard analysis to improve its graded approach to hazard controls, and ensure the basis and assumptions behind a low hazard determination are captured for future reference during similar work, or if changes occur during the course of work.

One of the challenges with the current IWD system is to ensure that changes in work processes result in a reassessment of activity-level hazards. Although most IWD processes observed by the Team provided a mechanism to capture changing hazards in work documents, this was not always the case. For example, the Team observed an MSS activity at LANSCE involving an annual preventative maintenance activity for cleaning the cooling towers. The 964 Cooling Tower annual preventive maintenance work package neglected to include sufficient hazard analysis due to workscope changes that had occurred in the past few years. A review of the work package and worker interviews identified a nonpermitted confined space; however, the IWD also allowed for the use of unspecified chemicals (assumed to be decalcification chemicals). As a result, the workers could have introduced chemicals (i.e., volatiles) that could have redefined the area as a "permitted" confined space per LANL requirements and required SME approval. The lack of specificity in the IWD regarding what chemicals workers might use in the nonpermitted confined space could have resulted in a potential unanalyzed hazard to the workers within the confined space.

In addition, due to subtle workscope changes over the past few years, the workers no longer performed the cooling tower pit cleaning process previously discussed solely by pressure washer. Workers had adopted the practice of "dry" hand brushing the pit screens to remove calcification. This new activity resulted in the presence of a dusty environment within the pit to the extent that the supervisor, based on input from the resident industrial hygienist, provided nuisance dust masks to the workers to reduce the effect of the dust. The dust generated by the workers could contain an additional hazard from locally present silica or potential biological hazards. The Team was concerned that the initial hazard analysis did not recognize the potential hazards presented by the changes in scope for this preventive maintenance activity. The lack of a walkdown or the proper execution of an effective postjob evaluation process resulted in a failure to identify potential hazards. The work planner and maintenance manager were not aware of the workscope change due to several breakdowns in the work control feedback process. The Cooling Tower annual preventive maintenance work package should have addressed the changes in scope in the postjob feedback process, and the PIC should have recognized the change in work methods as a change in workscope. The planner assumed the work and hazards remained the same while workers were making slight modifications, introducing new potential hazards without his involvement, or adequate hazard analysis.

Opportunity for Improvement: MSS should consider requiring walkdowns for semi-annual and annual preventive maintenance work until the feedback and postjob process is more robust and the PICs demonstrate a more comprehensive understanding of workscope changes.

The LANSCE maintenance manager conducts a lessons-learned meeting to review all completed work packages every Tuesday after the plan-of-the-week meeting. The work coordination team lead (supervisor of the planners), work execution manager, facility coordination team lead, and the maintenance manager attend the lessons-learned meeting. Discussions with the maintenance manager demonstrated that the work control feedback process does not always identify changes as required by the process. During worker interviews, the lack of consistent MSS worker feedback in the work control process was prevalent across the site. MSS should find more effective methods to encourage and stimulate worker feedback on all jobs, and effectively communicate postjob comments and the resulting corrective actions to the crafts who originated the comments.

Opportunity for Improvement: MSS should find more effective methods to encourage and stimulate worker feedback on all jobs, and effectively communicate postjob comments and the resulting corrective actions to the crafts who originated the comments.

Hazard analysis tools, such as the JHA tool, the Work Management System (WMS) tool, and the exposure assessment tool, in CTS continue to improve although their use is not widespread throughout the LANS Directorates.

The JHA is a tool that provides a smart system for defining job hazards and controls. Preparers of IWDs use the system to help fully identify hazards and associated institutional requirements, determine facility requirements, and document lessons-learned. MSS work control has evaluated and approved minor maintenance work based on documented JHAs and craft core training requirements. However, the FOD and Cognizant Maintenance Manager requesting the work for the various facilities must review and approve all MSS-approved low hazard work. MSS maintains JHAs for all minor work in the *MSS Job Hazard Analysis Manual*. Workers associated with the performance of minor maintenance, low hazard work understood the limitations of their tasks.

LANS developed the computer-based WMS tool to create, update, and review activity information according to the requirements of P300. The WMS consists of four stages: identifying the work activity, assigning a hazard grading, identifying FOD requirements (for a low hazard grading), and enabling continuous improvement.

In addition to the JHA and WMS tools, continued development in the CTS is also evident with respect to IH exposure assessments. Four CTS modules are currently in use to document and integrate workplace exposure data; namely, the worker activity exposure assessment module, IH module, JHA module, and the medical investigation module. LANS has expanded the CTS system to address chemical, physical (e.g., noise), and biological hazards, but does not incorporate radiological, laser, or ergonomic hazards.

The JHA and WMS tools have been effective in worksite analysis and hazard identification, but more personnel could be using the tools. LANL uses the Exposure Assessment (EA) tool within CTS for an estimated 50 percent of the exposure assessments. WX Division and Weapons Facility Operations use the JHA and WMS to compile hazards and controls and related training and qualification. P300 and AP-WXDIV-015, *WX Integrated Work Documents,* describe methods to identify and analyze hazards. IWM Refresher Course (Course 12454) states that P300 now requires confirmation that a responsible manager used a hazard-grading table to assess each activity. A review of records and interviews indicate that this may not be done in all cases**.** LANL should encourage the continued development, training of workers and use of JHA, WMS, and EA tools across all LANL Directorates.

Opportunity for Improvement: LANL should encourage the continued development, training of workers and use of JHA, WMS, and EA tools across all LANS Directorates.

