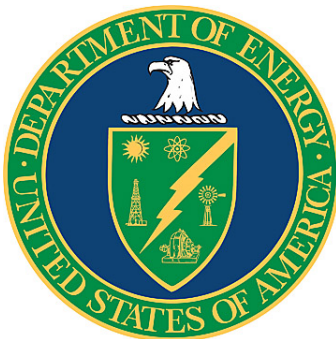


**Los Alamos National Security, LLC
Los Alamos National Laboratory
Los Alamos, New Mexico**

**Report from the Department of Energy
Voluntary Protection Program
Onsite Review
September 12-21, 2017**



U.S. Department of Energy
Office of Environment, 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 excellence can be encouraged and guided, but not standardized. 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's (OSHA) VPP. Since its creation by OSHA in 1982 and implementation by DOE in 1994, VPP has demonstrated that cooperative action among Government, industry, and labor can achieve excellence in worker safety and health.

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

However, 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 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 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 (LANS), conducted September 12-21, 2017, and provides the Associate Under Secretary for Environment, Health, Safety and Security with the necessary information to make the final decision regarding LANS' continued participation as a DOE-VPP Star site.

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ABBREVIATIONS AND ACRONYMS

AD	Associate Director
ADEPS	Associate Director for Experimental Physical Sciences
ADESH	Associate Director for Environment, Safety and Health
ADNHOO	Associate Director for Nuclear High Hazard Operations
ADPM	Associate Director for Project Management
AU	Office of Environment, Health, Safety and Security
AU-12	Office of Worker Safety and Health Assistance
BBS	Behavior-Based Safety
BLS	Bureau of Labor Statistics
CFR	Code of Federal Regulations
CRA	Contractor Readiness Assessment
CSR	Craft Safety Representative
DART	Days Away, Restricted or Transferred
DOE	Department of Energy
DTI	Department Training Institute
EA	Office of Enterprise Assessments
EFCOG	Energy Facility Contractors Group
EP	Emergency Preparedness
ES&H	Environment, Safety and Health
HAMMER	Volpentest Hazardous Materials Management and Emergency Response Federal Training Center
HPI	Human Performance Improvement
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ITI	Industrial Training International
IWM	Integrated Work Management
IWSST	Institutional Worker Safety and Security Team
JET	Joint Evaluation Team
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
MOV	Management Observation and Verification
MSA	Management Self-Assessment
MTC	Maintenance Training Council
MU	Maintenance University
NAICS	North American Industry Classification System
NNSA	National Nuclear Security Administration
OSHA	Occupational Safety and Health Administration
PADCAP	Principal Associate Director for Capital Projects
PADSTE	Principal Associate Director for Science Technology and Engineering
PIC	Person-In-Charge
PPE	Personal Protective Equipment
RCT	Radiological Control Technician
R&D	Research and Development
RLM	Responsible Line Manager
ROC	Rehearsal of Concept
SAFE	Safety Academy for Excellence
SSIP	Safety and Security Improvement Plan

SME	Subject Matter Expert
TA	Technical Area
Team	AU DOE-VPP Assessment Team
TRC	Total Recordable Case
TWF	Transuranic Waste Facility
VPP	Voluntary Protection Program
VR	Virtual Reality
WIPP	Waste Isolation Pilot Plant
WCRRF	Waste Characterization, Reduction, and Repackaging Facility
WSST	Worker Safety and Security Team
WOLVES	Worker Observations and Leadership Verifying and Ensuring Safety

EXECUTIVE SUMMARY

The Department of Energy's (DOE) Voluntary Protection Program (VPP) Team (Team) from the Office of Environment, Health, Safety and Security (AU) recommends that Los Alamos National Security, LLC (LANS) continue participating in DOE-VPP as a Star site. This report documents the Team's observations, conclusions, and identifies several opportunities for improvement that LANS can consider in its pursuit of excellence in worker safety and health. The Team conducted this triennial review of LANS September 12-21, 2017.

Established in 1943 as part of the Manhattan Project, the Los Alamos National Laboratory (LANL) covers approximately 40 square miles. Its single purpose was to design, build, and test an atomic bomb. Since its inception, the LANL mission has expanded to a broad national security focus. LANS manages and operates LANL under contract to DOE's National Nuclear Security Administration (NNSA). LANS is a private, limited liability company formed by the University of California, Bechtel, BWXT Government Group, Inc., and URS, an AECOM company. LANS employs approximately 7,200 of the 11,200 Laboratory employees.

LANS has had some events in the past 3 years. LANS contributed to the Americium release from the Waste Isolation Pilot Plant (WIPP) in February 2014. In May 2015, an arc-flash event occurred at Technical Area (TA)-53 causing significant injuries to a worker. Finally, criticality safety has been a continuing issue for LANS. Investigations and evaluations for these events have identified a variety of corrective actions.

LANS originally entered DOE-VPP as a Merit participant in 2010. After three annual Merit assessments, LANS finally achieved DOE-VPP Star status in 2014. Continued participation in DOE-VPP requires a triennial reassessment. This report summarizes the results from that evaluation and provides the Associate Under Secretary for Environment, Health, Safety and Security with the necessary information to make the final decision regarding LANS' continued participation as a DOE-VPP Star site.

Despite having only 1 year left in the operating contract, LANS managers remain committed to safety and operational excellence at LANL. They continue to invest in improvements that ensure the long-term sustainability of LANL and provide Laboratory personnel with the people, processes, equipment, and resources necessary for safe and successful performance of its National security mission.

Employee involvement in the LANL safety program continues to improve since the last review. In 2016, LANS managers recognized that the original approach to the Worker Safety and Security Team (WSST) program was "stagnating" and growth was limited. In response, LANS revitalized the WSSTs by empowering them to resolve larger site-wide issues. WSSTs have expanded the use of the learning teams to improve their understanding of why an injury or abnormal event occurred without focusing on assigning blame. This expansion has improved workers' understanding of the events and provided for better "one-on-one" supervisor/worker communications with regard to safety and health expectations.

LANS has made many improvements to the P300, *Integrated Work Management (IWM)*, worksite analysis processes. Those improvements include lessons learned from recent events. Recent improvements to LANS' readiness assessments ensure safe operations and readiness for startup activities.

LANS continues to improve its efforts to control hazards through the hierarchy of controls and employee involvement. Although the injury rates have been relatively flat over the past 3 years, LANS has experienced savings in medical costs due to a wellness outreach program that involves workers participating in their own health and wellness decisions, and reductions in the severity of injuries.

