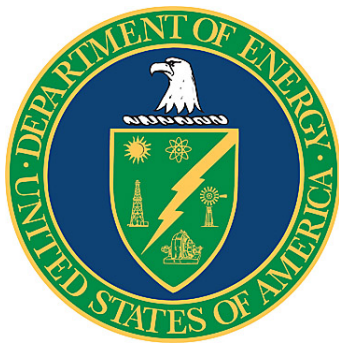


Pacific Northwest National Laboratory Battelle Memorial Institute

**Report from the Department of Energy
Voluntary Protection Program
Onsite Review
November 3-12, 2015**



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 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'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, 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 available 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 Battelle Memorial Institute at the Pacific Northwest National Laboratory (PNNL) in Richland, Washington, from November 3-12, 2015, and provides the Associate Under Secretary for Environment, Health, Safety and Security with the necessary information to make the final decision regarding PNNL's continued participation in DOE-VPP as a Star site.

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ABBREVIATIONS AND ACRONYMS

AnovaWorks	AnovaWorks, PLLC
AU	Office of Environment, Health, Safety and Security
BLS	Bureau of Labor Statistics
Battelle	Battelle Memorial Institute
BSF	Biological Sciences Facility
CFR	Code of Federal Regulations
CMS	Chemical Management System
CPP	Chemical Process Permit
CSC	CSC Hanford Occupational Health Services
CSM	Cognizant Space Manager
CY	Calendar Year
DART	Days Away, Restricted or Transferred
DOE	Department of Energy
EHSS	Environment, Health, Safety and Security
ELM	Enterprise Learning Management
EMSL	William R. Wiley Environmental Molecular Sciences Laboratory
F&O	Facilities and Operations
FUA	Facility Use Agreement
HAS	Hazard Awareness Summary
HCL	Hazardous Chemical Level
HDI	How Do I
HF	Hydrofluoric Acid
HR	Human Resources
ICAM	Identity, Credential and Access Management
IOPS	Integrated Operations System
ISMS	Integrated Safety Management System
JETS	Job Evaluation and Training System
JPP	Job Planning Package
LOLA	Laboratory Operations Leadership Academy
LOSA	Laboratory Operations Supervisor Academy
LSOC	Laboratory Safety Operations Council
NAICS	North American Industry Classification System
OSHA	Occupational Safety and Health Administration
PNNL	Pacific Northwest National Laboratory
PPE	Personal Protective Equipment
PSL	Physical Sciences Laboratory
RFID	Radio Frequency Identification Device
ROSA	Research Operations Supervisor Academy
RPL	Radiochemical Processing Laboratory
S&H	Safety and Health
SME	Subject Matter Expert
Team	Office of Environment, Health, Safety and Security DOE-VPP Team
TET	Travel Emergency Team
TIS	Training and Informational Services
TOR	Technical Oversight Representative

TRC	Total Recordable Case
VPP	Voluntary Protection Program
WET	Worker Eligibility Tool
WS&H	Worker Safety and Health

EXECUTIVE SUMMARY

The Office of Environment, Health, Safety and Security's Department of Energy (DOE) Voluntary Protection Program (VPP) Team (Team) recommends that the Pacific Northwest National Laboratory (PNNL) continue participation in DOE-VPP at the Star level. In the 3 years since the last onsite assessment, safety and health programs have become more effective and efficient. Battelle Memorial Institute's (Battelle) emphasis on Simultaneous Excellence and Operational Excellence models is supporting a laboratory management structure and culture that understands safety as a prerequisite for good science and mission success. PNNL is leading or actively engaging in effectively managing risk to accomplish its scientific goals. PNNL has created a predictive model for institutional risk that is helping PNNL focus its managers on projects that pose the highest risk to the institution. PNNL continues to provide the necessary resources to incorporate safety at the beginning of a project.

Battelle has operated PNNL for DOE and its predecessors since 1965. Located in Richland, Washington, PNNL is one of 10 DOE National Laboratories managed by DOE's Office of Science. Funding for work at PNNL comes from a wide variety of sources, including DOE's Office of Science, the National Nuclear Security Administration, other Government Agencies, private industry, and academia.

Recognition in the DOE-VPP requires an onsite review by the Team to determine whether the applicant's continuing performance deserves DOE-VPP Star recognition. The Team conducted the onsite review of PNNL from November 3-12, 2015. The Team had contact with many employees, managers, and supervisors, either formally or during observation of field activities.

The total recordable case (TRC), and days away, restricted or transferred (DART) case injury rates at PNNL have increased slightly over the past 3 years, and that trend is continuing through calendar year (CY) 2015. A review of the total number of all reported injury/illness events, regardless of classification, for the period of CY12 through CY15 year-to-date indicates that 40 percent of the cases involved PNNL craft/trade staff. This population represents less than 10 percent of the workforce. The craft/trade staff injuries also accounted for 47 percent of the total number of TRC cases and 64 percent of the total number of DART cases during the same period. Also, craft workers account for 41 percent of first-aid cases. PNNL has begun several efforts to address the increasing injury rates, such as a stretch and flex program, and targeted ergonomic improvements of work controls. Overall, PNNL is below the national scientific and research TRC and DART rates. PNNL does not offer any incentives tied to accident or injury rates. The slight increase in accident injury rates indicates that PNNL should refocus employees' attention to daily safety, health, and operational excellence.

PNNL subcontractors experienced high TRC and DART rates in 2012 and 2013. In those years, the majority of subcontractor work was related to facility modifications and maintenance, particularly construction trades. Comparing the subcontractor rates against the construction industry in those years, the PNNL rate was above the construction industry rate (3.9) in 2012, and (4.2) 2013, but below the rate (3.8) in 2014.

PNNL continues to provide multiple avenues for employees to submit concerns. Laboratory support for employee involvement in safety committees, community outreach, wellness programs, VPP regional and national activities, and the Hanford Safety Expo remains strong. PNNL has an extensive employee recognition program.

PNNL has improved its work control process to better include the hazard analysis. Other improvements include installing site-wide Wi-Fi that enables electronic access to the Integrated Operations System, hazard analysis, controls, and other electronic documents by Cognizant Space Managers (CSM) and researchers. PNNL has begun to analyze ergonomic hazards and provides solutions to reduce joint and body stresses.

Since the last review, PNNL's training program moved from the Human Resources Division to the Environment, Health, Safety and Security Division to align with the health and safety core organizations. In connection with the change, PNNL reorganized the Training Department. A review of the training material eliminated redundancies, improved course material, and saved over \$500,000. The Training Department effectively tracks training, administers Web-based training courses, and manages PNNL's training requirements. PNNL provides specialized training, such as the Laboratory Operations Leadership Academy and the Laboratory Operations Supervisor Academy (LOSA), to expand manager skills. It is also developing a course to focus on research operations.

TABLE 1
OPPORTUNITIES FOR IMPROVEMENT

Opportunity for Improvement	Page
PNNL should refocus employees' attention to daily safety, health, and operational excellence in everything at PNNL.	10
PNNL should consider including glove thickness in CPPs when identifying gloves as PPE.	13
PNNL should encourage the HR and WS&H staff to collaborate regarding decisions and program changes related to their shared responsibilities for the wellness program and ensure decisions are consistent with PNNL employees' needs.	19

I. INTRODUCTION

Recognition in the DOE-VPP requires a triennial onsite review by the AU DOE-VPP Team (Team) to determine whether the applicant is performing at a level deserving DOE-VPP Star recognition. The Team conducted the onsite review of PNNL November 3-12, 2015. The Team evaluated PNNL's safety programs against the provisions of DOE-VPP. During the site visit, the Team observed all types of daily work activities, evaluated safety documents and procedures, and conducted interviews to assess the strength and effectiveness of PNNL's health and safety programs.