The Team noted an increased level of worker involvement in the critique process. For example, the Team observed a critique of a glovebox breach (likely glove puncture) and contamination event in TA-55. Overall, the critique was effective. The Deputy FOD led the critique and focused on factfinding, ensured the involved workers were present, and followed the process for critiques. Although there was some minimal scripting/prompting by some managers present, there was no apparent negative effect on worker participation.

The Environmental Restoration and Waste Management program provides requirements to subcontractors through the Corrective Action Program and Appendix F of the respective subcontracts issued. The subcontractor implements the requirements through its ESH programs tailored to meet LANL requirements, and occasionally augmented by LANL SMEs and/or procedures. A LANL STR oversees the Appendix F requirements with support by the LANL ESH staff as needed.

The initial VPP assessment (April 2010) identified that workplace inspections were not being conducted with the intent and frequency expected of VPP Star participants. LANL was performing Safety and Security walkthroughs, MOVs, and 10 CFR 851 inspections, but those inspections were not consistently targeting specific safety and health conditions of the workplace and equipment. The 10 CFR 851 inspections were required every year for high hazard facilities and every 3 years for low hazard facilities per LANL procedures. The 2010 assessment included an opportunity for improvement that LANL considered closed, but it is not yet clear that LANL is performing inspections of the entire site that are continuously active at the expected frequency. The DOE-VPP Manual, Part 1, *Program Elements*, establishes in Section E.3.c., that there should be a system for conducting routine, general hazard assessments that follow written procedures or guidance and result in written reports of findings and tracking of hazard correction. For continuous activities, these hazard assessments must be conducted at least monthly and cover the whole worksite at least quarterly. After the ^{99}Tc release in 2012, the Laboratory Director initiated a Laboratory-wide campaign to focus on housekeeping. This effort is a good precursor for a frequent worksite inspection process. LANL should expand and document the current housekeeping inspection program to meet DOE-VPP expectations for monthly general hazard assessments that cover the whole worksite quarterly.

Opportunity for Improvement: LANL should expand and document the current housekeeping inspection program to meet DOE-VPP expectations for monthly general hazard assessments that cover the whole worksite quarterly.

Conclusion

Since the 2011 review, Worksite Analysis is continuing to mature and there has been continued improvement in the work control processes. The Team noted an improvement in the process and effectiveness of hazard identification across LANL. However, in some cases the use of SMEs or a foreman in lieu of worker participation for IWD and technical procedure development has resulted in less than adequate analysis for those activities. LANL needs to continue working toward a sustainable and effective IH exposure assessment process across all Directorates for all applicable hazards. LANL has developed effective hazard analysis tools, but not all areas of LANL fully implement and use the tools. LANL has maintained continued improvement in the Worksite Analysis tenet, but needs to address the opportunities for improvement cited in this section to meet the expectations for a DOE-VPP Star participant.

VI. HAZARD PREVENTION AND CONTROL

Once hazards have been identified and analyzed, they must be eliminated (by substitution or changing work methods) or addressed by the implementation of effective controls (engineered controls, administrative controls, or PPE). Equipment maintenance processes to ensure compliance with requirements and emergency preparedness (EP) must also be implemented where necessary. Safety rules and work procedures must be developed, communicated, and understood by supervisors and employees. These rules/procedures must also be followed by everyone in the workplace to prevent mishaps or control their frequency/severity.

In 2011, the Team determined that LANL had completed or initiated a number of improvements to hazard controls across LANL. Those efforts needed time to mature and demonstrate effectiveness and acceptance by the workforce to meet the requirements of the Hazard Prevention and Control tenet. LANL was demonstrating continued progress toward DOE-VPP Star status.

The safety and health staff at LANL is comprised of individuals with varying degrees of experience, education, and certification. Qualified personnel available onsite include: Fire Protection Engineers, Associate Safety Professionals, Certified Safety Professionals, Certified Industrial Hygienists, Certified Health Physicists, RCTs, Certified Professional Ergonomists, Criticality Safety Engineers, and a fully staffed Occupational Medicine Department. Roles, responsibilities, authorities, and accountability for these functions are well defined. The staff serves various organizations from both an embedded and deployed model. There is extensive and appropriate use of deployed ESH support personnel to aid workers in hazard control. Safety professionals are present in the field, and support a teaming approach for accomplishing work. Employees are willing to approach them to report unsafe conditions or acts. Safety professionals expressed genuine concern for others and regularly provide feedback to the employees on issues and concerns.

Methods of hazard prevention and control across the site generally followed the appropriate hierarchy of controls. The Team noted cases of process and/or material substitution where feasible. Examples include phase-out of perchloric acid in favor of a less hazardous dilution agent at the CMR facility, and engineered controlled interlocks restricting access during operations to the accelerators and a shot-firing vessel used to contain residue at DARHT. Engineered controls, such as certified gloveboxes, American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) Standard 110P, *Method of Testing Performance of Laboratory Fume Hoods,* certified Laboratory hoods, and effective ventilation systems are also prevalent across site areas and provide a primary exposure barrier. Administrative controls, such as postings, procedures, and work instructions, are also prevalent. Lastly, LANL effectively used PPE to control hazards that it cannot mitigate by engineered and administrative control.

The LANSCE Duty Officer Program, MOV program, and WSSTs are all mechanisms of performance assurance. Both TA-55 and LANSCE strive to identify issues before they become problems. Document control is a major component of performance assurance at LANSCE with program, experimental, and maintenance aspects. The bar coding improvements made in the sample custody and inventory have been a significant quality improvement. An Experiment Coordinator (EC) assumes sample custody, including inspection and database entry. The EC then transfers custody to the Instrument Scientist who either uses the material or determines if it

must go to sample storage. Prior to the Lujan event, this inventory was a manual process. Now the bar coding system enables simplified management/administration.

