National Security Technologies, LLC
Los Alamos Operations
Voluntary Protection Program Assessment
June 15-18, 2015

Background

National Security Technologies, LLC (NSTec), is a joint venture between Northrop Grumman Corporation (managing partner), AECOM, CH2M HILL, and Nuclear Fuel Services. Headquartered in Las Vegas, Nevada, NSTec manages operations at the Nevada National Security Site (NNSS) and has satellite operations across the country, including NSTec/Los Alamos Operations (NSTec/LAO) located just within the county limits of Los Alamos, New Mexico. This facility consists of three levels, occupying 41,489 square feet of usable area. The lower level houses shipping and receiving, maintenance shop, machine shop, pulsed x-ray laboratory, and storage facilities. The main level, or entrance to the facility, has approximately 50 percent office space and the remainder contains laser, holographic, camera development, radiography, electronics assembly, radiometry, and fiber optic workspaces. The upper level houses mainly office space with only a few laboratories. The Department of Energy (DOE) National Nuclear Security Administration's Nevada Field Office provides oversight of, and direction to, NSTec/LAO.

NSTec/LAO teams with Los Alamos National Laboratory to support the Defense Experimentation and Stockpile Stewardship (DESS) mission. In that role, NSTec/LAO performs research and development activities and provides technical support for unique experiments and activities for NNSS and DOE National Laboratories.

NSTec/LAO has a workforce of approximately 80 people engaged in instrument design, data collection and analysis, prototype testing, and field operational support. A portion of DESS support provided by NSTec/LAO is design, fabrication, testing, and fielding of sophisticated diagnostic systems, such as ultra-fast, electro-optic imaging and high-speed recording systems for capturing fast transient signals. NSTec/LAO also provides custom data analysis software development, equipment calibration, historical data archival, report production, project management, and management of its facility and equipment.

DOE admitted NSTec/LAO to the DOE Voluntary Protection Program (VPP) at the Star level in 2011. Continued participation in DOE-VPP requires a triennial reassessment. Two team members (Team) conducted observations, interviews, and document reviews from June 15-18, 2015, to determine if NSTec/LAO continues to meet the DOE-VPP requirements and expectations as specified in the DOE-VPP Manual.

The Team is presenting its results and recommendation to the Associate Under Secretary for Environment, Health, Safety and Security (AU) in an abbreviated format because the facility and workforce are small, and the Office of Worker Safety and Health Assistance (AU-12), within AU, conducted an evaluation of the parent NSTec organization in February 2015. A report from the assessment of NSTec Nevada contains detailed descriptions of the NSTec corporate mission and management systems, as well as opportunities for improvement that include NSTec/LAO.

Results

NSTec/LAO has only had one recordable injury in the past 4 years, a significant reduction from the previous 4 year period evaluated in 2011. Per the DOE-VPP program documents, small contractors (less than 200,000 hours/year) may use the best 3 out of the last 4 years when comparing injury rates to industry. As such, NSTec/LAO's average total recordable case (TRC) rate and days away, restricted or transferred (DART) case rate are both 0. The Team did not identify any fear of reporting injuries, any improperly classified or unreported injuries, or any disincentives to reporting injuries (See Table 1).

NSTec/LAO is a small, integrated organization. A Senior Manager, who also acts as the Operations Manager, leads four section leaders and a Deputy Operations Manager. NSTec/LAO employs approximately 80 people, many of whom possess advanced degrees in scientific disciplines, engineering, or are experienced technicians. As part of the NSTec corporate structure, NSTec senior managers from Las Vegas, Nevada, visit frequently to observe and interact with NSTec/LAO personnel. The result is a strong, visible managerial presence.

NSTec/LAO managers establish an expectation that safe performance of work is crucial to mission success. They ensure all personnel have the equipment and facilities necessary to meet that expectation. Although limited safety and health personnel are immediately available at NSTec/LAO, NSTec Nevada provides support upon request, as well as periodic visits of subject matter experts (SME). These SMEs perform safety and health evaluations on specific topics, perform industrial hygiene sampling, and identify issues or necessary corrective actions.