LANS continues to improve the safety and health training program to ensure that workers and managers recognize the hazards of their work and the environment. Efforts to provide the safety and health education through LANS-developed training and management development courses are ongoing. The Logistics division's Maintenance Training Council (MTC) identifies training process improvements. The MTC championed the Logistics' Maintenance University (MU) program that helps interested crafts people expand their knowledge of specialized applications and systems for their career development and increase their safety knowledge. The LANS training group is developing improved training for their workers through collaboration with the DOE Energy Facility Contractors Group (EFCOG) Training Working Group, National Training Center, Department Training Institute, Volpentest Hazardous Materials Management and Emergency Response Federal Training Center (HAMMER), and several other National Laboratories.

LANL is a large, complex organization, performing many hazardous research and development tasks that support national security, basic science, and other critical governmental functions. The infrastructure to perform this work resembles a moderately sized municipality, which includes a diverse population of highly educated researchers, skilled crafts people, and basic laborers. Since beginning its pursuit of the DOE-VPP Star in 2006, LANS has evolved into an institution that demonstrates its commitment to perform its hazardous mission safely. Workers no longer treat safety as an addition to the research work, but integrate safety into their research from the beginning. Despite this progress, LANS has had a few very high profile incidents. Rather than treating these incidents as isolated errors LANS has used these events to enhance safety and prevent recurrences. Over the past 3 years, since earning the DOE-VPP Star, LANS has expanded its efforts to engage employees in the difficult issues that arise and used worker suggestions to drive improvement.

TABLE 1
OPPORTUNITIES FOR IMPROVEMENT

Opportunity for Improvement	Page
LANS should evaluate the reason why the WCCRF and TWF WSST's participation levels are so low in order to increase employee involvement.	8
Logistics should develop and implement a formal CSR training and qualification program to ensure the CSRs have a structured qualification process for continuity and success.	10
LANL should revise P300-1 to document assumptions and results of hazard analysis for all research activities and retain those analyses as part of the research records to reduce the need for repeated analysis of the same or similar activities.	12
LANL should capture the improved approach to CRA and MSA in a guide or manual to ensure repeatability.	12

I. INTRODUCTION

Established 35 miles northwest of Santa Fe, New Mexico in 1943 as part of the Manhattan Project, LANL covers approximately 40 square miles. Its single purpose was to design, build, and test an atomic bomb. Twenty months later, on July 16, 1945, the Manhattan Project successfully detonated an atomic bomb at the Alamogordo bombing range's Trinity Site.

Since its inception, the LANL mission has expanded to include a broad national security focus. LANL projects include nuclear nonproliferation and border security, energy and infrastructure security, and countermeasures to nuclear and biological terrorist threats. LANL also supports research and development in fundamental sciences, including:

- high-energy and applied physics and theory;
- high-performance computing;
- dynamic and energetic materials science;
- superconductivity;
- quantum information;
- advanced materials;
- bioinformatics;
- theoretical and computational biology;
- chemistry;
- earth and environmental science;
- alternative energy systems; and
- engineering sciences and application.

LANS manages and operates LANL under contract to DOE's NNSA. LANS is a private, limited liability company formed by the University of California, Bechtel, BWXT Government Group, Inc., and URS, an AECOM company. Each organization has experience in nuclear defense programs, scientific research and development, large-scale facilities management, applying science and technology to homeland security challenges, and safety and security. LANS assumed direct management and operation of LANL on June 1, 2006. LANS has a Board of Governors that oversees and governs LANS. The Board has an executive committee of three individuals appointed by the University of California and three individuals appointed by Bechtel. The Board includes five independent Governors with expertise and experience in fields pertinent to LANL operations, and four Advisory Governors.

LANS employs approximately 7,200 of the 11,200 laboratory employees. The primary responsibility of LANL, about 65 percent of its work, is assuring the safety and reliability of the Nation's nuclear stockpile.

LANS has had three external reviews by the Office of Enterprise Assessments (EA) in the past 3 years. The first review, conducted in July 2014 by the Office of Nuclear Safety and Environmental Assessments within EA, examined the integration of selected nuclear safety hazard controls identified in the Transuranic Waste Facility (TWF) Preliminary Documented Safety Analysis into the TWF design. The review focused on active safety systems, specifically, the fire suppression system (designated safety significant), seismic power cutoff system (designated as safety-class), and the associated supporting and interfacing systems. A second

review by EA in November 2014 evaluated the Weapons Engineering Tritium Facility's Safety Significant Fire Suppression System. A third external review by EA in August 2015 reviewed the Safety Significant Ventilation System and interconnected portions of the associated Safety Class Confinement System at LANL's TA-55 Plutonium Facility.

LANS reported over 300 occurrences in the 3-year period since the last VPP review. The majority of the occurrence reports involved Technical Safety Requirements and Unreviewed Safety Questions. Areas involving industrial safety and health include electrical lockout/tagout, physical injuries, and other incidents.

LANS contributed to the Americium release from the WIPP in February 2014. In May 2015, an arc-flash event occurred at TA-53 causing significant injuries to a worker. Finally, criticality safety has been a continuing issue for LANS. Investigations and evaluations for these events have identified a variety of corrective actions and needs.

LANS originally entered DOE-VPP as a Merit participant in 2010. After three annual Merit assessments, LANS finally achieved DOE-VPP Star status in 2014. Continued participation in DOE-VPP requires a triennial reassessment. Personnel from the Office of Worker Safety and Health Assistance (AU-12), within AU, and subject matter experts (SME) from the DOE complex conducted observations and interviews from September 12-21, 2017. This report summarizes the results from that evaluation and provides the Associate Under Secretary for Environment, Health, Safety and Security with the necessary information to make the final decision regarding LANS' continued participation in DOE-VPP as a Star site.

II. INJURY INCIDENCE/LOST WORKDAYS CASE RATE

Injury Incidence/Lost Workdays Case Rate (LANL LANS)					
Calendar Year	Hours Worked	Total Recordable Cases (TRC)	TRC Incidence Rate per 200,000 hours	DART* Cases	DART* Case Rate per 200,000 hours
2014	16,267,348	102	1.25	30	0.40
2015	17,911,674	106	1.18	26	0.30
2016	17,195,282	111	1.29	17	0.20
3-Year Total	51,374,304	319	1.23	73	0.30
Bureau of Labor Statistics (BLS-2015) average for NAICS** (5612, 5629, 5417)			1.96		0.92

* Days Away, Restricted or Transferred

** North American Industry Classification System

3-year TRC Incidence Rate: 1.23

3-year DART Case Rate: 0.30

Conclusion

While LANS' injury and illness rates continue to be below that for comparable industries and below the rates before its pursuit of DOE-VPP Star status, recent performance has plateaued. LANS experienced an unusually high number of fractures to employees' hands in the latest rolling 12-month data period. Seven of the nearly 100 cases involved a fractured bone, where an employee was "caught in, on, under or between" objects, such as doors or drums. In addition, workers experienced 11 additional recordable cases due to hand injuries mainly from lacerations. LANS recognizes that large incremental improvements, such as those experienced from VPP efforts, become harder to achieve as programs mature and performance improves. It is focusing on lower severity injuries trends, such as hand injuries, to drive additional improvements. LANS is encouraging personnel to pause or stop work when safety questions arise, training managers and supervisors to support personnel with safety issues, and challenging all laboratory personnel to incorporate human performance improvement (HPI) principles into every task.