The Team had contact with employees, managers, and supervisors, either formally or during observation of field activities. Hazards associated with PNNL activities include potential radiological and chemical exposure, electrical hazards, elevated work, hoisting and rigging, and a multitude of other industrial hazards. Activities observed included: plan-of-the-day meetings, prejob briefings, dispatch work, planned work, construction activities, office work, research work, vendor operations, and maintenance work.

Battelle is the prime contractor for management and operation of PNNL. Battelle has operated PNNL for DOE and its predecessors since 1965. The Pacific Northwest Site Office oversees PNNL for DOE's Office of Science.

Located in Richland, Washington, PNNL is one of 10 DOE National Laboratories managed by DOE's Office of Science. Funding for work at PNNL comes from a wide variety of sources, including DOE's Office of Science, the National Nuclear Security Administration, other Government Agencies, private industry, and academia. PNNL:

- Provides the facilities, unique scientific equipment, and world-renowned scientists/engineers to strengthen the United States' scientific foundations for fundamental research and innovation;
- Prevents and counters acts of terrorism through applied research in information analysis, cyber security, and the nonproliferation of weapons of mass destruction;
- Increases the United States' energy capacity and reduces dependence on imported oil through research of hydrogen and biomass-based fuels; and
- Reduces the effects of energy generation and use on the environment.

PNNL has approximately 4,500 staff members and a business volume of about \$1 billion. At the main campus in Richland, Washington, PNNL manages a variety of laboratory facilities. For example, the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), a DOE Office of Science national scientific user facility, is located on PNNL's Richland campus. Other facilities are the Biological Sciences Facility (BSF), the Computational Sciences Facility, the Applied Process Engineering Laboratory, the Radiochemical Processing Laboratory (RPL), the Research Aircraft Facility, and the Physical Sciences Laboratory (PSL). PNNL also operates the Marine Research Operations Facility (including the Coastal Security Institute) in Sequim, Washington, and has satellite offices in Seattle and Tacoma, Washington; Portland, Oregon; and Washington, DC. Additionally, PNNL has personnel deployed around the globe conducting a variety of scientific and engineering missions.

II. INJURY INCIDENCE/LOST WORKDAYS CASE RATE

Injury Incidence/Lost Workdays Case Rate (PNNL Employees)					
Calendar Year	Hours Worked	Total Recordable Cases (TRC)	TRC Rate	DART* Cases	DART* Case Rate
2012	7,856,254	24	0.61	8	0.20
2013	7,474,301	28	0.70	10	0.26
2014	7,367,507	31	0.84	12	0.24
3-Year Total	22,698,062	83	0.73	33	0.29
Bureau of Labor Statistics (BLS-2014) average for NAICS** Code #5417 Scientific research and development services			1.2		0.5
Injury Incidence/Lost Workdays Case Rate (PNNL Subcontractors)					
Calendar Year	Hours Worked	TRC	TRC Rate	DART* Cases	DART* Case Rate
2012	21,984	2	18.20	1	9.17
2013	27,895	2	14.34	2	14.34
2014	31,348	0	0.00	0	0.00
3-Year Total	81,227	4	9.85	3	7.39
Bureau of Labor Statistics (BLS-2014) average for NAICS** Code #5417 Scientific research and development services			1.2		0.5

* Days Away, Restricted or Transferred

** North American Industry Classification System

3-year TRC Incidence Rate, including subcontractors: 0.76

3-year DART Case Rate, including subcontractors: 0.32

Conclusion

PNNL accident and injury rates meet the expectations for continued participation in DOE-VPP. TRC and DART case injury rates at PNNL have increased slightly over the past 3 years, and that trend is continuing through CY 2015. A review of the total number of all reported injury/illness events, regardless of classification, for the period of CY12 through CY15 year-to-date indicates that 40 percent of the cases involved PNNL craft/trade staff. This population represents less than 10 percent of the workforce. The craft/trade staff injuries also accounted for 47 percent of the total number of TRC cases and 64 percent of the total number of DART cases during the same period. Also, craft workers account for 41 percent of first-aid cases. PNNL has begun several efforts to address the increasing injury rates, such as a stretch and flex program, and targeted ergonomic improvements of work controls. The Team did not identify any incentives tied to

accident or injury rates. Overall, PNNL is below the national scientific and research TRC and DART rates.

PNNL subcontractors experienced high TRC and DART rates in 2012 and 2013. In those years, the majority of subcontractor work was related to facility modifications and maintenance, particularly construction trades. Comparing the subcontractors' rates against the construction industry (NAICS Code #238 for Specialty Trade Contractors) in those years, the PNNL rate was above the construction industry rate (3.9) in 2012 and (4.2) in 2013 and below the rate (3.8) in 2014. The DOE-VPP criterion is that the aggregate average for all PNNL and associated subcontractors for the previous year (2014 in this case) be at or below the comparison industry rate (NAICS 5417- Scientific Research and Development Services), which PNNL meets.

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 to meet the expectations of DOE-VPP. Management systems for comprehensive planning must address health and safety requirements and initiatives. 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) managers must be visible, accessible, and credible to employees. 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.

In 2012, PNNL managers demonstrated commitment to excellence in safety and health and recognized safety and health as a core business process. They had increased their visibility, credibility, and accessibility to laboratory personnel and dedicated the necessary resources to foster continued improvement. They supported broad involvement of laboratory personnel in safety and health improvements.

Since 2012, the Battelle Operational Excellence and Simultaneous Excellence models have matured and gained acceptance by PNNL senior managers. These Battelle corporate models define Battelle's desired cultural attributes based on leadership, risk management, continuous improvement, and engagement. Senior managers are highly attuned to Battelle's corporate expectations for safety as a precondition for conducting research, and a shared value among all PNNL staff. PNNL managers demonstrated a keen awareness of safety and health as a prerequisite to performing good science.

To promote corporate excellence, Battelle established several "communities of practice" among the laboratories it manages for DOE. PNNL actively participates in these Battelle communities of practice, particularly the Operations Community of Practice. The Operations Community of Practice is identifying and implementing consistent pursuit of operational excellence across all Battelle-managed laboratories. In connection with that, PNNL supports manager and supervisor training, such as the LOSA, and the Research Operations Supervisor Academy (ROSA) (currently under development), and the Laboratory Operations Leadership Academy (LOLA). These courses, taught at the Battelle Headquarters in Columbus, Ohio, or at PNNL and other Battelle-managed laboratories, help supervisors and managers develop additional knowledge and skills required to manage and lead in the research community.

A common theme among all managers interviewed by the Team was the belief that PNNL employees embraced a strong culture of reporting abnormal conditions, incidents, or accidents. PNNL managers encouraged and expected workers to identify issues and concerns, and report unusual conditions to the central point of contact. They monitored the number of calls to the central point of contact for trends, and investigated any changes in the number or frequency of calls. Workers interviewed at PNNL expressed a willingness to report unusual conditions and safety concerns without fear of reprisal from their managers.