Because safety and health resources must come from Las Vegas, Nevada, NSTec/LAO managers and workers depend heavily on their own knowledge and experience to design, develop, use, and enforce safety controls. In some cases, the safety professionals from Las Vegas are not adequately evaluating specific aspects of the safety and health program and not ensuring hazard controls are adequate. For example, one laboratory has a small linear accelerator that provides a pulsed X-ray source. The Team visited the laboratory and compared its observations with the most recent health hazard evaluation performed by an industrial hygienist from Las Vegas. The laboratory contains lead bricks stacked on the rack that supports the linear accelerator to shield personnel in offices on the level above the accelerator from X-rays. Laboratory personnel handle these bricks frequently to configure the accelerator and experiments. The lead bricks are painted, but the paint is chipping off, leaving large areas of exposed lead. Workers in the laboratory were not familiar with some aspects of the Occupational Safety and Health Administration's (OSHA) standards for lead programs, despite having completed Lead Awareness Training. The OSHA standard for lead requires documented air sampling results for lead that demonstrate workers are not exposed above 30 micrograms of lead per cubic meter of air (8-hour time weighted average) and implements additional controls, including medical monitoring if those sample results exceed that action level. Sample results for NSTec/LAO taken in 2011 were only surface swipe samples and did identify surface contamination above the NSTec corporate housekeeping limit. The industrial hygienist did not equate those surface sample results to potential airborne levels or collect air samples during lead handling activities, which OSHA requires to evaluate the need for medical monitoring. The most recent Health Hazard Evaluation performed in May 2014 did not address handling of lead bricks, did not reference the swipe sample results, nor did it recommend controls for handling the lead bricks. The health hazard evaluation had check boxes indicating a

number of controls were adequate, but did not provide any justification for that determination. For example, the health hazard evaluation determined that the shielding was adequate, but did not reference or include the analysis for that conclusion. The job hazard analysis in the work package identified handling the lead bricks as an activity and identified the coating on the bricks, but did not include any controls in the work package to inspect the coating or specify unacceptable conditions of the coating. Consequently, many bricks had coating that had chipped or was flaking. The initial Activity/Hazard Inventory Checklist identified that a Toxic Hazard Permit was not applicable before analyzing the lead hazard. Consequently, the controls were not adequate, and NSTec/LAO may be out of compliance with the OSHA lead standard. The local safety and health support staff and SMEs from Las Vegas did not identify these deficiencies. NSTec/LAO should ensure that health hazard evaluations include justification for conclusions that hazard controls are adequate, and ensure SMEs are reviewing programs and conditions in sufficient detail.

Opportunity for Improvement: NSTec/LAO should ensure that health hazard evaluations include justification for conclusions that hazard controls are adequate, ensure SMEs are reviewing programs and conditions in sufficient detail, and ensure workers understand the requirements of the OSHA Lead standard.

NSTec/LAO managers have challenged workers to identify improved methods of performing work. An example is the additional analysis and planning NSTec/LAO requires for moving heavy equipment (150 pounds or more). This policy resulted from an injury that occurred in 2013. In that case, a worker was attempting to move an optical bench weighing over 300 pounds. The optical bench fell over while on a forklift, crushing the individual's finger. NSTec/LAO performed its own formal accident investigation and identified multiple corrective actions. Implemented improvements included using commercial shippers for moving heavy equipment, using experienced riggers, and having a move plan. NSTec/LAO *Facility Safety Procedure*, OP-AA30.002, and the NSTec/LAO *General Laboratory Safety Procedure*, OP-AA30.003, now incorporate the move plan as a requirement.

NSTec/LAO issued the heavy equipment move policy approximately 1 year prior to this assessment, but some facility personnel were not aware of the policy. For example, NSTec/LAO has a laboratory that is developing and building a Muon Tracker, which weighs approximately 750 pounds. Personnel move this device frequently, both within the facility and between Los Alamos and a variety of other locations around the country. Despite these frequent moves, personnel responsible for the Muon Tracker were unaware of the local policy for a move plan and had moved the tracker from one location to another within the facility. In this case, although NSTec/LAO issued a new policy, it did not adequately evaluate all operations and existing work packages to ensure proper implementation. NSTec/LAO should ensure that it closely monitors policy changes affecting safety practices until the changes become fully understood and implemented.