III. MANAGEMENT LEADERSHIP

Management leadership is a key element of developing and sustaining an effective safety culture. The contractor must demonstrate senior-level management commitment to exceeding occupational safety and health requirements and meeting the expectations of DOE-VPP. Management systems for comprehensive planning must address health and safety requirements and initiatives. Elements of the management system include: (1) clearly communicated policies and goals; (2) clear defined assignment of responsibilities and authorities; (3) adequate resources; (4) accountability for both managers and workers; and (5) managers must be visible, accessible, and credible to employees. Authority and responsibility for employee health and safety must be integrated with the management system and must involve employees at all levels.

Since earning Star status in 2014, LANS has experienced several high profile events. In 2014, DOE determined that an Americium release from WIPP occurred because LANS improperly treated and packed several waste drums prior to shipment from LANL to WIPP. Although this was not the only factor, the release and subsequent identification of other at-risk drums significantly delayed the resumption of waste handling activities at WIPP, which led to LANL missing commitments to the State of New Mexico for removing waste. The May 2015 arc-flash event resulted in serious injuries to an electrician. Investigations by NNSA and EA identified failures in work planning and control related to electrical work. NNSA subsequently reduced the LANS award fee. In June 2017, LANS improperly shipped a quantity of plutonium via air rather than via ground transportation. Due to these (and other) events, NNSA announced in 2017 that it would not exercise the remaining optional extensions to the LANS contract. NNSA is planning to rebid the LANL operating contract, with the new contract being in place by October 1, 2018.

The decision not to exercise the remaining options on the LANS contract will create stress for the LANS workforce. As with any other contract transition, workers will be concerned about their positions at the Laboratory under a new managing contractor. Senior managers are trying to reduce the stress by encouraging workers to focus on their daily tasks, follow procedures, and avoid errors. Although most workers encountered by the Team have not yet begun to be overly concerned about the transition, they did express some trepidation. LANS managers have adopted a philosophy that focuses on the Laboratory, rather than the company, and are working to ensure a smooth transition to the new contractor. Experience in DOE-VPP with contract transitions suggests that LANS can better facilitate the coming transition by encouraging workers to identify improvements made over the last 5-10 years they believe the new contractor should retain. This proactive approach may help many workers quickly accept the new contractor, and help the new contractor earn the workers' trust.

LANS senior managers have always been committed to accomplishing the mission safely. Since beginning the pursuit of DOE-VPP Star status, these managers have learned many lessons about safety culture, human performance, and managing risk. Over the past 3 years, LANS senior Laboratory leaders have focused their efforts on getting workers to stop or pause work whenever there is a question about safety. Senior leaders are trying to understand where their blind spots exist. The plutonium-shipping event, in particular, was a bellwether event for the Laboratory Director and his direct reports. Most managers have focused their attention on the perceived high-risk work, not on routine work. A common thread to each of these events is a failure by

workers and their supervisors to recognize routine errors or conditions that led to the event. Senior managers do not make the detailed decisions at worksites, but must ensure supervisors and first line managers have the tools and processes to make good decisions. For the past 2 years, LANS has been collaborating with Lawrence Livermore, Lawrence Berkeley, and Sandia National Laboratories to develop training for first line managers and supervisors that helps them identify error-likely situations, trains them to intervene when conditions are not as expected, and assists workers in exercising pause or stop work. The Safety Academy for Excellence (SAFE) training provides first line managers with 2 days of immersive training that includes scenarios where they must decide which correct actions to take. Class attendees include research team leaders, maintenance supervisors, and operations supervisors. This training also helps personnel build networks across organizational boundaries and share experiences. LANS held its first training course at LANL during this assessment. Class size limitations will make it difficult for LANS to provide this training to all first line managers and supervisors, but the Associate Director (AD) for Environment, Safety and Health (ADESH) has expressed a desire to have at least 500 people complete the training before the current contract expires.

LANS has also developed an operational leadership model to help managers guide mission success, which includes safety. This model incorporates the guiding principles of Integrated Safety Management (ISM), VPP tenets, and HPI. The three components of the model that contribute to success are leadership commitment, employee engagement, and management systems. These components lead to essential behaviors that are needed to anticipate and prevent issues, as well as understanding and learning from events. The essential behaviors are communication and trust, continuous learning and recognition, and active involvement. LANS evaluates events, errors, or operational upsets using this model to identify appropriate corrective actions and address more underlying organizational, cultural, procedural, or systemic contributors.

LANS managers have embraced the value of manager visibility and presence in work areas and laboratories. LANS expects all managers to perform two to four management observation verifications (MOV) per month. These MOVs may include monitored evolutions where the manager observes an activity and provides immediate feedback or visits a work area and talks to workers. Some directorates require specific focus areas, such as conduct of operations, inclusion of workers or WSST members in the MOV, and MOVs in another manager's area. LANS intends these MOVs to help workers gain trust in managers, reinforce expectations for operational leadership, and give managers an awareness of conditions. Managers were positive about the benefits of these MOVs.

LANS managers support the WSSTs in helping LANS address broader issues and problems. All managers interviewed demonstrated a healthy working relationship with their WSST members and expressed appreciation for the WSST's contributions to solving issues. This improved relationship is leading to broader participation and enthusiasm for WSSTs and greater trust between managers and WSST members. The improved trust was evident during walkdowns and meetings observed by the Team, where workers were very comfortable speaking with senior managers about issues and problems. Workers did not avoid managers and were eager to share ideas or problems.

LANS has monitored this increasing trust through its annual site-safety culture surveys. While those surveys do indicate an improvement in trust, a portion of the population remains somewhat skeptical of managers' desire to hear about problems or stop work, especially when other production pressures exist. One exceptional practice by the Principal Associate Director for Capital Projects (PADCAP) is publishing two stop-work events in each weekly newsletter. PADCAP includes all the skilled crafts and maintenance workers. The director expects each manager to identify stop work events during the week and report them up the management chain. The workers executing the stop work are recognized and praised in the newsletter for their actions that prevented an incident, injury, or occurrence. Other LANS managers should identify similar opportunities as a means of gaining the trust of the remaining population of skeptical workers.