Resources for safety and health are paid for through "chargeback and overhead stacking" on projects. Senior managers are working to keep these costs at reasonable levels to maintain competitiveness, but are not cutting safety and health support as a first step of reducing costs. Project leads and researchers do question the chargeback costs, but do not consider safety and health as a barrier to performing work. To support identifying safety and health as a mission

enabler, PNNL has implemented a number of improvements in its safety programs to ensure it appropriately manages hazards without placing unnecessary impediments to research. Those improvements include the following:

- PNNL evaluated all Environment, Health, Safety and Security (EHSS) training courses. PNNL removed content that was not essential to assuring safety and performance of the worker. PNNL also reduced the frequency of some required training to be more consistent with DOE and industry practices. With these changes, PNNL reduced training costs by an average of \$550,000 per year starting in fiscal year 2012.
- PNNL implemented a new system for managing chemicals. All chemicals were evaluated and placed in one of three hazard categories: low, medium, or high operational significance. PNNL reduced labeling and inventory controls on chemicals in the low category, which saved researchers substantial time and money by allowing them to focus on safety of higher hazard chemicals.
- PNNL implemented a radio frequency identification device (RFID) for tracking chemicals in 2015. RFID improves accuracy and reduces costs associated with tracking laboratory chemicals. The use of RFID technology also reduces the need to handle containers during the periodic inventory process making it safer. A staff member can walk into a laboratory, pull the trigger on a device, and immediately update the inventory without ever having to handle a chemical or search cabinets.
- PNNL revised its chemical process permit (CPP) procedure. Using the operational significance construct, PNNL only requires permits for high operational significant chemicals. This reduced the number of required permits from around 1,300 to less than 600. This saved money, time, and focused attention on the chemicals with the most risk.
- PNNL improved its electrical worker training courses by streamlining the content and clarifying which course(s) applied to the work being done.
- PNNL updated the electrical work permit process, changing it from a time-consuming manual form to an electronic form that can be processed in the field.
- PNNL combined three separate water safety programs into one. Boating safety, dive safety, and free swimming are now combined in the PNNL water safety program.
- PNNL combined ladder safety and scaffold safety with the working at heights program.

In 2013, PNNL self-identified a significant breakdown of its beryllium program. PNNL identified noncompliance with the requirements of title 10, Code of Federal Regulations, part 850 (10 CFR 850). It reported this situation and agreed to a consent order from the Office of Enforcement, within DOE's Office of Enterprise Assessments. In response to the issue, PNNL has improved its self-assessments of all its safety and health programs. It had been using a risk-based approach to program assessment, but in light of these issues, it performed an extensive self-assessment. This ensures that the data used to determine program risk and effectiveness is accurate and that critical controls are appropriately identified and monitored. Other improvements include clarifying the roles, responsibilities, authorities, and accountability for all safety and health programs. All managers interviewed by the Team were sensitive to the need to verify reported data on program performance and conduct additional management oversight of critical controls.

In 2012, PNNL was piloting a risk-based predictive model to grade its management and oversight of projects. Since then, that model has gained acceptance among managers as an effective way to manage risk at the project and workgroup level. That model uses identified high risk hazards, worker engagement survey data, and past operational experience to rank projects

and workgroups according to risk. Workgroup managers receive the results of this ranking annually, and use that data to make program or project adjustments to reduce the likelihood of significant events.

In 2015, Battelle appointed a new Laboratory Director at PNNL. The new director has reorganized portions of PNNL to create direct organizational alignment of PNNL with its customers, provide better accountability for project performance, and deliver service more effectively. Because of this reorganization, the Operational Systems Directorate has developed a comprehensive strategic vision to identify critical products and services, key customers and stakeholders, and implement a sustainable model of service delivery that helps managers establish an appropriate balance of resources and activities

PNNL uses its Laboratory Safety and Operations Council (LSOC) to monitor safety performance, identify safety issues, create safety improvements, and share lessons across the organization. The LSOC consists of the Laboratory Director, senior managers, operations managers, Directorate Safety and Operations Council chairs, and the VPP steering committee chairs, and meets every 4-6 months. The Team observed an LSOC meeting that included excellent participation between all members and the Laboratory Director. One particularly important conversation during the LSOC meeting involved potential intimidation of CSMs by principal investigators over implementation of safety requirements. CSMs are the primary people responsible for implementing safety and health requirements within laboratory spaces, and the concern was raised that principal investigators who bring large volumes of business to PNNL may not implement or follow safety requirements identified by the CSM. The Laboratory Director quickly stated his support for the CSMs, reiterated the need for line managers to get into the laboratories to support CSMs, and reinforced his personal policy of the need for PNNL to be frank with senior personnel that may think they “get a pass” because they bring lots of business and money to the Laboratory.

Since 2012, Battelle initiated a corporate process that benefits PNNL, known as *Continuous Commissioning*. This process involves a team assessment of operational capabilities and responses at Battelle-managed laboratories. Battelle uses the teams to identify operational issues before the issues harm the laboratory/institution, specifically seeking blind spots and issues that are discounted or overlooked. The teams also provides broad and rapid sharing of potential vulnerabilities and evaluates safety culture principles. The process is modeled after practices in the nuclear power industry and the nuclear navy.

In 2012, the Team recommended that PNNL managers should find ways to improve the Operational Excellence survey response rate. Therefore, PNNL modified the survey process to expand the response time and provided additional reminders to selected staff to complete the survey. As a result of those actions, PNNL has seen a modest increase in response rates from about 50 percent to about 60 percent.

PNNL continues to monitor vendors and subcontractors through the technical oversight representatives (TOR). TORs are trained and qualified to perform oversight of projects or vendor work at various levels appropriate for the type of work being performed. PNNL requires contractors performing major construction projects to use the PNNL Contractor Environment Safety and Health Manual to ensure compliance with DOE and PNNL requirements.

Conclusion

PNNL managers continue to demonstrate and lead a strong safety program. They provide the necessary resources to incorporate safety at the beginning of a project, not add safety to the project after it has been planned. PNNL managers understand, support, and implement the Battelle Operations Excellence and Simultaneous Excellence models as a necessary function that permits appropriate risk management in research work. PNNL managers demonstrate the expectations for Management Leadership in DOE-VPP.

IV. EMPLOYEE INVOLVEMENT

Employees at all levels must 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 and participate in open forums to discuss continuing improvements, recognize and resolve issues, and learn from their experiences.

In 2012, Employee Involvement had created a positive health and safety culture at PNNL. PNNL not only promoted employees' health and safety ideas at work, but also off-campus through many hours of community involvement. The Team recommended that managers should continue to empower their employees through their open communications at the VPP steering committee and safety meetings, and continue to recognize employees that contributed to the health and safety culture at PNNL.

The 2015 Team observed that PNNL employees at all levels continue to have open communication with their managers to promote a safe and healthy work environment. Employees indicated that they frequently bring issues to their managers, and felt comfortable doing so. This includes support for stop-work authority with no fear of retaliation by both managers and employees. In an effort to increase employee input and suggestions, PNNL changed its safety committees from Directorate Zero Accident Committees, to the Directorate Safety and Operations Council. These committees now address operational improvements, as well as safety issues. Some examples of employee suggestions adopted by PNNL include crosswalks, defined bike paths, improved lighting in parking lots, and bike repair stations.