MSS has shown significant improvement in hazard control since the last VPP review. MSS managers and workers have shown a great deal of maturity since implementing the actions in 2011 for improving the quality of IWDs used for maintenance and construction. These efforts have progressed in identifying the hazards and controls by using a teaming approach that involves SMEs from the field, engineers, and planners that possess the knowledge for the planned task. Although in some cases previously discussed in Worksite Analysis where workers were not always directly involved in planning, the teaming approach resulted in clearer, more useful work instructions. With a few exceptions, all contained accurate task descriptions and facility-specific documentation for controlling or eliminating hazards.

Another MSS and Project/Construction Management improvement is the development of a program that incorporates 25 STRs that provide daily "documented" job walkdowns. These walkdowns cover the behavior of the employees and the site conditions for their construction subcontractors. STRs work with the ESH group, which also performs construction oversight of the direct hire construction workforce. MSS documents any issues on the ESH assessment forms. Construction Management-deployed ESH staff enters the observations into a tracking system in order to trend behavior and hazards. LANL believes these observations are useful to both the subcontractors and the direct hire workforce in identifying any adverse safety behaviors and worksite conditions. The monthly report also tracks and trends the first aid, recordable injuries, and DART cases. The results of the assessments and daily logs are trended and presented at the monthly safety meetings for the direct hire forces and subcontractors. MSS also disseminates this information monthly to the Building Trades Business Agents.

Prejob briefings within MSS have also improved significantly. The briefing is based on worker involvement in the prejob planning process. The supervisor offers workers the opportunity to ask questions or raise concerns based on the briefing. In a typical prejob briefing, the workers understood the contents of the work package, and the employees were engaged in highlighting the potential hazards and controls that were defined in the IWDs. The supervisors now facilitate the prejobs and use an interactive approach that increases the effectiveness by engaging the craft employees. The supervisors also gave workers time to review the work package prior to the prejob briefing. This process improves worker engagement and preparation for the task.

Other safety improvement initiatives at LANL were also evident during this review. For example, several mishaps involving visibility while backing up with large pickup trucks at CMR have resulted in an initiative requiring use of spotters to better control this vulnerability.

For several years, slips, trips, and falls have been the primary source of recordable injuries at LANL. LANL has implemented extensive efforts to reduce these injuries by aggressively addressing parking lot and sidewalk conditions, ensuring ice melt is readily available during winter months, clearly marking crosswalks, and directing pedestrian traffic away from rough, unimproved trails onto sidewalks. In combination with these efforts to improve walking surfaces, LANL has implemented extensive campaigns to educate workers on proper walking techniques and eliminating at-risk behaviors while walking (cell phone use or other distracted walking, overloaded conditions, proper footwear). LANL has continued and expanded the availability of the Slip Simulator discussed in the 2011 DOE-VPP report, with over 4,300 Laboratory personnel completing the training. Comparison data between trained and untrained

personnel show strong, statistically significant reductions in the number of injuries for trained personnel. As previously discussed in Management Leadership, ADBS implemented a "pedestrian observation" program that the AD attributes with significant reduction of slip/trip/fall injuries in the directorate.

Workers and researchers across LANL consistently indicated a willingness to stop or pause work when necessary. For example, craft workers at LANSCE indicated that they had paused work on several occasions during the past year primarily because of incomplete work packages or because information was missing from the work package (e.g. drawings).

The Team found that implementation of hazard controls identified in IWDs and IWD-equivalent work documents was also generally effective. For example;

- The work description and identification of hazards and controls in the IWD for the Fluids and Turbulence Laboratory (TA-53, Building 3), was well-documented and easy to follow. Features of this IWD (IWD # 9349) that were exceptional included: detailed prejob guidance written from a lay person's perspective with respect to hazards and controls; detailed description of hazards and controls; laser alignment procedure with the use of photos to describe important laser features; and e-mails from the SMEs associated with this work describing their evaluation(s).

- Within ADEP, several work evolutions were observed where hazard controls were employed without incident; these included: the wastebox line sorting and segregation; metal box cutting; Transuranic (TRU) waste shipment preparation; and RCT coverage of work in Contamination Areas (CA), High Contamination Areas (HCA) and Airborne Radiation Areas. ADEP uses computer-based access controls, electronic dosimeters, and RWP issuance to confirm training status, and ensure individuals are aware of and acknowledge RWP requirements prior to conduct of radiological work.

- LANL effectively incorporated appropriate radiological and IH controls into IWDs and procedures governing actinide chemistry research work in CMR and TA-3. This included identification of PPE requirements, self-survey practices, and spill reporting.

The TA-55 Performance Analysis database is an excellent tracking and reporting tool. The ability to configure the systems' data to capture and report Occurrence Reporting and Processing System (ORPS), sub-ORPS, Human Performance, Integrated Safety Management, and many functional data crosscuts, enables managers to obtain information easily about their organization's performance. Managers routinely use the Performance Analysis database, indicating its usefulness.

The LANSCE Plan-of-the Day (POD) meeting, the LANSCE Maintenance POD, and the TA-55 Integrated POD (IPOD) were effective and efficient. Participants discussed the schedules of activities for the day and appropriately addressed coordination of resources.

As described above, the Team observed significant improvements in hazard control across many Laboratory areas. Notwithstanding these improvements, LANL needs additional emphasis in a few areas where it continues to face challenges related to controlling hazards.

