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FROM: GLENN S. PODONSKY
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SUBJECT: Transmittal of Final Report – Independent Oversight
Inspection of Environment, Safety, and Health Programs at
the Thomas Jefferson National Laboratory,
August 2008

The Office of Health, Safety and Security's Office of Independent Oversight conducted an inspection of environment, safety, and health programs at the Thomas Jefferson National Accelerator Facility (TJNAF) during the period of May – June 2008. Attached is the final report on the inspection activities.

TJNAF has made significant improvements in safety management in the past few years, driven in part by the Thomas Jefferson Site Office. TJNAF injury and illness rates are significantly below Department of Energy (DOE) averages and, with few exceptions, work observed by Independent Oversight was conducted safely. However, the contractor assurance system is not yet fully effective. In addition, a number of deficiencies were identified with the forklift safety program.

Pursuant to DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*, the approved corrective action plan for the findings contained in the inspection report should be provided to us within 60 calendar days from the date of this memorandum. If you have any questions, please contact me at (301) 903-3777, or your staff may contact Thomas Staker, Director, Office of Environment, Safety and Health Evaluations, at (301) 903-5392.

Attachment: *Independent Oversight Inspection of Environment, Safety, and Health Programs at the Thomas Jefferson National Accelerator Facility, August 2008*

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**Independent Oversight
Inspection of Environment,
Safety, and Health Programs at the**



Thomas Jefferson National Accelerator Facility

August 2008

Office of Environment, Safety and Health Evaluations
Office of Independent Oversight
Office of Health, Safety and Security
Office of the Secretary of Energy



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Abbreviations Used in This Report

CAIRS	<i>Computerized Accident/Incident Reporting System</i>
CAS	<i>Contractor Assurance System</i>
CATS	<i>Corrective Action Tracking System</i>
CEBAF	<i>Continuous Electron Beam Accelerator Facility</i>
DOE	<i>U.S. Department of Energy</i>
ES&H	<i>Environment, Safety, and Health</i>
FEL	<i>Free Electron Laser</i>
FM&L	<i>Facilities Management and Logistics</i>
HSS	<i>Office of Health, Safety and Security</i>
ISC	<i>Integrated Support Center</i>
ISM	<i>Integrated Safety Management</i>
JSA	<i>Jefferson Science Associates, L.L.C.</i>
NSRC	<i>Nanoscale Science Research Centers</i>
OSHA	<i>Occupational Safety and Health Administration</i>
PPE	<i>Personal Protective Equipment</i>
SC	<i>Office of Science</i>
SOTR	<i>Subcontracting Officer's Technical Representative</i>
THA	<i>Task Hazard Analysis</i>
TJNAF	<i>Thomas Jefferson National Accelerator Facility</i>
TJSO	<i>Thomas Jefferson Site Office</i>

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1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight, within the Office of Health, Safety and Security (HSS), inspected environment, safety, and health (ES&H) programs at the DOE Thomas Jefferson Site Office (TJSO) and the Thomas Jefferson National Accelerator Facility (TJNAF) during May through July 2008. HSS reports directly to the Secretary of Energy, and the ES&H inspection was performed by Independent Oversight's Office of Environment, Safety and Health Evaluations.

Within DOE, the Office of Science (SC) has line management responsibility for TJNAF. SC provides programmatic direction and funding for research and development, facility infrastructure activities, and ES&H implementation at TJNAF. At the site level, line management responsibility for TJNAF operations falls under the TJSO Manager. Under contract to DOE, TJNAF is managed and operated by Jefferson Science Associates, L.L.C. (JSA), which is a partnership involving the Southeastern Universities Research Associates and Computer Sciences Corporation.

TJNAF's primary mission involves research in the areas of nuclear physics, theoretical and computational physics, superconducting accelerator operations, and -lasers (FELs). To accomplish this mission, TJNAF operates various scientific facilities, including the Continuous Electron Beam Accelerator Facility (CEBAF), the Free Electron Laser (FEL) facility, and various other equipment and laboratories. These facilities are available to various users from DOE, other U.S. government agencies, other countries, and various other industrial and academic organizations. These agencies and organizations provide funding for various experiments and equipment modifications/upgrades to support experiments, many of which are performed by visiting scientists/students.

Potential hazards that need to be effectively controlled at TJNAF include exposure to radiation, radiological contamination, lasers, hazardous chemicals, and various physical hazards associated with facility operations (e.g., cryogenics, oxygen-deficient environments, and high-voltage electrical equipment). Radiological/irradiated materials and hazardous chemicals are present in various forms at TJNAF.

The purpose of this Independent Oversight inspection was to assess the effectiveness of ES&H programs at TJNAF, as implemented by JSA, under the direction of TJSO and SC. Independent Oversight evaluated a sample of activities at TJNAF, including:



Aerial

- Implementation of the core functions of integrated safety management (ISM) for selected TJNAF facilities and activities, focusing on work planning and control systems at the activity and facility levels. The Independent Oversight inspection selectively evaluated:

- Work activities at the FEL Test Laboratory, which is a kilowatt-class, high-average-power, sub-picosecond free electron laser (FEL), used for research funded primarily by the Department of Defense.
- Work activities at the Test Laboratory, which is a building at TJNAF where various TJNAF organizations perform a variety of experiments and tests involving mechanical and electrical equipment, chemical and cryogenic materials, and lasers.
- Facility maintenance and construction performed by subcontractors at the direction of the TJNAF Facilities Management and Logistics (FM&L) organization.
- TJSO and TJNAF feedback and continuous improvement systems, with a focus on their application to TJNAF facilities and activities that were evaluated during this Independent Oversight inspection. The review of TJNAF feedback and improvement programs included an evaluation of injury and illness reporting and investigation, which is one of Independent Oversight’s current focus areas. The review of feedback and improvement systems also constitutes the Independent Oversight evaluation of the effectiveness of TJSO’s and TJNAF’s implementation of DOE Order 226.1A, *Implementation of DOE Oversight Policy*, which is a long-term Independent Oversight focus area.