Opportunity for Improvement: NSTec/LAO should ensure that it closely monitors policy changes affecting safety practices until the changes become fully understood and implemented.

NSTec/LAO managers are sensitive to schedule pressure and work to eliminate those pressures by appropriate planning. Managers encourage workers to step back, pause, or stop work until issues are resolved. Despite this encouragement, workers do not frequently stop or verify they are implementing correct safety controls or challenge their coworkers on more complicated activities. In a few cases, workers and managers alike may have become complacent regarding assumptions that activities are safe, and have not challenged existing practices. The Team observed some cases where personnel did not challenge assumptions or did not believe identified controls were necessary. The lead coating controls previously discussed demonstrated this condition. The Team identified another example of this condition observing workers use ethyl alcohol for cleaning optical components. Typically, workers spray or squirt a small amount of alcohol onto a cleaning tissue, then wipe the component. NSTec/LAO expectations for chemical safety require the user to wear safety glasses when handling ethyl alcohol, yet the Team observed workers using ethyl alcohol without wearing safety glasses. Workers believed the method they used did not present an eye hazard, and did not believe the control was necessary and could actually hinder them from performing work correctly and accurately. Rather than evaluate other methods of using ethyl alcohol that would remove the potential for eye injury, workers ignored the control, and managers and supervisors did not enforce the control.

NSTec/LAO should consider several approaches to eliminate worker complacency. For example, when performing job hazard analyses, NSTec/LAO should challenge workers and managers alike to use the hierarchy of preferred controls. They should begin with elimination of the hazard and then consider substitution, engineered controls, administrative controls, and finally, using personal protective equipment (PPE) as the last resort. For example, rather than spraying or squirting ethyl alcohol onto a cleaning tissue, workers might be able to use a shallow container to pre-wet the tissues, and eliminate or reduce the risk of eye injury, eliminating the need for safety glasses. Additionally, NSTec/LAO could analyze the lead shielding blocks previously discussed, and replace the blocks with thinner shielding mounted to the ceiling in the laboratory that would eliminate the need for personnel to move the lead shielding blocks.

Opportunity for Improvement: NSTec/LAO should review the use of PPE throughout the facility, evaluate the controls using the hierarchy of controls, and potentially reduce the dependence on PPE and avoid worker complacency.

Employees at NSTec/LAO continue to participate in the safety program primarily through the Los Alamos Safety Team (LAST). Though members can rotate annually, the current LAST members have been on the team for a few years. The team consists of the Administration and Facilities Manager, along with one representative from each of the sections. The LAST elects one member as a chairperson and normally meets monthly.

A review of the LAST meeting minutes demonstrated that members are aware of the routine safety discussions and the specific health and safety program requirements NSTec/LAO implements. Additionally, the Team attended the June 2015 LAST meeting and observed good discussions between members regarding specific safety conditions. One issue, in particular, demonstrated an inquisitive attitude by the chairperson. The chairperson has been pursuing information regarding blue light emitted by bright, light-emitting diodes used for camera characterization. When visiting the National Institute for Standards and Technology (NIST) last year, the LAST chairperson observed that workers at NIST wore yellow-lensed safety glasses

when working with blue light sources. Although there are no established standards for blue light exposure, the chairperson began asking questions about the potential hazards. Prior to this assessment, the chairperson pursued getting yellow lenses for workers in laboratories where blue lights are used. The Team reviewed one laboratory and recommended NSTec/LAO consider engineered controls (curtains, walls, workspace reconfiguration) as a more effective means to reduce potential worker exposure to the blue light.

The highly skilled and experienced workforce at NSTec/LAO represents both an asset and a challenge to NSTec/LAO. NSTec/LAO personnel are proud of their knowledge and accomplishments, as well as their excellent safety record. Despite this knowledgeable workforce, NSTec/LAO safety improvement efforts have focused on a rules-based approach to safety. NSTec/LAO might be able to achieve significantly greater employee involvement by challenging the employees to consider more intellectually stimulating approaches to safety. For example, NSTec/LAO employees have not received training in more advanced safety concepts, such as human performance improvement. NSTec/LAO should consider training employees on advanced safety topics, such as human performance improvement, as a means of engaging the workforce in pursuit of safety excellence.