While LANL has implemented effective hazard controls in many cases, the Team observed workers and managers felt a sense of urgency in meeting the agreements between LANL and the

State of New Mexico for removal of wastes from the plateau. Workers and managers share a high level of dedication and mission orientation to achieve these waste disposal goals, but interviews also indicated workers' concerns with staffing, recent staff attrition or transition to 24/7 shift work implementation, and their inability to support WSST commitments due to performance expectations to process the waste out. The Team's observation of work at times appeared "harried", particularly as problems arose (i.e., encountering higher activity waste materials), but workers and managers did not stop or pause work as questions or problems arose. Workers in the corrugated box line indicated they only had several more boxes left to complete the current waste stream and they would be "pleased to move on to the next waste." Motivation to complete the task and feelings of staff shortages may have contributed to errors by workers in implementing controls as noted in the following examples.

- The Team observed an RCT in the radiological controlled area (adjacent to the corrugated metal box line processing area) with an uncovered wound on his hand. The RCT reported he incurred the wound at home. The area training and RWP briefing requires wound protection prior to entering radiological areas to prevent internal contamination. When this was brought to his attention, the RCT reported to Occupational Medicine for a wound count. LANL issued a Radiation Protection Observation and determined the RCT's actions to be a procedural violation.

- The Waste Characterization, Reduction, and Repackaging (WCRR) facility uses working platforms to provide workers access to gloveboxes and reduce ergonomic stress. The design of the platforms may not align with work methods and practices, and in one case, workers exceeded the posted rating limit of 500 pounds during work. When workers unloaded a higher activity waste drum into the glovebox, they scrambled to don lead aprons, and isolate the materials in a shielded configuration within the glovebox. The Team observed that, at times, up to five workers were on one section, two deep on the platform. Two workers were using the gloveports, two more workers were conducting radiological monitoring, and a fifth worker was looking into the window directing movement of shielding. In addition, individuals occasionally sat on the top railing, decreasing the efficacy of the safety rail system. Lastly, two platforms had supplement pads to increase the height (primarily for shorter workers who stand on 6-8" blocks) of the working position; however, this results in the safety rail system providing less protection than designed by the manufacturer. LANL should maintain the manufacturer's safety railing system specifications (i.e., height) when additional blocking is in use, either by adding an additional span of toprail, or other protective guarding. This approach would allow LANL to maintain the ergonomic improvement for shorter workers without compromising the manufacturer's safety margins for the platform.

As discussed in Management Leadership, LANL needs to ensure that production pressures to comply with negotiated agreements do not lead to errors by workers.

Opportunity for Improvement: LANL needs to ensure that production pressures to comply with negotiated agreements do not lead to errors by workers.

In PF-4, work in one major process area had been paused for several weeks due to criticality safety infractions related to inadequate conduct of operations, including unclear wording and understanding of the limits. In some cases, individuals outside of the operating organization

(including DOE field office and DNFSB staff) noted the infractions. Part of the corrective actions being performed during the time of this review were to walk down specific process procedures with a team of workers and SMEs to ensure the procedures were workable and addressed hazard controls (including, but not limited to, criticality safety controls). Although the identified corrective actions and approach appear to be appropriate, the magnitude of infractions and unclear controls resulting in the work pause and subsequent discovery of several additional controls needing improvement indicates that PF-4 has not yet demonstrated sustained success in implementation of effective hazard controls at the time of this review. LANL needs to continue walking down procedures with a team of "hands-on" workers and SMEs to ensure procedures are workable, remove ambiguous language, clarify assumptions, and resolve the outstanding conduct of operations issues.

Opportunity for Improvement: LANL needs to continue walking down procedures with a team of "hands-on" workers and SMEs to ensure procedures are workable, remove ambiguous language, clarify assumptions, and resolve the outstanding conduct of operations issues.

In a separate TA-55 evolution, workers performed an operation to x-ray an item at TA-55 in accordance with procedure, and RCT activities were extensive and appropriate for the radiation hazard. However, during the observation, the Team noticed a trash can labeled *Beryllium Waste*. IH had sampled the area, and the can was on the LANL beryllium inventory list. However, two of the three workers involved with the x-ray activity were not familiar with the reason for the trash can; the third operator noted that occasionally they x-ray beryllium items and use the can to dispose of the PPE gloves. The procedure for the activity, "General High Energy Radiography at PF-4," listed the chemical beryllium as a hazard. The only control listed in the procedure was "Dispose of beryllium contaminated gloves in approved waste drum." Beryllium items, beryllium contamination, beryllium waste, and when or why workers needed gloves for beryllium protection were not addressed in the procedure.

During a routine FOD tour at TA-55 in a chemistry laboratory, there was construction in progress in the back half, so there were additional PPE requirements for entry into this area. The FOD and ESH Manager observed two workers in the area without the required bump caps or hardhats. The FOD and ESH Manager immediately questioned the workers and counseled them on entering without proper PPE. When they had said they were only looking for their bump hats so they could don them, the FOD reminded them that they should have not taken them off and left them in the posted area. Another problem the FOD discovered was that there were several entrance paths (five), but workers had only labeled one path as a construction boundary needing the PPE. Programmatic work was occurring in the construction area (construction was in the overhead), and programmatic workers routinely entered and exited through unposted entrance paths. While this was an excellent example of management presence in the field (see discussion in the Management Leadership section), overall, the observation demonstrated a lack of coordination between the affected programmatic and construction groups and poor conduct of operations from a posting and posting compliance perspectives.