PNNL continues to support multiple avenues for employees to submit concerns. Options include: submitting anonymous concerns through the PNNL employee concerns Website, submitting a written concern to a manager, calling a hotline, or e-mail. In addition to anonymous avenues, employees can discuss any issue with supervisors, contact the Hanford Atomic Metal Trades Council safety representative (both bargaining and nonbargaining employees), or contact the VPP steering committee representatives or other PNNL safety committee members. Other employee-involved committees include: the laser safety committee, the sealed source safety committee, the As Low As Reasonably Achievable committee, the beryllium advocacy committee, the chemical assessment committee, the institutional biosafety committee, and the integrated operations system (IOPS) advisory committee.

PNNL uses its workers to solve crosscutting safety issues, such as the worker safety and health lock and tag working group. In June 2015, PNNL created this group to recommend the best approach for implementing consistent and compliant lock and tag requirements. The charter identified 14 employees to resolve weaknesses in the PNNL system, including implementing lockout/tagout for nonelectrical hazards, long-term improvements, training, evaluating trends, distributing lessons learned, and developing a lock and tag self-assessment process. The working group consisted of craft personnel, researchers, managers, and affected workers. Discussions with the working group participants demonstrated that their managers supported the assignment to the working group, allowing workers to devote time and energy to produce a

quality product. Group decisions were submitted to a vote. If the group could not agree on a solution, the issue was elevated to senior management. PNNL is evaluating the results of the group's efforts and implementing recommendations.

As observed in 2012, the PNNL VPP steering committee meets monthly and consists of both bargaining and exempt employees. The steering committee is an informational resource to support the VPP tenets and develop solutions to issues. The steering committee publishes a monthly newsletter, supports open forums for employees to bring forward issues, participates in evaluations and outreach to other DOE sites to share safety and health information, and discusses mentoring other sites considering applying for VPP participation. As noted in the 2012 report, PNNL continues to send representatives to the regional and national Voluntary Protection Programs Participants' Association conferences. Attendees include representatives from the EHSS Division, scientists, technicians, and craft employees.

PNNL continues its community involvement through Team Battelle, including arts and culture, civic and community, education, and health and human services. As noted in the 2012 review, an employee can either participate in one of the many existing projects or submit a request for a new project to the Team Battelle advisory committee, many of which promote safety and health. PNNL also supports the local Hanford Health and Safety Expo held in Pasco, Washington. The event draws an estimated 80,000 people from the Tri-Cities area during the 2-day event.

PNNL has been presenting a safety road show since 2011. Originally, the road show focused on assimilation of the summer interns into the PNNL safety culture in a convenient and entertaining way. The road show is a gathering of subject matter experts (SME) who set up displays to convey information and answer questions from the summer interns. The road show occurs throughout the year at different locations to make attending convenient. PNNL renamed this event an "open house" to better reflect an expanded target audience to include interns and post-doctorate personnel, as well as new hires. The Team observed an open house, which included cochairs of the VPP steering committee passing out safety glasses, booths presenting bicycle safety tips, a 25-point home safety checklist, hazards of pressurized systems, environmental sustainability, biological and chemical hazards, electrical safety, emergency preparedness, distracted driving awareness, and ergonomics. The open house uses a survey card to track attendance. The card asks attendees to identify which booth is the most informative, which booth is the least, and improvements that individuals would like to see. Approximately 100 people attended the open house that the Team observed.

PNNL employees participate in wellness activities twice a year. Each event uses a wellness challenge theme to encourage participation. Employees can compete individually or as a team. The summer wellness event of 2015 had approximately 600 participants.

In 2012, the Team noted that, as a *thank you* to employees, PNNL held an annual VPP picnic. Approximately 1,600 employees attended the 2015 event that included former and retired workers. PNNL and vendors established safety booths at the picnic to provide safety, security and sustainability information to attendees. PNNL continues to support this event. In addition to thanking employees with a company picnic, PNNL has an extensive recognition program for employees at all levels. Individual performance awards are monetary with a range of \$150 to \$1,000 depending on the significance of the effort. Other laboratory awards include operational excellence, contributions to science, administrative excellence, and science and engineering awards.

PNNL's directorate level recognition includes "tokenology," business systems' "high-five," EMSL's director awards, energy and environment yearly awards, national security performance awards, operational excellence, and technology and deployment outreach awards. In 2012, the tokenology recognition was just starting. In this process, PNNL awards employees with tokens of appreciation that they use to purchase PNNL items, such as retractable lanyards, stress balls, tote bags, glass water bottles, and ball caps.

In 2012, the Team noted that PNNL implemented a new program to encourage telecommuting and enhance flexibility at PNNL. Telecommuting decreases PNNL's environmental impact, reduce workers' carbon footprint, and creates a more appealing workplace for current and future employees. The program would allow employees to work at least one day per week at home. PNNL staff told the Team that their initial goal was 40 percent of employees teleworking at least one day per week by 2020. For the past 2 years, the participation rate has held steady at seven percent. PNNL is reevaluating the teleworking goal and will submit a revised goal and tracking process to senior managers in December. The laboratory uses the teleworking numbers to take credit for its greenhouse emissions goal in support of DOE's sustainability efforts.

The slight upward trend in TRC and DART rates over the previous 3 years demonstrates that most worker injuries occur during routine tasks. PNNL identified an aging workforce as a contributor to this trend, but the Team believes worker complacency regarding controls for routine tasks may be a contributor. The Team observed multiple conditions or actions that indicate some worker complacency. For example, material was stored in areas clearly marked to remain clear in front of breaker boxes and electrical cabinets. Some workspaces were cluttered with combustibles and equipment. In one case, the Team observed an individual wearing inappropriate clothing (shorts) in a radiological laboratory. Although the one case was not itself a trend, other personnel in the laboratory were unaware that facility requirements specifically prohibited shorts, and no one challenged the individual. Although the Team observed many people using handrails on stairs, an equal number of personnel did not. The Team observed employees frequently ascending or descending stairs with their hands full when an elevator was close by. These observations, combined with the increasing trend of injuries during routine activities, indicate PNNL may be able to improve its injury rates by refocusing employees' attention to safety, health, and operational excellence in all activities at PNNL.

OPPORTUNITY FOR IMPROVEMENT: PNNL should refocus employees' attention to daily safety, health, and operational excellence in everything at PNNL.

Conclusion

PNNL continues to provide multiple avenues for employees to submit concerns. Laboratory support for employee involvement in safety committees, community outreach, wellness programs, VPP regional and national activities, and the Hanford Safety Expo remains strong. PNNL has an extensive employee recognition program. The Laboratory has not yet achieved the employee participation it desires for telework and is reevaluating the program and approach. Slightly increasing accident injury rates indicate that PNNL should refocus employees' attention on routine safety, health, and operational excellence. PNNL meets the DOE-VPP expectations for the Employee Involvement tenet.

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. 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 hazards that are encountered and include a system to ensure that newly recognized hazards are properly addressed. Successful worksite analysis also involves implementing preventive and/or mitigating measures during work planning to minimize the impact of hazards.