Opportunity for Improvement: NSTec/LAO should consider training employees on advanced safety topics, such as human performance improvement, as a means of engaging the workforce in pursuit of safety excellence.

The value of employee involvement and attention to safety was particularly evident in the design and development of a new cluster computer at NSTec/LAO. This effort, led by one person, was a tremendous success. The individual considered applicable safety issues and integrated improvements in the computer design to eliminate hazards. For example, he designed the system with a removable power plug in each module that completely deenergizes that module for repairs and maintenance, allowing system maintenance without using lockout/tagout. He limited the height of the computer cabinets so personnel would not need step stools or ladders to work on system components. He changed the cabinet materials from steel to aluminum, reducing the weight of each module to less than 35 pounds so one person can lift each module. He specified reduced noise fans (40 decibels or less) for the cooling systems to reduce background noise for operators. Finally, he designed the system to work on normal 110-volt power, rather than higher voltage 3-phase power. Incorporating these changes not only reduced hazards, but also made the system less expensive to operate and maintain.

NSTec/LAO has been performing the same tasks, or closely related tasks, for many years. Consequently, the personnel understand the primary hazards within its facilities. It performs nearly all tasks under one of 23 work packages. NSTec/LAO reviews each of these work packages annually, and reissues the work package at least every 3 years. Each work package consists of several sections and follows the NSTec corporate work control process. Because NSTec/LAO follows the NSTec corporate work control process, the Team observed conditions similar to conditions observed at NSTec Nevada in February 2015. For example, hazard analyses did not include the analysis of the hazard that justified the controls. NSTec/LAO is not effectively using the hazard analysis process to evaluate the expected effectiveness of controls or evaluate the hierarchy of controls to eliminate reliance on PPE. The Team observed some hazards or controls that NSTec/LAO had not adequately evaluated. For example, to control

many laser hazards, several NSTec/LAO laboratories have an interlock system on the door. This interlock system has a button that a person inside the laboratory can push to allow the door to open for up to 20 seconds without shutting down the laser. In one laboratory, NSTec/LAO has an open beam Class 4 laser. Although unlikely, it is possible that opening the door could expose a person outside the laboratory door to incidental laser light in the event the laser fired while the door was open. NSTec/LAO had not evaluated this condition during work package development. NSTec/LAO should consider installing a curtain inside doors of laboratories to protect personnel outside the laboratories when workers override the door interlock.

Opportunity for Improvement: NSTec/LAO should consider installing a curtain inside doors of laboratories to protect personnel outside the laboratories when workers override the door interlock.

In addition to the interlocks associated with laser and X-ray systems, NSTec/LAO has several other engineered controls. For example, NSTec/LAO requires personnel to use reduced power lasers for system alignments, and several optical benches include shields, curtains, or boxes to prevent incidental exposure to laser flash. LAO has also developed special lifting equipment for moving some heavy equipment, such as large zoom lenses, and the Muon detectors previously discussed.

NSTec/LAO also uses many administrative controls, such as postings on laboratory doors, work packages, and training, to control hazards. In one case, the Team observed NSTec/LAO's laser safety key control program was not an effective engineered control, but administrative controls masked the weakness. Class 3B and 4 lasers in use at NSTec/LAO require keys to operate the laser, intended to be an engineered control to ensure the user only operates the approved laser. Laser users must check out a key from the laser safety officer and return the key when finished using the laser, or at the end of the week. The user may retain the key over the weekend with permission from the laser safety officer. The laser safety officer verifies the person is qualified to operate the laser before issuing the key. Further inspection identified that multiple lasers from the same manufacturer all use identical keys. Therefore, key control does not limit the user to only using the approved laser, but instead relies on the individual's training and knowledge to prevent unapproved laser operation. To improve the reliability of the laser key control program, NSTec/LAO should work with the laser manufacturers and vendors to ensure each laser in the facility has a unique key.

Opportunity for Improvement: To improve the reliability of the laser key control program, NSTec/LAO should work with the laser manufacturers and vendors to ensure each laser in the facility has a unique key.