The above two examples at TA-55 demonstrate that while corrective actions are in place to improve conduct of operations, the hazard prevention and control program continues to need time to mature, ensure workers at TA-55 effectively recognize unsafe work conditions and are willing to pause work and reevaluate when they identify these unsafe practices. Using workers

and WSSTs to help address longstanding problems should result in improved, sustainable corrective actions, greater ownership by workers of the results, and quicker maturity of the resulting improvement efforts. LANL needs to seek broader worker involvement in work planning, use WSSTs to help address conduct of operations issues, and allow workers to have a much larger role in defining corrective actions to issues raised by outside entities, such as DNFSB.

Opportunity for Improvement: LANL needs to seek broader worker involvement in work planning, use WSSTs to help address conduct of operations issues, and allow workers to have a much larger role in defining corrective actions to issues.

The Team noted a potential concern with hazard communication and contamination control associated with research work at TA-3 and TA-48. Specifically, these practices in and around contaminated open-faced hoods may not ensure that sufficiently frequent contamination surveys are performed and that workers are made aware of the current contamination levels or contamination status of hoods that they access when performing research. LANS is labeling open-faced hoods containing removable contamination as radioactive materials inside laboratory areas posted as controlled areas and radiological buffer areas. LANS is not posting hoods as CAs or HCAs when contamination levels exceeding LANL procedure, *Radiation Protection* P121, Table 14.2 levels may exist, as is customary at many DOE sites around the complex.

The LANS justifies this approach based on a LANS developed definition of "area" that states:

> *For purposes of radiological control, a space is considered an area (and subject to posting as an area) if it is accessible to an individual and that individual could receive a whole-body exposure (extremities are not considered whole body). Containment devices such as gloveboxes, hoods, or open-front boxes are not considered or normally posted as areas for radiological purposes*.

The first sentence only addresses whole body exposure and does not address contamination potential. In addition, 10 CFR 835 does not define "area" but instead defines "entrance or access point" in relation to posting as *any location through which an individual could gain access to areas controlled for the purpose of radiation protection. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use*. Many sites in the DOE complex interpret this statement to include large, open-face hoods of the type used in research operations. Consequently, it is common practice to post hoods as CAs and HCAs.

The above concern relates principally to radiological hazard communication and increased frequency of contamination surveys that may be warranted. Work observations and a review of IWDs associated with this type of work indicated that other radiological controls, such as PPE, self-monitoring, and work practices, were appropriate and conservative.

Opportunity for Improvement: LANL should evaluate current practices regarding hazard communication and contamination control associated with contaminated open-faced hoods in comparison with practices across the DOE complex, and consider making appropriate changes based on the evaluation.

In the maintenance area, MSS conducts corrective and preventive maintenance work for a number of facilities that require routine personnel access to the roof to perform that work. In anticipation of the new fall protection requirements being suggested by OSHA for General Industry, MSS utilized a systematic approach based upon the number of maintenance actions performed last year that required roof access. MSS has installed fall protection equipment per a directive from the Utilities and Infrastructure FOD. The Utilities and Infrastructure FOD prepared a cost analysis that demonstrated that if one building required 13 scheduled maintenance actions for 2012 and an additional 4 unplanned work events, the estimated cost was $1,140 each time to support the installation of a temporary fall protection system or scaffolding; this totaled $19,380 for 2012. MSS installed the new permanent system in the same facility for approximately $10,000 that reduced worker exposure to falls for those who had to install the temporary system each time, as well as the crews performing maintenance.

In 2011, the Team observed an effective emergency planning capability based on the LANS response to the 2011 Las Conchas fire and ongoing improvements from the May 2000 Cerro Grande fire. Once again, during the course of this review, LANS demonstrated an effective EP and communication to workers in response to several active wildfires in the area; one of them being a 14,000-acre fire in the Jemez mountains just north and west of Los Alamos. LANS maintains a readily available Emergency Operations Center fully supported with personnel, procedures, and equipment for area emergencies. LANS maintains appropriate cooperative agreements to manage emergencies effectively.

LANS has documented emergency procedures in place to govern the response to area or Laboratory-wide events. LANS conducts drills at least annually to ensure effectiveness of personnel response and emergency procedures. A full service hospital is located adjacent to the Laboratory so advanced medical attention is in the immediate area. LANS has a fully staffed fire department on contract to respond with firefighting equipment, hazardous material response, etc. The Team observed several other examples of effective EP at LANS. The LANSCE EP Coordinator recently completed an update of facility EP procedures to develop consistency with institutional processes. Additionally, the LANSCE EP Coordinator is leading a crosscutting team to determine additional evacuation routes on the east side of the Mesa. The TA-55-deployed emergency management specialist has recently completed the standup of a facility-level emergency response organization at RLUOB and has made substantial progress on completing corrective actions from a seismic exercise at PF-4 identified in a LANS Seismic Tabletop After Action Report (EPP-AAR-232, R0, dated April 10, 2013). LANS performs drills annually for all occupied buildings within TA-53 and TA-55 and executes Emergency Planning Hazard Assessment exercises annually per defined scenarios. The Los Alamos Fire Department responds to the site and completes annual preincident plans that incorporate Building Run Sheets and facility hazard lists to facilitate effective responses. The Fire Department personnel do triennial Emergency Familiarization tours to train all firefighters on the facilities and related hazards.

The Occupational Medicine program at LANS resides under the Associate Director for ESH. The Occupational Medicine Division clinic is located in TA-3 in Building 1411. The Occupational Medicine Division has two licensed physicians, including the Medical Director position, two nurse practitioners, four physicians' assistants, six full-time nurses, two part-time nurses, two Employee Assistance Program (EAP) counselors, three full-time and one part-time psychologist, five diagnostic testing technicians, and worker compensation staffers. There is always a nurse and medical provider on call during the off-shift.