In 2012, PNNL employed multiple processes under IOPS to address hazards and develop controls. IOPS was a very robust system that provided user tools to CSMs. SMEs were available and engaged in helping CSMs and laboratory workers define hazards and identify controls. Workers demonstrated their awareness of hazards in their spaces, but some ambiguity existed in the documentation and implementation of controls. PNNL continued to implement new processes designed to improve management of hazardous substances and work activities. The Team recommended that PNNL should continue to improve its planning and approval processes at the activity level and ensure consistent expectations for work planning and control across the laboratory.

PNNL continues to use IOPS to identify and manage the hazards and controls of laboratory workspaces. Project managers use IOPS, building managers, CSMs, and SMEs (from the facility core team) to evaluate new project acceptance into a laboratory workspace. For instance, new projects may affect the facility use agreements (FUA). The FUA describes the approved activities for a facility and provides limits to analyzed hazards, such as chemicals and their permitted quantities in the facility. The FUA can also limit radiological and biological hazards. The FUA is linked to the Chemical Management System (CMS), which limits the ordering of chemicals and total quantities for a facility to the specifications in the FUA. If chemicals are not within scope of the FUA and/or approved in the CMS, they cannot be ordered without SME approval. Adjustments may be required to both documents after a hazard analysis and review of controls for the new project.

IOPS is an effective process to identify and analyze hazards from the variety of research work at PNNL. The CSM identifies and compares specific process hazards associated with new or changing activities against the IOPS database to document additional hazards and training requirements. If new projects are within the routine operating envelope of the workspace, the project may be accepted. When projects do not fit within the routine operating envelope, the project undergoes an activity review process to identify hazards that need mitigation.

The CSM is key to effective hazard identification and analysis in the laboratory spaces. CSMs interviewed by the Team were aware of the hazards, controls, and projects in their laboratory spaces. For some laboratories, such as BSF, PNNL has assigned a CSM as a full-time job, devoted to keeping up with inspections, projects, and controls in the laboratory.

The laboratory spaces visited by the Team had a hazard awareness summary (HAS) posted on the outside of the laboratory entrance, as well as the list of active users (researchers) and passive users (maintenance workers) of the space. The IOPS HAS refers to other documents that analyze

and define controls for hazards, such as a CPP. For example, the HAS for a BSF laboratory describes the operating envelope for the laboratory space. It also lists the hazards allowed in the laboratory that includes biological, chemical, and others. The biological hazards that were in the laboratory were appropriately analyzed to ensure identified controls adequately protected workers in the laboratory.

The General-Chemical work control document in “How Do I” (HDI) (PNNL’s Web-based portal for identifying requirements) provides information and controls for the use of chemicals. It is a graded assessment of chemical hazards that assigns hazardous chemical levels (HCL) of 1, 2, and 3. An HCL-3 is the highest level and requires a CPP prior to working with the chemical. CPPs are listed in the HAS. The Team reviewed PSL-522A-CPP-1537 for the use of 48 percent hydrofluoric acid (HF) solutions to clean substrates. The CSM, project manager, and the worker safety and health (WS&H) professional worked closely to analyze the hazards and develop the controls for HF. The recommended personal protective equipment (PPE) for this application is Silver Shield™ or nitrile gloves used in conjunction with outer Ansell ChemTech™ butyl gloves, but did not specify the thickness of the nitrile or butyl gloves. Since manufacturers offer gloves at various thicknesses, and multiple thicknesses are available throughout PNNL, it is possible for a user to select the wrong glove for this use. To strengthen the PPE requirement and avoid the researcher making a mistake on glove selection, PNNL should consider including glove thickness in CPPs when identifying gloves as PPE.

Opportunity for Improvement: PNNL should consider including glove thickness in CPPs when identifying gloves as PPE.

For Facility and Operations (F&O), PNNL continues to use ADM-016, *Work Control Procedure*, to analyze the work hazards involved with facility operations, maintenance-related services, and construction projects. ADM-016, *Work Control Procedure*, defines F&O work activities as either:

1. Dispatch: work performed by PNNL. The work hazards are identified and mitigated by utilizing controls found in HDI or IOPS. Controls include skill of the craft, hot work permits, zero energy checks, lockout/tag-out, etc.; or
2. Planned work: does not meet dispatch criteria and where two or more hazard controls must complement each other (interdependent) or be sequenced to safely mitigate the hazard of the work. It requires a job planning package (JPP) assembled by the planner, building engineer, or construction engineer with a clear scope, hazards and controls, details to perform the work, and supporting documentation.

Three types of planned work use a JPP. These include facility modifications projects, engineering and design projects, and work completed by contracts for PNNL. The Facility Core Team (consisting of the building manager, building engineer, safety and health, environmental compliance representative, fire protection engineer, craft workers, and others) works together to ensure the safety envelope of the FUA, State and Federal regulations, and documented safety analyses are considered and incorporated during the development of the JPP.

The F&O work observed by the Team was primarily categorized as dispatch work. Roughly 80 percent of electronic service requests are dispatch work; the remaining are planned work to include preventive maintenance, standard operating procedures, capital projects/contracting work

office, and TOR contracting work. The Team evaluated each of these types of work and agreed that the activities observed were well within the knowledge of the workers performing that work. Some of the work activities observed included preventive maintenance of pumps and oil level checks, cutting and machining of metal parts in the fabrication shop, prejob walkdowns by the crafts and SMEs, and a chemical glovebox window removal to install an oven into that glovebox. All activities were performed as dispatch work and the workers' knowledge and experience was adequate to safely perform the tasks.

The Team observed a construction project by a subcontractor to replace ventilation systems on a building roof. The construction JPP followed the PNNL *Contractor Environment, Safety and Health* manual and included a detailed job safety analysis that identified general and specific hazards of the project. Each of the hazards was addressed with appropriate controls. Some examples included stanchions connected with a flagged, high visibility rope surrounding the work area to keep workers a safe distance away from the edge of the roof. Roof access is via a permanently installed staircase instead of temporary scaffolding or ladders. Removal of the ventilation ducting required several methods to cut and remove the existing ducting, including a hand-held reciprocating saw or a portable band saw. Craft workers used leather gloves and safety glasses. After the duct was cut, the edges were covered with tape; and the duct was laid onto plastic sheeting and covered. Craft workers were careful to avoid contact with the inside of the duct, which potentially contained contaminants from past years of use.

PNNL continues to improve the IOPS system. Users query HDI to help them navigate to the appropriate work controls and procedures. The managers of the HDI software constantly ask the users for feedback to improve the interface. Users think HDI is well developed and answers their questions. Another improvement to increase the effectiveness of the IOPS system (and to go paperless) is the wireless infrastructure available on PNNL. It allows researchers to access IOPS (available on PNNL-issued laptop computers) for training criteria and laboratory hazard information from locations where the Wi-Fi is available. The *F&O IOPS Work Practices* remain required reading for F&O workers. Each of these improvements has made work planning and control more user friendly.

The WS&H Department assigns safety and health (S&H) personnel to the facility core teams for industrial hygiene and occupational safety support. The deployed S&H personnel are involved in the workspaces and work closely with the CSMs to solve issues and understand the hazards of the facility.