LANS managers have supported many improvement efforts that minimize or eliminate hazards at LANL (see Hazard Prevention and Control). LANS managers' investment in these projects, and subsequent cost savings and production increases, demonstrates LANS' commitment to continuous improvement.

LANS has begun using High Reliability Teams and increased its use of learning teams to review incidents. These incidents may not be high-level events or Occurrence Reporting and Processing System (ORPS) reportable events, but they do represent learning opportunities. The High Reliability Team focuses on HPI principles to identify improvements and create error-tolerant processes. The Team observed three different learning teams within the Logistics division that emphasized the "no blame" approach and focused on reviewing the event from the start of the day until the event occurred. The learning teams evaluated whether the worker(s) had production pressures, the right tools available, and the proper controls in place to address the hazards. The learning teams also considered alternate work methods to avoid the event. In addition to evaluating how to perform the work more safely, the learning teams provided an excellent platform for managers to demonstrate their dedication to performing work safely to the worker in a one-on-one personal environment.

Since the 2014 shipment of drums to WIPP that caused the Americium release, LANS has replaced many managers in its environmental management organization. These new managers have extensive experience in environmental management, and other technical areas necessary to manage the wastes. These new managers have gained workers' trust and respect and had a positive impact on the organization.

Conclusion

Despite having only 1 year left in the operating contract, LANS managers remain committed to safety and operational excellence at LANL. They continue to invest in improvements that ensure the long-term sustainability of LANL and provide Laboratory personnel with the people, processes, equipment, and resources necessary for safe and successful performance of its National security mission. Improvements since 2014 demonstrate the Management Leadership and commitment to continuous improvements expected for continued participation in DOE-VPP.

IV. EMPLOYEE INVOLVEMENT

Employees at all levels must continue to be involved in structuring and operating the safety and health program and in decision making that affects employee health and safety. Employee involvement is a major pillar of a strong safety culture. Employee participation is in addition to the right to notify 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 is welcome. Managers must be proactive in recognizing and rewarding workers for their participation and contributions. Employees and managers must communicate and collaborate in open forums to discuss continuing improvements, to recognize and resolve issues, and to learn from their experiences.

In 2014, the Team determined that Employee Involvement and participation in the LANL safety program had improved tremendously since the last review. Some groups continued to excel and take a much more active role than others. The managers' focus, coupled with employee participation, demonstrated a commitment to sustained improvement across the Laboratory. WSSTs had become more visible and provided value. Behavior-Based Safety (BBS) and HPI approaches were maturing and gaining acceptance, but some opportunities remained for improved participation. The use of BBS and HPI across LANL had successfully turned Employee Involvement into a strength that met the expectations for a DOE-VPP Star participant.

WSSTs continue to represent the primary vehicle for direct employee involvement. Currently, there are approximately 60 Facility and Directorate-level WSSTs at the Laboratory with several hundred personnel involved. WSST charters typically require members to serve for 2 years; a staggered membership replacement schedule ensures continuity.

In 2016, LANS recognized that the WSSTs were "stagnating"; and in response, LANS increased efforts to revitalize the WSSTs' involvement in Laboratory-wide issues. To assist that revitalization, LANS sought WSSTs' involvement in addressing larger site-wide issues, such as site-wide sign improvements, and traffic and pedestrian safety concerns. Team interviews and observations identified strong management support for the WSSTs. The Team noted good communication and interaction of senior managers with the WSST team members. The observed WSSTs were well organized with agendas prepared for each meeting, and the WSSTs kept notes to facilitate communicating their discussions to other workers. LANS also added a Student WSST to address the unique challenges students faced compared to the average LANL employee.

The Team observed a good example of the success of the WSST during the AD for Experimental Physical Sciences (ADEPS) Material Science WSST Committee meeting. The meeting was well attended by both upper managers and workers. The Team noted excellent communication among attendees and attendees willingly provided their opinions and observations. One WSST member identified that eight post-doctoral and graduate students had recordable injuries in the previous 6 weeks, an abnormally high number compared to previous injury history. The WSST held comprehensive discussions about the reasons for the increase. While learning teams had reviewed each injury individually, there had not been a comprehensive review addressing the trend. The WSST formed a new learning team to evaluate commonalities associated with those injuries. The WSST's recognition that the original learning team reviews did not prevent

additional injuries demonstrated their willingness to seek out the cause of safety concerns and improve safety. In addition, the willingness of the WSST team members to accept the responsibility to re-evaluate the previous learning team's results is indicative of an improved safety culture and a learning organization.

The Team observed one exception to the WSST's success during interviews with the AD for Nuclear High Hazard Operations (ADNHHO) and AD for Environmental Management workers located at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF) and TWF. The Team interviewed several workers who stated they were too busy to participate and several WCRRF personnel were not aware of what the WSST was or what it could do for them. Two employees interviewed at the TWF had participated in a WSST prior to transferring to TWF, but have not been involved since transferring. A review of the WSST meeting attendance records supported the workers' accounts and showed greatly reduced participation over the past quarter for the environmental management division's WSSTs. There are several potential causes for this reduced WSST participation, including production pressures, the planned transfer of the environmental management function to a yet unnamed contractor, and personnel turnover among workers. LANS should evaluate the reason why the WCRRF and TWF WSST's participation levels are so low and pursue opportunities to increase employee involvement.

Opportunity for Improvement: LANS should evaluate the reason why the WCRRF and TWF WSST's participation levels are so low in order to increase employee involvement.

The WSSTs strongly support the learning team approach initiated 3 years ago to address injuries, abnormal conditions, or issues of concern. Learning teams are a group of workers from an organization (WSST) formed to learn from events, and identify and follow up on improvement actions. This approach avoids blaming individuals and emphasizes improved processes. The Team observed three separate learning teams that demonstrated the value of the approach. In each of these cases, workers were comfortable discussing the facts of the event in question, identified contributing factors to the event, and offered comprehensive suggestions and solutions in conjunction with environment, health and safety (ES&H) personnel and HPI experts. ES&H and HPI personnel actively supported the process to seek improvements in the safety processes. The use of learning teams reinforces LANS' commitment to improved safety rather than assigning blame as the result of an event. In addition, the process strengthens communication among workers, managers, and safety personnel.