NSTec/LAO relies on PPE in a variety of situations based on national standards, such as eye protection for laser hazards. NSTec/LAO provided special glasses for some laser use that provides effective protection in the frequency of a high-powered laser. Previously, users of that laser had to wear extremely dark glasses for protection. Personnel had restricted vision with those glasses and would partially or completely remove the glasses to perform work. The new glasses allow users to see in other visible spectra while protecting them from the high-powered laser. This encourages users not to look around the safety glasses to perform work.

For other hazards, the controls were much less specific in the job hazard analyses. In particular, the job hazard analyses often used terms like "appropriate gloves" and "appropriate eye protection." These terms leave the decision on appropriate controls to the end-user, potentially without the benefit of understanding the assumptions and limitations of the PPE in relation to the hazard. NSTec/LAO should specifically identify the appropriate controls in its job hazard analyses and work packages.

Opportunity for Improvement: NSTec/LAO should specifically identify the appropriate controls in its job hazard analyses and work packages.

LAO has made efforts to reduce ergonomic stress, including providing ergonomic mats in some laboratories, providing ergonomic desk chairs, performing periodic reviews by an ergonomist from Las Vegas, and establishing limits on lifting equipment. To improve implementation of lifting limits, LAO should consider posting the weight of heavy items on the item itself when it arrive at the facility. This would be particularly useful for spools of fiber-optic cables, special equipment, or other items that personnel might move by hand.

Opportunity for Improvement: LAO should consider marking the weight of heavy items when the items arrive at the facility.

NSTec/LAO continues to have an effective safety and health training program. In 2011, the Team determined that NSTec/LAO was having difficulty getting training updates into the corporate Plateau learning management database. Since 2011, NSTec Nevada has been effective in receiving, updating, and providing training updates to NSTec/LAO.

NSTec/LAO participates in the NSTec Corporate *Learning as Leadership* program. In this program, current and potential managers participate in a variety of assessments, training, and mentoring opportunities to build their personal leadership skills and improve the corporate culture, including safety.

Since 2011, NSTec Nevada has provided more corporate training to NSTec/LAO through use of video teleconferencing. This training approach provides instructors with a face-to-face link with students, allows students to address questions directly to the instructor, and can be more effective than computer-based training.

Conclusions

NSTec/LAO has a small, integrated workforce that understands the hazards associated with its work. Managers are visible, credible, and accessible to all personnel, and have clearly demonstrated their commitment to safety as a value. NSTec/LAO has only had one recordable injury in several years. Its response to that injury reflected a desire to ensure the circumstances would not be repeated. There are opportunities to be more inquisitive and diligent in its integrated safety management process, but those opportunities do not indicate any major deviation from required rules and standards. NSTec/LAO personnel were very receptive to feedback from the Team, and were receptive to the Team's ideas and suggestions. NSTec/LAO meets the expectations in each of the DOE-VPP tenets. The Team recommends that NSTec/LAO continue participation in DOE-VPP at the Star level.

Table 1
INJURY INCIDENCE/LOST WORKDAYS CASE RATE

Table 1.1 Injury Incidence/Lost Workdays Case Rate (NSTec/LAO)					
Calendar Year	Hours Worked	TRC	TRC Rate	DART Cases	DART Case Rate
2011	126,853	0	0.00	0	0.00
2012	120,924	0	0.00	0	0.00
2013	127,906	1	1.56	1	1.56
2014	133,275	0	0.00	0	0.00
Best Three Years (2011, 2012, 2014)	381,052	0	0.00	0	0.00
Bureau of Labor Statistics (BLS-2013) average for *NAICS Code # 5417 (Scientific research and development services)			1.1		1.9
Table 1.2 Injury Incidence/Lost Workdays Case Rate (Subcontractor)					
Calendar Year	Hours Worked	TRC	TRC Rate	DART Cases	DART Case Rate
2011	880	0	0.00	0	0.00
2012	3,068	0	0.00	0	0.00
2013	7,530	0	0.00	0	0.00
2014	7,368	0	0.00	0	0.00
Best Three Years (2011, 2012, 2014)	11,316	0	0.00	0	0.00
Bureau of Labor Statistics (BLS-2013) average for *NAICS Code # 5417 (Scientific research and development services)			1.1		1.9

*North American Industry Classification System

TRC Rate, including subcontractors: 0
DART case rate, including subcontractors: 0