As discussed in previous reviews, the evaluation of task/work/environment, enrollment, and removal from medical monitoring programs and ongoing monitoring job task analysis using Form 1793 was a well-intentioned process that had not been effectively implemented. LANS has attempted to complete the transition to a new Job Demands Evaluation form; however, that action has only been completed for MSS to date. The remainder of the workforce is still using the old 1793 form or no form at all. LANL should develop a plan to convert the remainder of the Laboratory to the new form/process to ensure consistent and effective analysis of the workers' physical and emotional readiness and to ensure supervisors do not ask workers to perform work they may not be able to perform.

Opportunity for Improvement: LANL should develop a plan to convert the remainder of the Laboratory to the new Job Demands Evaluation form/process to ensure consistent and effective analysis of the workers' physical and emotional readiness and to ensure supervisors do not ask workers to perform work they may not be able to perform.

LANS has made a significant investment and effort in the Health and Fitness Program to improve personal worker health and safety through a multitude of innovative health services. The LANS Health and Service Program provides health promotion to the workforce through Health Risk Assessments (biometric screening and health coaching), Motivational Programs (self-paced activity programs), Health and Safety Fairs, Lifestyle Modification Programs (nutrition, weight loss support groups, health and fitness consultation), EAP (stress management, smoking cessation) and onsite fitness facilities. A Wellness Center is located in TA-3 Building 1663. Fourteen satellite and five Fire Department wellness centers are located across the Laboratory. The Wellness Centers have rules regarding the use of all exercise equipment, appropriate behavior, and cleanliness.

Conclusion

In the 2011 review, the Team determined that LANS had completed or initiated a number of improvements to hazard controls across LANS and those improvements required more time to mature and demonstrate effectiveness. The current review demonstrated that the methods of hazard prevention and control generally followed the appropriate hierarchy of controls, but in some cases, production pressures and the lack of a "hands-on" approach to work planning resulted in less effective hazard controls or worker errors in implementing those controls. LANS needs to build on its successes in other tenets and encourage greater employee involvement in complex issues at the higher hazard facilities related to conduct of operations, work planning and control, criticality safety, radiological controls, and worker perceptions related to a safety conscious work environment to achieve DOE-VPP Star Status.

VII. SAFETY AND HEALTH TRAINING

Managers, supervisors, and employees must know and understand the policies, rules, and procedures established to prevent exposure to hazards. Training for health and safety must ensure that responsibilities are understood, that personnel recognize hazards they may encounter, and that they are capable of acting in accordance with management expectations and approved procedures.

In 2011, the Team determined that LANS safety and health training and the associated qualification programs were generally effective and ensured that employees were appropriately trained to recognize hazards of work and the work environment, and to protect themselves and their coworkers. LANS had migrated the training records to the more comprehensive UTrain (Plateau) database. LANS was spearheading the Learning Tree system for many of its courses utilizing the "electronic blackboard" technique that provided instant student feedback to the instructor. These developments demonstrated the pursuit of excellence in safety and health training and LANS met the requirements of the Safety and Health Training tenet of DOE-VPP at the Star level.

LANS managers and workers continue their safety and health education through training courses and management development programs provided by LANS. Conversations with supervisors and workers indicate LANS personnel know the safety and health hazards of their work area. The revision of the *Maintenance Worker Qualification Standard*, CT-LANS-QS-409-R03, has emphasized the integration of education and specific training to a qualification plan, and the *Conduct of Training Manual*, P781-1, revision 7, standardizes training courses.

LANS continues to use "manager grooming" programs identified in the 2010 and 2011 VPP assessment reports. The "New Manager On-Ramp" course, a 1-day role-play assessment process, assesses for the requisite interpersonal skills associated with effective leadership, has now had 1,033 employees participate in the course. Of the 561 endorsed through the process (e.g., those demonstrating a profile of leadership dimensions and attributes aligned with strong managerial skills), 245 have been selected into management positions. The "Protégé/Mentor" program, designed for personal and professional development, contributes to the grooming of future and incumbent managers. Over the past 2 years, LANL deconstructed the 3-day "Management Academy" course into five management-fundamentals modules. Respectively, the modules cover the following content: LANS LLC/Human Resources; Employee Relations; Budgeting and Finance; Procurement and Property; and Environment, Safety and Health. The five modules may be taken in any order and are individually scheduled (though must be completed within 1 year), allowing managers scheduling flexibility, as well as sufficient assimilation time.

The courses, led by internal Laboratory SMEs, prepare employees for management positions. One day is dedicated to human resource information; another to finance, budgeting, and procurement; and the third day focuses on environment, safety, health, quality, and security. The three courses are individually scheduled and may be taken in any order; however, they must be completed within 1 year. The courses are instructor-led and taught at the Canyon School, located in the City of Los Alamos. The Canyon School is an old, unused elementary school that LANS has taken over, which provides classrooms away from the site so students can focus on their studies.

Craft worker training has improved since the 2011 assessment with the revision of the LANS *Maintenance Worker Qualification Standard*, CT-LANS-QS-409-R03. Prior to being hired, craft workers must have a high school degree (or equivalent), sufficient experience in the craft, and be a member of their respective Union. Once hired, all craft workers receive core training, and they must stay current in the training to be eligible for work. Core training includes training on the hazards a worker may encounter while performing maintenance activities and on the controls associated with the hazard. Core training (curricula 10968) includes General Employee Training (GET), beryllium awareness, asbestos awareness, lead awareness, ladder safety, basic craft worker PPE, IWM overview, back clinic video, and fire extinguisher video. GET covers topics, such as rules and procedures to prevent exposure to hazards, safety requirements, VPP, and pause and stop work training.