The Institutional Worker Safety and Security Team (IWSST) continues to provide a platform to raise and address WSST issues that individual WSSTs cannot resolve. The IWSST is composed of a chair, co-chair, management champions, voting delegates from the 16 Associate Directorates, SMEs, workers, and managers. The Principal Associate Director for Operations is the primary champion. The ADESH and the AD for Mission Assurance, Security, and Emergency Response are also champions. One champion participates in an IWSST meeting or activity at least once per month. The IWSST meets quarterly to address issues and coordinate assistance for Laboratory-wide solutions. Additionally, the IWSST invites all members of the WSSTs to the quarterly meeting. The Team attended the quarterly IWSST meeting. The IWSST leadership was well organized and structured and the presentations provided by various

WSST groups were informative. LANS broadcasts the IWSST and quarterly WSST meetings via LANL's internal communications media to all LANL employees. LANS also records the meetings and makes them available to all LANS employees on the internal network.

The IWSST sponsors several events. The most popular is the *WSST Fest*. This event provides a venue for WSSTs to present lessons learned, best practices from their organizations, and celebrate safety successes during the year. Approximately 4,000 workers from across LANL attended the 2017 *WSST Fest*. The theme for 2017 was *Sharing Successes*. The *WSST Fest* included multiple booths and included safety demonstrations involving glovebox safety improvements, appropriate use of high-voltage personal protective equipment (PPE) by LANL linemen, the dangers of tree branches near high-voltage transmission lines, and a distracted driving simulator.

The Worker Observations and Leadership Verifying and Ensuring Safety (WOLVES) is a Logistics employee behavioral observation process designed to reward safe behaviors and discuss at-risk behaviors. The WOLVES conduct peer-to-peer observations with no blame attributed to anyone. Managers continue supporting peer-to-peer observation awards. Awards consist of logo hardhats, Leatherman® pocket tools, flashlights, and tool bags. The WOLVES team created three safety videos, including one that reinforced the importance of pause and stop work.

The WOLVES program also builds teamwork and employee ownership of safe behaviors. Senior managers continue to serve in a coaching role, to remove barriers, and provide resources. The Logistics WOLVES recruited Union stewards to increase worker faith and support of the program. The Team observed a WOLVES meeting. During this meeting, the Division Director for Logistics told the WOLVES team members that he needs the WOLVES members to be his eyes and ears in the field. He needed them to: reinforce to the crafts that they need to maintain a safe work pace; encourage crafts to stop, think, and consider the 'what ifs' prior to performing work; and not to allow the crafts to be overworked with overtime to the point that compromised worker concentration that might result in worker performance errors or injuries. He stated this is the "funny time" at the end of the Fiscal Year where workers might get to work more overtime that might lead to fatigue, schedule pressures, and increased errors. Additionally, Logistics has added or replaced 400 or more workers in the past year. The Division Director considers these newer workers a risk because they may accept additional risks or unsafe conditions based on their work experience outside LANL and their limited exposure to LANL's safety culture expectations.

While participation (observations) in the WOLVES program continues to increase, the number of observations conducted has not met the Logistics' Safety and Security Improvement Plan (SSIP) goals. Logistics should evaluate its SSIP goals relative to WOLVES, identify the impediments that prevent reaching the SSIP goals, and identify appropriate incentives for workers that will encourage greater participation in BBS observations.

Logistics piloted the Craft Safety Representative (CSR) program over the past 3 years with one craft individual to test the programs' viability. The pilot was so successful that Logistics began negotiating with management and the Union to establish union consensus for the new position and additional funding to support expanding the program. In 2017, Logistics received

acceptance from the Union and LANS management to add four additional personnel to the CSR program. The CSR program selects craft personnel and provides them with safety and health training and improved communication techniques. The CSRs work in the field performing ES&H functions with a craft perspective.

Logistics' experience with the original CSR was so successful that workers enthusiastically supported expansion of the program. Logistics selected the four personnel for indoctrination into the process. Logistics has not yet established a formal training and qualification program for the CSR position. Logistics should develop and implement a formal CSR training and qualification program to ensure the CSRs have a structured qualification process for continuity and success.

Opportunity for Improvement: Logistics should develop and implement a formal CSR training and qualification program to ensure the CSRs have a structured qualification process for continuity and success.

Another noteworthy initiative, originally proposed 2 years ago by a new LANS employee, involved improving Laboratory-wide communication. Initially intended for just part of the Laboratory, the idea involved establishing a LANL Internet "Radio Station." After collaboration with the LANL Communications Office and procuring equipment, the LANL Radio went online in 2017. Broadcasts over the Laboratory's Intranet, LANL Radio provide popular music, intermixed with relevant safety and security messages. LANL Radio also has real-time broadcast capability that can alert workers to emerging issues, such as impending storms or fires. A regular feature titled "Safety Impressions" includes other announcements of interest. LANL Radio can also provide information, such as flu shot schedules, lessons learned, or traffic alerts to improve safety and security awareness. To reach more workers, LANS plans to produce a geographically limited phone application that would only function on LANL property.

Conclusion

Employee involvement in the LANL safety program continues to improve since the last review. In 2016, LANS managers recognized that the original approach to the WSST program was stagnating and limiting the growth of the WSSTs. In response, LANS revitalized the WSSTs by empowering them to resolve larger site-wide issues. WSSTs have expanded the use of the learning teams to improve their understanding of why an injury or abnormal event occurred without attributing blame to anyone. This expansion has improved workers' understanding of the events and provided for better one-on-one supervisor/worker communications. Logistics piloted the CSR program and added four CSRs to improve craft worker safety while conducting work. As a result, LANL continues to meet the expectations in the Employee Involvement tenet for continued participation in DOE-VPP.

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 control new hazards. Implementation of the first two core functions of an integrated safety management system (ISMS), defining the scope of work and identifying and analyzing hazards, form the basis for a systematic approach to identifying and analyzing all hazards encountered during the course of work. The results of the analysis must be used in subsequent work planning efforts. Effective safety programs also integrate feedback from workers regarding additional hazards; and include a system to ensure that new, or newly recognized, hazards are properly addressed. Successful worksite analysis also involves implementing preventive and/or mitigative measures during work planning to minimize the impact of such hazards.

During the 2013 and 2014 assessments, the Team determined that LANS' worksite analysis was maturing and the work control processes were improving. The Team noted improvement in the process and quality of hazard identification across LANL. However, in some cases, the use of an SME or a foreman in lieu of worker participation for integrated work documents (IWD) and technical procedure development resulted in a less than adequate analysis for those activities. LANL needed to continue working toward a sustainable industrial hygiene exposure assessment process across all Directorates for all applicable hazards. LANL developed hazard analysis tools, but not all areas of LANL fully implemented the tools.