The WS&H Department is making improvements to its exposure assessments based on discussions with the DOE field office. WS&H is replacing the workplace exposure assessment, which relied more on professional judgement to determine exposures from potential hazards. The new exposure assessment report emphasizes documented exposures and data gathering. This approach is building a better technical basis for exposure estimates that can be applied to similar exposure groups and exposure banding.

PNNL attributes some of the rise in DART and TRC to the effects of an aging workforce and workplace ergonomic hazards. The occupational health SME oversees the ergonomic program, and WS&H staff performs office and targeted ergonomic assessments using a checklist and assessment tools. PNNL did realize the need for some specific industrial ergonomic assessments and contracted this year with a certified professional ergonomist. Based on direction from the WS&H staff, the higher risk F&O work of material handling and shielded facilities operator

work with hand activities were prioritized for the ergonomist. The following activities were assessed over a 3-day period:

Material Handling:

- Handling thick-walled 12”, 14”, and 16” diameter pipes used for containment;
- Handling bags of Ice-Melt® (salt) into transport devices for distribution across PNNL;
- Handling and delivery of boxes of paper to various buildings across PNNL; and
- Other activities that should be considered during workplace surveillance.

Hand Activities:

- Extensive use of manipulators; and
- Hot Cell streaming tests.

The ergonomist also provided training to the WS&H staff over a 2-day period to improve the application of ergonomic assessment tools. The ergonomic assessment and training is a good start to address ergonomic hazards and to reduce the strain on an aging workforce.

The Team visited several laser laboratories. Each laboratory had a posted HAS that contained laser use permits, CPPs, and identified the hazards of the workspace. In February 2015, PNNL contracted a recognized laser safety expert to review its program. Identified recommendations are in the PNNL Optional Tracking System. One issue identified in the report was the need for an accurate inventory of all lasers. During this assessment, the Team found a second identical laser in an EMSL laboratory that was not on the laser use permit, but was used for similar experiments. A second laser use permit was generated and added to the HAS during this assessment.

Conclusion

PNNL has improved its work control process by understanding the hazards through analysis. The IOPS approach to work control for laboratories proactively analyzes the hazards for activities allowed to be performed within each facility and laboratory and determines the majority of the laboratory work is within the skill of the researchers. While a few minor observations regarding some laboratory housekeeping issues and some ambiguity in the specificity of PPE recommendations related to appropriate glove use for HF were noted, most researchers were aware of the hazards present within their laboratories and understood the analysis that derived the controls required to perform safe operations. Site-wide Wi-Fi increases the use of notebook access to IOPS, hazard analysis, controls, and other electronic documents for CSM and researcher use. Although there is a rise in the injury rates, PNNL is analyzing ergonomic hazards and providing solutions to reduce joint and body stresses. PNNL continues to improve the analysis of its hazards to meet the expectations of Worksite Analysis for continued participation in DOE-VPP.

VI. HAZARD PREVENTION AND CONTROL

The second and third core functions of 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 addressed by the implementation of effective controls (engineered controls, administrative controls, or PPE). Equipment maintenance processes to ensure compliance with requirements and emergency preparedness must also be implemented where necessary. Safety rules and work procedures must be developed, communicated, and understood by supervisors and employees. These rules and procedures must also be followed by everyone in the workplace to prevent, control the frequency of, and reduce the severity of mishaps.

In 2012, the Team found PNNL continued to pursue improvements that strengthened its hazard controls hierarchy. The IOPS process needed some improvement providing detailed selection criteria for laser and chemical controls. The emergency management and the occupational medicine programs had been adapted and improved to better support PNNL employees.

PNNL continues to implement the proper hierarchy of controls. PNNL incorporated a new element of hazard elimination by using its Risk Hazard Analysis Process. This evaluates if proposed projects represent too high a risk to employees or the institution. Some project work has been refused based on that risk analysis.

PNNL continues to invest in engineering controls throughout its facilities. Laboratories are fitted with engineered controls, such as ventilated fumehoods. Workers in the PSL are performing organic chemical work in gloveboxes (some with inert atmospheres) to reduce explosion hazard potential. PNNL extended the vent stacks and replaced 60 fumehoods in the PSL to reduce exposure from exhaust hoods and boxes. PNNL installed ergonomic floor mats to reduce worker fatigue in some laboratories and installed new and updated equipment.

PNNL has also invested in engineered controls related to facility operations. For some facilities, PNNL has replaced outside fixed ladders used for roof access with traditional staircases to facilitate worker access and transport of materials to the roof. As discussed in the 2012 review, PNNL has continued to install fall protection barriers around routinely accessed roof equipment in lieu of installing costly anchor points and relying on individual fall protection.

As the last line of defense, PNNL incorporates the use of administrative controls and PPE to protect the workers. Administrative controls include frequent review and revision of laboratory procedures, the use of permits to ensure adequate hazard controls (i.e., lockout/tagout, chemical, energized work permits, etc.), and individually identified training requirements for access to spaces. PPE is required and described in the various analysis processes or identified in the workers' training. Team observations during the review determined most workers were aware of, and complied with, PPE requirements.

The PNNL *Emergency Management Plan* provides an overview of the emergency management program for laboratory-managed facilities at the PNNL site, the Hanford site, Sequim, and Richland. PNNL established the program to meet DOE Order 151.1C, *Comprehensive Emergency Management System*, as well as Federal and State regulations. PNNL performs approximately 70 drills per year ranging from tabletop exercises, fire drills and evacuations, to full participation exercises. Interviews with emergency management personnel demonstrated a proactive approach to the emergency management program and the methods used to meet the

program's expectations. For example, the emergency management program implemented an additional element to the communication notification system. PNNL purchased a commercial automated notification system that allows the PNNL emergency management program to communicate with its employees through texting (personal cell phone numbers) and allows for multiple e-mail addresses (whereas the original system was limited to work e-mail addresses) in addition to desktop pop-up alerts. This system greatly increased PNNL's ability to communicate with its employees and their families about imminent danger or emergency conditions.

The PNNL emergency management program performed several drills that challenged the programs and systems. Earlier this year, PNNL performed a "mutual aid" drill that included the Benton County, city of Richland, and the Hanford Fire Response teams. The drill simulated a low level earthquake on the Hanford site. While the damage simulated was minimal, the drill identified the complications associated with logistics and communications presented by the involvement of multiple response organizations on a limited access site, such as Hanford. Identified issues, included outside responders who were not familiar with the site layout and the communications systems that were not properly synchronized.

In addition, the emergency management program has implemented several new and innovative plans to address the continual challenges associated with government operations and ensure hazards at PNNL remain appropriately controlled during a government shutdown. For example, the PNNL *Government Shutdown Plan* outlines a detailed "process" (not checklist) for addressing the challenges with a government shutdown. The plan provides a method to evaluate the current rules and regulations so that PNNL managers will have the necessary information available to make informed decisions. The plan addresses the steps associated with facility shutdowns and the personnel who are essential to operate facilities with radiological significance that cannot be "turned off." PNNL managers need to be aware of these examples of potential impact to make informed judgements in the event of another government shutdown. Another section of the plan addresses the basis of a shutdown, such as a debt-ceiling shutdown versus delays in passing a spending bill. Each situation invokes differing legal government spending requirements and the attention to those details is indicative of the proactive approach applied by the emergency management program staff.