Next, craft workers receive their specific duty area requirements training. For example, all ironworkers have four requirements (curriculum #644) including: nonenergized/nonelectrical (curricula #2909); incident crane operator (curricula #122); fall protection (curricula #9257); and scaffold user (curricula #3949). Third, depending on specific work performed within a craft, a worker will complete endorsement requirement training. For example, a stationary equipment craft worker qualified in stationary equipment elevators, must first complete the endorsement requirements of two courses in confined space, two courses in elevator maintenance, obtain a National Center for Employee Development elevator maintenance certificate, and complete On-the-Job-Training (OJT) requirements for stationary equipment mechanics. The training requirements for all the craft found on LANL is organized and coordinated in the Qualification Standard.

Finally, craft may need to complete additional training prior to entering a TA or building. For example, the training offices use TA-53, *Employee Training Questionnaire,* and TA-55, *Training Questionnaire and Work Authorization,* respectively, to assign training requirements to employees assigned in those areas. In some cases, access to a building requires training on all the hazards within the building, such as the Lujan Center. In those cases, the badge reader at the building entrances prevents personnel without required training from entering without a proper escort.

The MSS Division trains managers, supervisors, and PICs using the standards built in LANS *Maintenance Manager Qualification Standard*, CT-LANS-MM-QS-0001-R3, LANS *Maintenance Supervisor Qualification Standard*, CT-LANS-QS-143-R03, and other similar documents. Minimum requirements for a management position are a bachelor's degree and 4 years of experience, and a supervisory position requires a high school diploma and 5 years of experience. Each position must complete its core requirements to be fully qualified. In addition, because of their unique responsibilities, the PIC has special training requirements. A PIC can also be a superintendent, general foreman, foreman of record, or a working/acting foreman. The PIC training prepares the person to understand a broader sense of worker roles and responsibilities to include HPI indicators related to skill-based errors, role-based errors, knowledge-based areas, safety and health responsibilities, and other important knowledge areas that apply to maintenance. MSS has invested significant resources to revamp its training program and produce capable individuals who support an active safety and qualification program. Future plans in MSS include creating a Maintenance University where craft personnel can pursue additional training and qualifications, including supervisory and managerial skills.

MSS recently developed a qualification standard for construction superintendents using the maintenance fieldwork execution superintendent's qualification standard as a starting point. Building on that model, the construction group manager determined that the construction superintendent's qualifications also need additional emphasis in project management to be truly qualified for the position. The manager for the construction group has developed a new job description for construction superintendents and is currently working to develop a new qualification standard for this position. The construction manager expects to have the new construction superintendent qualification program in place within the next year.

Across the Laboratory, managers, supervisors, and employees alike must know and comprehend the rules, policies, and procedures established to minimize worker exposure to hazards. IWM required training ensures work preparers (high/complex and moderate hazard level), PICs, responsible line managers, SMEs, FODs, and workers are consistently engaged in hazard control. IWM training (#12494) is a 2-day course that trains the use of a "What-If" checklist to aid high hazard work preparers to think through processes. IWM training (#28008) teaches the JHA tool for preparers and approvers. In one case identified by the Team, supervisory training for newly deployed group leaders in the ESH transformation (see Management Leadership) did not include some critical responsibilities for supervisors. The training did not include timecard responsibilities, communication, and conflict resolution.

Fully incorporated in LANS, UTrain is a computer system that includes available courses and tracks the extensive training requirements of workers, and the completion of training. Supervisors, PICs, and others can access workers' training records to ensure training is complete prior to the start of jobs. The Team confirmed several workers' training and qualifications by spot checking UTrain.

UTrain automatically e-mails reminders to workers and supervisors when training is nearing expiration, allowing ample time to renew the training. LANS uses the UTrain report capability to generate expired training reports for the nuclear-related areas, but not for other areas of the Laboratory. A review of UTrain training status for the entire Laboratory showed several thousand overdue training requirements. The Team was unable to determine if expired training indicated a widespread problem with worker qualification, or other problems, such as LANS not removing previous employees from the active database. LANL should update the training records and modify the UTrain database if necessary, to more readily provide accurate training status reports for all Laboratory personnel.

Opportunity for Improvement: LANL should update the training records and modify the UTrain database if necessary, to more readily provide accurate training status reports for all Laboratory personnel.

In August 2012, a ^{99}Tc contamination event occurred at the Lujan Center. After a thorough investigation, the accident investigation board recommended corrective actions to reduce the chance of a similar event in the future. Policies and procedures generated by the board became the foundation of the *Lujan Center Resumption and Operations Plan*, TA53-PL-320-003.2. To strengthen the controls placed on Lujan, the role of EC expanded to include verification of user training from the training center, from the specific Lujan laboratories, and from OJT training for specific flight paths. The emphasized use of training with verification of completion in UTrain, and verified by the EC, is a strong tool that helped create better controls in the Lujan Center.

A Team member attended a confined space air-monitoring instrumentation course at the White Rock Training Center. The Center is located offsite and provides employees the training in an atmosphere where there are no work distractions. Classrooms contain mockups of work scenarios to create a sense of field conditions so training is more realistic for the employee. As the confined space course proceeded, the instructor reviewed an actual permit, handed out confined space literature, and reviewed confined space requirements. A multi-gas detector sampled air in a confined space mockup to demonstrate monitoring activities. Employees worked either individually or in teams, and were well engaged in the course. The instructor corrected the test given at the end of the course, and reviewed wrong answers with the employee to ensure they understood their mistakes. The air-monitoring SME approved the lesson plan, and the instructor offered to answer future questions as employees applied the training in the field.