Since the 2013 and 2014 assessments, LANS has made additional improvements to the IWM process. In January 2016, LANS transferred ownership of the Laboratory's IWM program to a group consisting of the ADNHHO and the Principal Associate Director for Science, Technology and Engineering (PADSTE). The move changed the ES&H organization's role from process owner to process support, and integrated IWM into operations at the Laboratory. A PADSTE team revised the LANS work planning and control document P300, *Integrated Work Management*, and associated documents. Changes included reducing the size of the P300 procedure, strengthening worker input in work planning, introducing HPI as a key procedure element with the reemphasis on pause/stop work, and the streamlining the language in work packages. Other changes included establishing an IWM Advisory Panel, placing additional emphasis on regular hazard evaluation of the work areas, and increasing the guidance on risk assessment. Process improvements to make the procedure more user-friendly included the streamlining of work package language, and including hazard screening questions in the IWM procedure.

Because of the physical size of the Laboratory and the multitude of laboratory organizations coordination of work activities is complex. The P300 IWM Advisory Panel recognized this complexity and reinforced the requirement to identify a single responsible line manager (RLM) and person-in-charge (PIC). The RLM, using the criteria from P300 and input from SMEs, determines the hazard level of the proposed work.

LANS relocated planning for research and development work activities from P300, *Integrated Work Management*, Attachment A, to a revised and separate document, P300-1, *Integrated Work Management for R&D*. P300-1 maintains the basic structure and approach to worksite analysis found in P300 and includes ISM principles, and customizes the process for research and

development (R&D). Like P300, P300-1 categorizes work as low hazard or moderate/high hazard by a hazard analysis team that includes SMEs performing hazard analysis for work determined to be moderate or high hazard. The hazard analysis review team's composition requirements are in Table 1 of P300-1.

Work is screened by the team using the four questions in P300-1, Attachment C, Table B-1. For low hazard work, a work control document is not required. Table 1 of P300-1 indicates that documentation of the hazard analysis is optional for moderate hazard work. Because documentation of the basis for protective measures that result from hazard analysis for low or moderate work is optional, limited information will be available for future reference by supervisors, SMEs, or workers. Consequently, when the work scope changes or work restarts after a protracted work stoppage, personnel might need to repeat hazard analyses to ensure worker protection. A review of the most recent LANL recordable injuries and illnesses cases found several instances where more rigorous hazard analysis and related protections might have prevented the incidents. LANL should revise P300-1 to document assumptions and results of hazard analysis for all research activities and retain those analyses as part of the research records to reduce the need for repeated analysis of the same or similar activities.

Opportunity for Improvement: LANL should revise P300-1 to document assumptions and results of hazard analysis for all research activities and retain those analyses as part of the research records to reduce the need for repeated analysis of the same or similar activities.

During work planning improvement efforts implemented in response to the 2015 arc flash event, the ADEPS introduced a Rehearsal of Concept (ROC) process to identify weakness or omissions in work planning and hazard identification. The ROC process is essentially a readiness review performed after work planning, but before the work begins. The ROC process identified several instances of work control scoping weaknesses and work package/process improvements (see Hazard Prevention and Control).

The Nuclear and High Hazard Operations directorate established a Joint Evaluation Team (JET) because of the TA-55 stand down in 2014 to improve the Contractor Readiness Assessment (CRA) and Management Self-Assessment (MSA) process. The JET process was piloted at the WCRRF with lessons learned applied to the TA-55 restart. While the previous LANS restart process met the DOE requirements for conducting readiness assessments, the JET effort improved that process and drove continuous improvement through worker involvement with the support of SMEs. The JET mentoring/coaching approach involved SMEs working hand-in-hand with facility workers to walk through procedures on the floor to ensure that the procedures work as written. In addition, SMEs may ask workers how they would respond to proposed upset conditions. The JET process ensures workers demonstrate a clear understanding of their responsibilities and knowledge of the process. This approach also builds worker trust in the process. LANS has successfully used the JET process in 60 other reviews since 2014, but LANS has not yet captured the JET process in a formal policy or procedure. LANL should capture the improved approach to CRA and MSA in a guide or manual to ensure repeatability.

Opportunity for Improvement: LANL should capture the improved approach to CRA and MSA in a guide or manual to ensure repeatability.

LANS has introduced other work planning improvements because of the events mentioned earlier in this report. LANS reinforced the guiding principles of ISM and the criteria from DOE-VPP and developed the concept of Operational Leadership. Through the Operational Leadership effort LANS is reducing risk by reinforcing the idea that line management is responsible and accountable, that employee engagement is critical, and that mission success depends on cooperation and communication.

Some of the improvements from the 2015 arc flash event include increased worker involvement in workscope development and planning; the use of more color-coded flagging, barriers and placarding; more formal work execution place keeping to aid in work coordination and control; and a reemphasis on the need to pause work.

Additional work planning improvements were implemented because of the plutonium shipping event. These include: the implementation of a two-person rule and physical locks for hazardous shipping labels and manifest documents; the transfer of the fissile material shipping function to the Associate Director for Plutonium Science and Manufacturing (ADPSM); and the revision of shipping work instructions, procedures, and training.

The Logistics division implemented the use of mobile electronic tablets to improve work package documentation, improve work package instruction and recordkeeping. The use of the tablet platform speeds delivery of work orders to planners and workers and streamlines work package closure. LANL has performed over 20,000 work orders using electronic work packages, which NNSA's Office of Safety, Infrastructure and Operations (NA-50) recently recognized with an Excellence of Operations award.

Workers interviewed indicated they know and understand the discipline system. Employees indicated that, with the new emphasis on safety, they would not hesitate to pause or stop work. The Team confirmed that there was adequate access to safety, health, and radiation safety professionals.

Conclusion

LANS has made many improvements to the P300 IWM worksite analysis processes. Those improvements include lessons learned from recent events. Recent improvements to LANS' readiness assessments ensure safe operations and readiness for startup activities. LANS continues to meet the Worksite Analysis expectations for continued participation in DOE-VPP.

VI. HAZARD PREVENTION AND CONTROL

The third and fourth core functions of an ISMS, identify and implement controls and perform work in accordance with controls, ensure that once hazards have been identified and analyzed they are eliminated (by substitution or changing work methods) or controlled using engineered controls, administrative controls, or PPE. Equipment maintenance processes must ensure compliance with requirements and emergency preparedness. Safety rules and work procedures must be developed, communicated, and understood by supervisors and employees. Everyone in the workplace must follow these rules and procedures to prevent, reduce the frequency, or limit the severity of mishaps.

In 2014, the Team identified that LANS 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 increased worker errors in implementing those controls. LANS built on its successes and encouraged 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.

Throughout the onsite assessment, the Team found many examples of the hierarchy of controls. One of the more notable worker-identified examples was in TA-22 that included an award-winning holding fixture redesign. The original fixture design used four Allen head cap screws that workers had to remove and reinstall for every fixture use. A single process production run required the removal and reinstallation of 480 screws. The improved award-winning fixture design replaced the screws with a clasp that reduced the ergonomic risk of a repetitive motion injury from the screw removal and reinsertion.