The travel emergency team (TET) program has been in effect for approximately 8 years and recently transferred to the emergency management program. The TET provides emergency response support to any PNNL staff on official travel that are involved in an emergency or disaster experience. The TET includes SMEs in specialties that equip them to effectively evaluate and address emerging situations. The TET SMEs are prepared to arrange for medical treatment, language translations, financial concerns, personnel extraction, and ensure clients' intellectual and physical property are properly accounted for in all travel situations. For example, the TET recently arranged to airlift a PNNL employee injured in a foreign country to a suitable medical facility to address that employee's health concern.

In order to strengthen its support of PNNL employees' safety while on foreign travel, the travel safety program is using a pilot commercial program (Stabilitas Ventures). This program provides real-time tracking of personnel across the globe, systematically analyzes developing geographical, political, and disaster issues, and synchronizes that information with the location of employees to alert and maintain communications with those employees to ensure their safety. Additionally, the program allows (in the event of an emergency) for PNNL TET SMEs to directly communicate with foreign-based employees to ensure their safety and, if necessary, to

provide a “geo-fence” that identifies safe and “no go” zones in and around the employee’s specific location. PNNL is evaluating the effectiveness of the program and will provide an assessment in the coming year.

As in 2012, the Team interviewed the radiation protection manager, observed technicians performing routine surveys, and toured the high-risk radiation facilities at PNNL. PNNL continues to perform most of its radiochemistry work in the RPL. Access control and radiation monitoring observed by the Team satisfies the intent of 10 CFR 835, *Occupational Radiation Protection*. The Team observed technicians and laboratory workers using good radiation assessment techniques and processes. Mobile survey instrumentation did not reveal any out-of-date calibration stickers, and all equipment was in good working order.

The current radiation protection manager has only been in that position for a short period. When assigned several months ago, the laboratory was dealing with a contamination event from an alpha-emitting source at RPL. To help recover from the event, he was in the facility daily. With the help of the technicians he was able to build an effective team to facilitate recovery. During an interview, the manager indicated his priorities in team building included, establishing trust and partnership between the workers and managers at the facility and the need to continue that effort with the remainder of the health physics workforce.

In 2012, PNNL switched to newer optical dosimeters that are more sensitive to low doses than the thermoluminescent dosimeters used at Hanford. The newer dosimetry is more effective for the significantly lower radiation doses encountered in the research environment. Due to the dosimetry change, PNNL established its own accredited dosimetry program through the DOE Laboratory Accreditation Program.

PNNL’s 2012 conversion from the CSC Hanford Occupational Health Services (CSC) occupational medicine contract to AnovaWorks, PLLC (AnovaWorks) is complete. AnovaWorks has continued its efforts to tailor its services to the needs of the PNNL workforce. PNNL established space for AnovaWorks in the Laboratory Support Building, which allowed access to the occupational medical program.

AnovaWorks provides foreign travel employees the prescriptions for any medicine required during foreign travel. In addition, they provide workers with any required immunizations and a travel medical kit. AnovaWorks provides all occupational medical exams, foreign travel consultations, injury/illness care, work restriction reviews, return-to-work evaluations, and seasonal flu shots.

In addition, AnovaWorks has expanded its services to include personal health services to all PNNL employees. These services include: free wellness checks, health education and counseling, immunizations, treatment for minor injuries and skin conditions, acute/minor illness checks, and self-limited illnesses and conditions. These clinic visits are free-of-charge for all PNNL staff.

PNNL has continued to implement its Well-4-Life program described in the 2012 review under WS&H Department; however, as of October 2015, the program responsibility was transferred to the Benefits Department under the Human Resources (HR) Division. This move was made in order to align the wellness elements with changes in the benefit plans. Well-4-Life program elements include wellness challenges, brown bags, and other staff engagement-related activities. WS&H will support the portion of the program aimed at lifestyle and disease management such

as pre-diabetes intervention, heart health, and tobacco cessation. Due to the transfer of the wellness program, it will be important to maintain communication between organizations to ensure the elements continue to meet the health needs of the PNNL employees. PNNL should encourage the HR and WS&H staff to collaborate regarding decisions and program changes related to their shared responsibilities and ensure decisions are consistent with PNNL employees' needs.

Opportunity for Improvement: PNNL should encourage the HR and WS&H staff to collaborate regarding decisions and program changes related to their shared responsibilities for the wellness program and ensure decisions are consistent with PNNL employees' needs.

In response to increases in strain-related injuries in the F&O Division, the WS&H Department also helped implement the F&O stretch and flex program by contracting with Kadlec Regional Medical Center to develop instructional videos and posters. With the introduction of the stretch and flex program, PNNL hopes to reduce strain injuries experienced by the F&O Division's employees.

Conclusion

PNNL continues to pursue improvements that strengthen its hazard controls and invest in those controls. The emergency management and the occupational medicine programs have been adapted and improved to better support PNNL employees. PNNL continues to meet 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 established to prevent exposure to hazards. Training for health and safety must ensure that responsibilities are understood, personnel recognize hazards they may encounter, and they are capable of acting in accordance with managers' expectations and approved procedures.

In 2012, the Team found that PNNL continued to make improvements to its safety and health training program. Training and Informational Services (TIS) made a concerted effort to consolidate redundant training and seek feedback on all classes. TIS was actively working with managers to streamline training and keep content relevant. TIS was updating classes to make refresher training more interesting and consolidating classes to reduce demands on employees' time. The Team recommended that PNNL should improve its training for cryogenic and laser hazards.

PNNL's training function moved to the EHSS Division from the Human Resources Division as of October 1, 2015. PNNL's rationale was that this reorganization aligns the Training Department with the core safety and health organization and the operational culture. It also allows closer contact with the many SMEs within EHSS.

The Training Department has recently reorganized and divided into three working groups: design, development, and deployment; eLearning and training technology; and training administration. The design, development, and deployment group is responsible for instructional training and is comprised of six full-time instructors and relies on SMEs for instruction of some courses (e.g., PNNL beryllium worker). Over 80 individuals are trained as either classroom instructors or classroom developers to supplement the full-time training staff in this group. The eLearning and training technology group is composed of three instructional designers and administers over 200 Web-based courses. The training administration group is composed of six training coordinators who are matrixed to each of the directorates. Training coordinators maintain the Enterprise Learning Management (ELM) system. The group also coordinates training through the Volpentest Hazardous Materials Management and Emergency Response (HAMMER) Training Center, including such courses as *40-Hour Hazardous Waste Worker* (000835), and *Basic Crane and Rigging Safety* (0003799).

The Training Department uses the PeopleSoft® ELM system to track training, administer Web-based training courses, and interface with several other PNNL systems, including the Access Control Enterprise System (ACES), Identity Credential and Access Management (ICAM), Computer Access Request System (CARS), Job Evaluation and Training System (JETS), Medical Surveillance Tool, and IOPS. The course catalog function of ELM provides course details, such as course abstract, creation date, minor update date, major revision date, duration, retrain requirements, prerequisites and mandate document, target audience, delivery method, as well as schedules for upcoming classroom courses for training that is administered through the department. A recent update to ELM included external portals to allow user training to offsite staff and laboratory visitors so that cyber security will not be compromised. In 2017, the proposed purchase of upgrade (ELM 9.2) will allow additional functionality improvements that will support a more project-based approach (as opposed to line hierarchical organization).