An opportunity for improvement from the 2010 assessment stated that LANS should identify tailoring approaches to training that are more compatible with workers' background and experience. Several craft employees stated that they would prefer more hands-on training rather than looking at books in a classroom or computer-based training. Based on interviews with instructors, LANL's systematic approach to training has driven many qualification courses to include more hands-on training and student demonstration of skills to ensure proficiency, and hands-on training will be included in more courses in the future. LANS continues to tailor training approaches that are compatible with the worker's needs while enhancing the worker's education.

LANS is using its training and video production resources to develop products that other organizations can use to promote excellent safety and health through the LANS Safety Cinema videos Web site at http://www.LANS.gov/safety/videos/safetycinema/. LANS' Safety Cinema™ Web site won the 2013 Communicator Award from the International Academy of Visual Arts in the education category, and the International Summit Creative Award in the training category. Safety Cinema™ is a series of videos, fliers, posters, presentation slides, and safety practices that support the well-being of employees at work and at home.

Conclusion

LANS continues to improve safety and health training to ensure that employees can recognize the hazards of work and the work environment, and they can protect themselves and their coworkers. UTrain continues to be a powerful tool that supervisors access to verify worker training prior to the start of work, and notifies the worker and supervisor prior to the expiration of training. The emphasis of training infused at the Lujan Center after the ^{99}Tc contamination event aided in the reopening of the Center. The production of safety and health videos led to a prestigious cinematography award. LANS meets the requirements of the Safety and Health Training tenet of DOE-VPP at the Star level.

VIII. CONCLUSIONS

LANL is making substantial improvements in worker safety and health, encouraging additional employee involvement, providing resources, and demonstrating management commitment to excellence in safety and health. Innovations at LANL that address the leading causes of injuries, such as the slip simulator, widespread efforts to improve walking surfaces, and encouraging workers to ask questions and pause or stop work if necessary, are resulting in significant improvements and preventing injuries. WSSTs are active and energized and pursuing continued and sustainable improvement. In three tenets, Management Leadership, Employee Involvement, and Safety Training, LANL meets the expectations for a DOE-VPP Star participant. In the Worksite Analysis and Hazard Prevention and Control tenets, LANS needs to build on its successes in the other three tenets and encourage greater employee involvement in resolving complex safety issues. These issues have repeatedly been identified in the higher hazard facilities and include conduct of operations, work planning and control, criticality safety, radiological controls, and worker perceptions related to a safety conscious work environment. LANL should revise P300 to reflect using hazard analysis to improve its graded approach to hazard controls and ensure the basis and assumptions behind a low hazard determination are captured for future reference during similar work, or if changes occur during the course of work. The Team recommends that LANL continue in DOE-VPP at the Merit level while it addresses the specific remaining improvements.

Appendix A

Onsite VPP Audit Team Roster

Management

Glenn S. Podonsky
Chief Health, Safety and Security Officer
Office of Health, Safety and Security

William A. Eckroade
Principal Deputy Chief for Mission Support Operations
Office of Health, Safety and Security

Patricia R. Worthington, PhD
Director
Office of Health and Safety
Office of Health, Safety and Security

Bradley K. Davy
Director
Office of Worker Safety and Health Assistance
Office of Health and Safety

Review Team

Name	Affiliation/Phone	Project/Review Element
Bradley K. Davy	DOE/HSS (301) 903-2473	Team Lead, Management Leadership
John A. Locklair	DOE/HSS	Employee Involvement
Michael S. Gilroy	DOE/HSS	Worksite Analysis, Hazard Prevention and Control
Brian A. Blazicko	DOE/HSS	Safety and Health Training
Carol S. Henning	DOE/Idaho Operations Office	TA-55, LANSCE, CMR
Daniel A. Stachelski	DOE/West Valley Demonstration Project	Facility Maintenance and Construction
Edward A. Stafford,	DOE/HSS	TA-55, LANSCE, CMR
James R. Lockridge	DOE/HSS	TA-55, LANSCE, CMR
Joseph Lischinsky	DOE/HSS	Environmental Restoration, Waste Management
Mario A. Vigliani	DOE/HSS	TA-3, CMR, Laboratories
Phillip Coretti	Energy Solutions	Management Leadership
William Crouse	Pacific Northwest National Laboratory	TA-3, CMR, Laboratories
Bruce E. Hill	National Security Technologies, LLC/Los Alamos Operations	TA-16, DARHT

Name	**Affiliation/Phone**	**Project/Review Element**
Corrine R. Jones	Battelle Energy Alliance/Idaho National Laboratory (INL)	Facility Maintenance and Construction
Bonnie L. Anderson	CH2M♦WG Idaho, LLC/Idaho Cleanup Project/INL	Environmental Restoration, Waste Management
Jerry Erpenbach	Wastren Advantage Inc./ Oak Ridge	TA-16, DARHT
Michael Horton	Wastren-EnergeX Mission Support LLC/Portsmouth Gaseous Diffusion Plant	Environmental Restoration, Waste Management
Steven J. Maki	Fluor Federal Services/Richland Operations Office, Hanford Site	Facility Maintenance and Construction
Donletta P. Watts	Savannah River Remediation, LLC/Savannah River Site	Employee Involvement