Employee suggestions and ideas also resulted in many additional hazard controls. For example, workers identified production process improvements during the readiness startup activities of the TWF that also enhanced worker safety. In one case, workers recognized the hazard presented by inadvertent equipment movement during waste handling operations due to a slight incline at the waste transfer location. Workers and supervisors jointly identified a new location for these waste handling activities. In another case, because waste containers can be stacked in varying configurations, some of which are unstable or waste space, workers identified a standardized waste container stacking array that avoids the hazards from rework and repeated container handling. Because of workers’ suggestions, workers began using hard hats when moving waste drums with lifting equipment.

Workers identified improvements in other areas of the Laboratory. For example, LANS has established an excellent ergonomics improvement program. This program’s goals are to reduce the risk of injury, improve productivity, reduce error rates, and improve worker comfort. One process began with a walk down of 105 different tasks suggested by WSSTs, managers, employees, and an ergonomist. These tasks were risk-ranked based on potential risk or actual ergonomic injury. Ergonomic improvements included purchasing better equipment for laboratory, production, and maintenance work and subsequent reductions in ergonomic-related injuries. In one laboratory, workers used an air bulb hundreds of time a day to blow air. Workers replaced the bulbs with an aquarium air pump and airline operated by a foot pedal. This

simple improvement greatly reduced hand and elbow strain caused by squeezing the air bulbs. In another laboratory, workers had to measure out and weigh small quantities of dust (chemical preparation). The operation required hundreds of repetitions, and 5-10 minutes per sample to complete. The project identified a commercially available dispenser that was very accurate, only took a few seconds to accurately weigh and dispense the material, and eliminated the repetitive motions. The project also identified replacing a mechanical arbor press with a pneumatic arbor press that was more accurate and eliminated hand, elbow, and shoulder strain for workers. Similarly, laser-measuring tools were substituted for measuring activities that used hand-held micrometers.

Several initiatives have contributed to cost saving and improved worker safety. One effort by the Nuclear and High Hazard Operations Support evaluated 65 loading docks and compressed-gas cylinder storage rack locations. Rather than purchase new vessels, the old or expired compressed gas vessels were reconditioned, tested, and returned to service. LANS installed light-emitting diode lamps and fixtures that last of tens of thousands of hour (50 time more than incandescent lamps) to decrease maintenance costs incurred from replacing incandescent lamps and reduce hazards from elevated work. Another notable practice involved workers videotaping critical maintenance work activities and using those videos as training aids to ensure new workers execute critical work steps as planned.

Because of continued events related to motor vehicle operation, LANS now purchases vehicles with backup cameras and continues to emphasize the use of spotters. A “How’s My Driving” bumper sticker program has also been resurrected. The program provides a vehicle number and phone number to report vehicle operation observations. Other motor vehicle safety program improvements include the installation and use of solar powered, radar-speed signs and dedicated crosswalk traffic lights at locations with high pedestrian traffic crossing roadways. LANS is also adding Global Positioning System tracking devices to government vehicles. These devices allow LANS to monitor driving practices and provide feedback directly to workers and their supervisors about unsafe practices (such as speeding).

LANL has a comprehensive occupational medical program. The LANL medical clinic staff includes a medical director, licensed occupational physicians, and nurses. Because a hospital is located just outside the LANL gates, the LANL medical facility primarily provides new hire and return-to-work medical evaluations, along with an extensive wellness program. A recent improvement to the existing wellness program, rolled out in August 2015, uses a commercially available program. LANL’s *Virgin Pulse* wellness program incentivizes employees and their spouses to participate in variety of activities to accrue points toward a monetary reward. Employees can apply up to \$100 dollars per year toward medical flexible spending or health savings accounts. By logging into the software application, workers can track their participation and apply for reward points. Employees earn points for exercise (e.g., steps measured by a fitness tracker), tracking eating habits, and annual wellness checkups. Through this and other awareness programs, LANS has reduced its employee medical costs and begun giving employees a one-month medical insurance premium “holiday” toward the end of the fiscal year.

The Occupational Medicine staff conducts regular worksite visits. Occupational physicians, nurses, and a physical therapist, who is also an ergonomic specialist, routinely interact with workers in their workplace to identify workplace hazards. A weekly peer-review committee that

includes the medical director, safety and health professionals, and case managers meets to discuss new and open work-related injuries and illnesses.

To reduce exposure from musculoskeletal hazards and repetitive motion illnesses, LANS employs an ergonomic team of 13 full-time, qualified ergonomic evaluators, a physical therapist and a PhD level SME. Awareness of the program's benefits is spreading as demonstrated by additional evaluation requests. The LANS ergonomics program focuses on areas that include push/pull/lift work, computer use, glovebox work, and general repetitive work activities. The program has both office and non-office practical laboratories that help employees understand ergonomic risks and risk reduction tools. The non-office practical laboratory has received increased attention from craft and labor organizations. Available ergonomic tools include electric-assist moving carts and ergonomically designed gas bottle handling tools. Overall, the program has helped reduce ergonomic injuries across the Laboratory.

As noted during facility visits, LANL has been purchasing and installing ergonomic equipment for non-office areas, such as sit-to-stand workbenches, anti-fatigue mats, and modified tools and tool handles for glovebox work. As discussed earlier, other ergonomic improvements range from providing microscopes with adjustable eyepieces and replacing squeeze bulbs with fish tank air pumps. LANL has taken advantage of office ergonomic improvements, such as portable standing computer stations and stools, and introduced them into the non-office ergonomic program.

Conclusion

LANS continues to improve its efforts to control hazards through the hierarchy of controls and employee involvement. The injury rates have been relatively flat over the past 3 years. LANS has experienced cost savings in medical costs due to a wellness outreach program that involves workers in their own health and wellness decisions, and reductions in the severity of injuries. LANS meets the Hazard Prevention and Control expectations for continued participation in DOE-VPP.

VII. SAFETY AND HEALTH TRAINING

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

In 2013 and 2014, the Team determined that LANS continued to improve safety and health training to ensure that employees could recognize the hazards of work and the work environment, and they could protect themselves and their co-workers. UTrain was a powerful tool that supervisors accessed to verify worker training prior to the start of work and notified the worker and supervisor prior to the expiration of training. The training emphasis at the Lujan Center aided the reopening of the center after a Technetium-99 contamination event. The production of safety and health videos led to a prestigious cinematography award.

LANS managers and workers continue their safety and health education through training courses and management development programs provided by LANS. LANS uses the UTrain computer system as the focal point of its Learning Management System. UTrain contains all available courses, identifies workers' training requirements, and tracks completion of training. Supervisors, PICs, and others can access their workers' training records to ensure training is complete prior to the start of jobs.