Staff who perform, supervise, or manage activities at PNNL are qualified to perform their assigned responsibilities based on education, experience, and training. PNNL prepares ELM training requirements for each staff member, combining required courses with other job-specific,

project-specific, staff development, and agreed-upon training. Training occurs in several formats: classroom, computer-based, Web-based, and on-the-job training. Development of new training is described in the HDI workflows: *Conduct Training*; *Quality Instructors or Developers*; *Design, Develop and Evaluation Training*; and *Identify, Schedule and Complete Training*. Changes to the training program are initiated because of administrative changes, operating experience, evaluations, incidents, and regulatory requirements or as identified by trainers, users, or managers.

Training requirements for work within IOPS spaces depends on the hazard interaction within the space. Passive users may enter the workspace, but may not interact with any of the hazards; active users are actively involved with the hazards. The CSM grants access for users of the IOPS space, authorizes the hazards the user may interact with (i.e., active versus passive), assigns formal training for those hazards, and assigns permit and procedure reading assignments as applicable.

On the 1st and 15th of each month, training coordinators send notifications to all staff for past due and currently due (due by the end of the month or not yet taken) classes. Upcoming classroom training notifications are sent up to 60 days prior to the retrain date. Training coordinators also send notifications to all managers when individuals have past-due training. Automated messages of training due can also come from ICAM and IOPS. This has been effective in maintaining PNNL's performance indicator above 90 percent on all required training and 95 percent for worker safety and health-related training courses.

Since the last onsite review in 2012, the Training Department completed a review of all the courses and required the owners of the training to review each course, eliminate redundant or unneeded courses, and strengthen and refresh other courses. This effort helped manage risk, keep the laboratory's safety culture strong, created efficiencies based on feedback from staff members, and resulted in a \$550,000 savings. The eLearning group recently completed a yearlong project to resolve inconsistency in the electronic courses so that course delivery is possible on any learning management platform. The organization has recently begun emphasizing just-in-time training rather than adhering to a rigid training schedule to be better able to respond to training requests to meet project needs.

The Team observed a Web-based *PNNL New Hire Orientation* (002350) and *PNNL Refresher Training* (002351), as well as classroom training *PNNL Beryllium Worker* (01551). Both Web-based training courses included links to lessons learned, videos, and Web-pages with additional information, which combined for an effective presentation. The *PNNL Beryllium Worker* course instructor is a part-time instructor who has medical issues associated with beryllium; the beryllium SME attended a portion of the class as a resource to answer specific questions. The instructor was knowledgeable and frequently provided time for questions, which allowed for good discussion. The beryllium SME, who was also knowledgeable, added information to the discussions concerning industrial hygiene sampling protocol and data. Information from both the instructor and SME was well received by the class.

PNNL offers many training opportunities for managers and leaders through mentoring and coaching, peer-to-peer relationships, and classroom learning. All new managers are required to take *Manager Readiness Training* (002600), which consists of a series of meetings with the Chief Operating Officer, the Operations Manager, and functional owners to ensure manager readiness. PNNL also develops leaders through the PNNL University, which has five 2-year programs: Advanced Leadership Program, Emerging Leader Program, Management Skills

Development, Project Manager Development Program, and Scientist and Engineer Development Program.

PNNL recently began participating in LOSA, held at Battelle in Columbus, Ohio, with personnel from other Battelle laboratories across the country. LOSA is a 2-day leadership development opportunity for front-line supervisors and uses a fast-paced, simulation intensive approach that integrates training, case-study discussions, individualized feedback, and cross-laboratory networking. Managers meet with the attendees prior to the class to discuss Battelle's safety culture principles; and after each class, managers meet to find out what attendees learned about themselves and provide support on personal development actions. Each class is limited to 20 individuals (5 from PNNL); 25 individuals have attended LOSA from PNNL. PNNL has developed a communication forum, and is developing additional training for the LOSA-trained supervisors, including generational differences, crucial communications, and other topics.

The research operations community of practice has been chartered with developing a ROSA course for front-line research supervisors across the Battelle-operated laboratories. It will be similar to the LOSA, which is primarily for front-line management and operations managers. ROSA will allow time for front-line research and development managers to gather in one location, learn from each other, from scenarios that are presented at training, meet the leaders and gain their perspectives on safety, and build a network among themselves for future lessons learned, and ongoing communications. The PNNL end goal is to further implement the Battelle Safe Conduct of Research principles and continue to enforce the safety culture built at the laboratories.

LOLA began approximately 2 years ago. and targets the development of senior managers throughout Battelle. It uses experience-based and situational learning opportunities, including one session titled "Leading in Crisis."

Because of the beryllium corrective action plan, the worker eligibility tool (WET) was improved. The tool was under the Training Department, but the responsibility for the tool transferred to the WS&H Department. WET is used to ensure that personnel are qualified to perform work based on the medical surveillance program and training. The tool's logic structure required modification to ensure that the system's data was correct. WET now ensures that predecessor training and equivalency training is included in the system. WET includes information on biological (e.g., blood-borne pathogens), chemical (e.g., beryllium), general (e.g., confined spaces, fire watch, etc.), and physical (e.g., lasers).

Conclusion

Since the last review, PNNL's training function moved to the EHSS Division from the Human Resources Division to align with the organization's health and safety core. A review of the training material eliminated redundancies, improved course material, and saved over \$500,000. The Training Department tracks training, and administers Web-based training courses. ELM interfaces with several other PNNL systems to efficiently manage PNNL training requirements. PNNL provides specialized training, such as LOLA and LOSA, to expand manager skills. They are also developing a new course, ROSA, to focus on research operations. PNNL meets the DOE-VPP expectations for the Safety and Health tenet.

VIII. CONCLUSIONS

The Team recommends that PNNL continue participation in DOE-VPP at the Star level. In the 3 years since the last onsite assessment, safety and health programs have matured and become more effective and efficient. Battelle's emphasis on Simultaneous Excellence models and Operational Excellence models is maintaining a laboratory management structure and culture that understands safety as a prerequisite for good science and mission success. PNNL is leading or actively engaging all these efforts, and effectively managing risk to accomplish its scientific goals. PNNL has created and implemented a useful predictive model for institutional risk that is helping PNNL effectively focus its managers on projects that pose the highest risk to the institution.

APPENDIX A

Management

Matthew B. Moury
Associate Under Secretary for
Environment, Health, Safety and Security

Stephen A. Kirchhoff
Deputy Associate Under Secretary for
Environment, Health, Safety and Security

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

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

Onsite VPP Assessment Team Roster

Name	Affiliation/Phone	Project/Review Element
Bradley K. Davy	DOE/AU (301) 903-2473	Team Lead Management Leadership
John A. Locklair	DOE/AU	Employee Involvement, Safety and Health Training
Brian A. Blazicko	DOE/AU	Worksite Analysis
Michael S. Gilroy	DOE/AU	Hazard Prevention and Control, Worksite Analysis
Larry K. Yearsley	DOE Richland Operations Office	Worksite Analysis
James B. Lovejoy	DOE Idaho Operations Office	Worksite Analysis, Hazard Prevention and Control
Karen Voisard	Navarro Research & Engineering, Inc.	Safety and Health Training
Bruce E. Hill	National Security Technologies, LLC/ Los Alamos Operations	Worksite Analysis, Hazard Prevention and Control