UTrain automatically e-mails reminders to workers and supervisors when training is nearing expiration, allowing ample time to renew the training. The LANS Nuclear High Hazard Operations group uses a "bolt-on" application called the Worker Quality Assurance System to UTrain, which allows facility managers and supervisors to verify training qualifications of workers not directly under their responsibility (such as deployed Logistics crafts),

All personnel at LANL receive annual training for emergency response to events such as fires, active shooters, natural phenomenon, or other events that would require workers to evacuate or shelter-in-place. This training consists primarily of online training modules. LANS identified a potential weakness with this approach in 2016 when a small fire on a building roof during roof replacement triggered a fire alarm in the building. The small fire was an expected event and workers installing the roof quickly extinguished it. Because a building fire alarm activated, most personnel quickly exited the building and went to their assigned muster locations. The building contains a sensitive compartmented information facility, and some workers in the facility were not familiar with emergency evacuation procedures. Many workers had not maintained their annual training. Since that time, managers for the area have placed additional emphasis on ensuring workers complete annual refresher training. LANS could provide additional emphasis on the importance of annual training requirements by linking workers' access to buildings to completing annual training.

The Logistics Division continues to use MTC to identify training process improvement opportunities. The MTC is a committee within Logistics, whose primary focus is to optimize training within Logistics to improve the division's performance to "world class levels of performance." The Logistics Deputy Division Leader chairs the MTC. The committee

membership consists of 14 members, including the Logistics Work Control Manager, Logistics Maintenance Programs Manager, Logistics Deployed Training Manager, two Maintenance Managers, two Work Execution Managers, two Work Control Team Leads, two Maintenance Coordinator Team Leads, and two Superintendents. The MTC meets quarterly to evaluate the status of the Logistics training and seek opportunities to improve Logistics training and qualifications program.

The MTC champions the Logistics MU program. The MU program provides interested crafts with the opportunity to expand their knowledge of specialized applications and systems voluntarily. The MU program includes training in areas, such as: Vibration Fundamentals, Vibration Analysis for Managers, Excel Basic/Advanced, Primavera Scheduling, Logistics customer service, and Infrared Thermography Level 1. These voluntary training courses assist craft worker to improve their knowledge base that expands their career potential and improves the safety culture for them. Nine hundred Logistics employees have taken advantage of the MU program.

Logistics developed the Associate Director for Project Management (ADPM) Organizational Leadership, *Conduct of Craft Supervision & Effective Communications Training*, and implemented the training in March 2016. The training's objective is to instruct ADPM craft leaders on their individual responsibilities and accountabilities for achieving LANL Organizational Leadership expectations on the proper conduct of craft supervision, effective styles of interpersonal craft communications, and the promotion of a safety conscious work environment that encourages employee involvement.

Logistics is implementing an HPI simulator. Located in the SM-38 building, the simulator is a room that contains several simulated maintenance areas with multiple error scenarios. These scenarios demonstrate real-time hazards in the workplace and reinforce craft workers' skills at identifying day-to-day hazards and potential errors in a controlled environment. The simulator includes electrical safety and scaffolding hazards. Logistics intends to expand the simulator's areas of focus as the program matures.

The LANS Training group director is the vice-chair on the DOE EFCOG's Training Working Group and routinely works with DOE's National Training Center and Department Training Institute (DTI) to coordinate training improvements and establish training reciprocity agreements across the DOE complex.

LANS has established the Radiological Control Technician (RCT) Academy in conjunction with HAMMER to train new RCTs. The RCT Academy tests all applicants' knowledge of general requirements prior to hiring. This has resulted in savings to the Laboratory by screening out unqualified applicants.

LANL has invested in several other training simulators to improve worker training. The LANS Training Group recently purchased a commercial "off the shelf" forklift simulator to ensure forklift operator training and proficiency without the hazards associated with driving an actual forklift. This simulator uses virtual reality (VR) technology and enhances the training experience. The Training group is in the process of purchasing an additional forklift training simulator VR capability and feedback (vibration) modes to improve the training. A mobile crane

and overhead crane simulator training systems has also been procured. Industrial Training International (ITI) developed the simulators; LANL is working with ITI to develop additional software scenarios to improve the training's realism.

LANS is evaluating a commercial software package called *Articulate Storyline* that allows workers to access previous training module elements online anytime they wish. This provides the worker the opportunity to review past training anytime from their desktop or mobile tablet prior to performing a work task that they may not have performed recently.

LANS is collaborating with three other National laboratories to provide safety culture improvement training to supervisors and first line managers. This training will help supervisors and managers positively affect safety culture by enhancing leadership skills and behaviors. The training introduces HPI elements in a simulated approach to operational leadership alongside peers from other laboratories, including Lawrence Berkeley, Lawrence Livermore, and Sandia National Laboratory. The overall goal is to improve its safety awareness and attention to detail, improve relationships, and build trust so personnel have no qualms asking questions, pausing work, or stopping work for safety reasons (see Management Leadership).

Conclusion

LANS continues to improve the safety and health training program to ensure that workers and managers recognize work place and environmental hazards. The Logistics division's MTC identifies training process improvements. The MTC champions the Logistics MU program, which helps interested crafts people expand their knowledge of specialized applications and systems for their career development and increase their safety knowledge. The LANS training group is developing improved training for their workers through collaboration with the DOE Energy Facility Contractors Group (EFCOG) Training Working Group, National Training Center, Department Training Institute, Volpentest Hazardous Materials Management and Emergency Response Federal Training Center (HAMMER), and several other National Laboratories. As a result, LANS meets the Safety and Health Training expectations for continued participation in DOE-VPP.

VIII. CONCLUSIONS

LANL is a large, complex organization performing many hazardous research and development tasks that support national security, basic science, and other critical governmental functions. The infrastructure necessary to perform this work resembles a moderately sized municipality with a diverse population that includes highly educated researchers, skilled crafts people, and basic laborers. Since beginning its pursuit of the DOE-VPP Star in 2006, LANS has evolved into an institution that demonstrates its commitment to performing its hazardous mission safely. Workers no longer treat safety as an addition to the research work, but integrate safety as a mission enabler for that research. Despite this progress, LANS has had a contributing role in a few very high profile incidents. Rather than treating these incidents as isolated errors, LANS has used these incidents to learn and further enhance safety and prevent recurrence. Over the past 3 years since earning the DOE-VPP Star, LANS has expanded its efforts to engage employees in the difficult issues that arise and has used worker suggestions to drive further improvement. The Team recommends that LANS continue to participate in DOE-VPP at the Star level.

Appendix A: Onsite VPP Assessment Team Roster

Management

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