In support of a separate HSS Independent Oversight special review of nanomaterials, the Independent Oversight team also collected information about nanomaterial work practices at TJNAF. The special review is being performed at the request of the Secretary of Energy and includes onsite reviews of work practices at selected DOE laboratories. To collect data efficiently and with minimal impact on DOE site operations, the onsite review of TJNAF was performed concurrently with this ES&H inspection. The primary focus of the onsite reviews is to compare selected DOE laboratory operations against the approach outlined in the DOE *Nanoscale Science Research Centers Approach to Nanoscale ES&H Revision 2 – June 2007* (referred to as the NSRC Approach). TJNAF currently has one project involving nanomaterials which is performed at the FEL. The results of Independent Oversight’s review of nanomaterial work practices for this project are discussed in the FEL work control section and will also be discussed in a separate special review report.

Sections 2 and 3 discuss the key positive attributes and weaknesses, respectively, identified during this inspection. Section 4 provides a summary assessment of the effectiveness of the major ISM elements that were reviewed. Section 5 provides Independent Oversight’s conclusions regarding the overall effectiveness of TJSO and TJNAF management of ES&H programs, and Section 6 presents the ratings assigned during this inspection. Appendix A provides supplemental information, including team composition.

Appendix B presents the findings identified during this Independent Oversight inspection. The findings are also referenced in the applicable portions of Sections 3 and 4 of this report. In most cases, the findings listed in Appendix B were derived from multiple individual deficiencies that are described in the detailed results provided to the site in a separate document.

In accordance with DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*, SC must develop a corrective action plan to address each of the findings identified in Appendix B, including the associated individual deficiencies, and provide appropriate causal analyses, corrective actions, and recurrence controls for each finding. The weaknesses in Section 3 provide a management-level summary of the findings; these weaknesses do not need to be separately addressed in the SC corrective action plan because the findings encompass the scope of the weaknesses.

2 Positive Attributes

Positive attributes were identified in several ES&H programs, particularly in certain aspects of hazard controls and TJSO oversight.

Laser hazards for FEL work activities are well characterized and controlled.

FEL makes extensive use of engineered controls for personnel protection that are supplemented by administrative controls, such as rigorous certification of the protection systems following modification and extensive training requirements. For example, the FEL Laser Safety Training for system modifications is comprehensive and appropriately addresses the requirements of the FEL laser standard operating procedure. The practical training is particularly effective in demonstrating the operation of the system, including responses to use of crash buttons and other interlock challenges.



FEL High Voltage Power Supply

The Test Lab has a comprehensive and proactive safety program in place for its use of acids. The Test Lab uses various acid mixtures containing high concentrations of hydrofluoric acid for cavity processing, and materials research and development. The safety program for acids includes detailed hydrofluoric acid and general chemistry awareness and first aid training, task specific on-the-job training, personal protective equipment (PPE) evaluation and monitoring, and coordination with local hospitals.

Hazards associated with nanomaterial research at FEL are effectively mitigated through application of appropriate engineering controls, along with development and implementation of conservative administrative controls and PPE consistent with the NSRC Approach document. TJNAF has applied conservative controls for nanomaterial hazards in several areas. Ventilation design, operations, and maintenance requirements are comprehensive and conservative. PPE requirements conservatively include respiratory protection in addition to the specified skin protection for all activities with exposed nanomaterials outside of the approved fume hood. Although nanomaterials are not specifically addressed in Federal transportation or waste disposal regulations and thus are not required by regulation to be packaged,

transported, or disposed of as hazardous materials, TJNAF has established specific packaging, transport, and waste disposal requirements and protocols. Industrial hygiene sampling and waste handling processes are defined in procedures and are meeting (or are making acceptable progress in meeting) the expectations stated in the NSRC Approach document.

FM&L Subcontracting Officer’s Technical Representatives (SOTRs) are very experienced, knowledgeable, and effectively engaged in reviewing subcontractor performance and ensuring that TJNAF requirements are met during maintenance activities. FM&L SOTRs approve subcontractor safety plans, walk down new requested facilities maintenance work to develop the scope of work, identify hazards and determine needed controls, draft formal task hazards analysis, develop operating procedures, ensure coordination with facility tenants, conduct interactive pre-job briefings with subcontractor workers and supervisors, authorize the start of work, review and actively support work activities, and solicit feedback to develop lessons learned.

TJSO has substantially improved its staff capability and processes to provide effective oversight of ES&H performance at TJNAF. Through a series of initiatives to drive contractor performance and to establish clear directives and processes, TJSO has established a solid baseline oversight program with a small number of ES&H staff. TJSO directives are well thought out and clearly written, supporting consistent implementation of oversight actions within the staff. Additionally, cooperative support arrangements with the SC Integrated Support Center (ISC) have provided effective subject matter expert support to the TJSO ES&H staff. TJSO staff conduct frequent facility walkthroughs and are very knowledgeable of conditions and operations. Issues are identified, and rigorous technical review is applied to potential problems. TJSO staff are mentored in their oversight skills by their peers and by TJSO management.

3

Weaknesses

Although aspects of ES&H management are effective, there are weaknesses in ISM programs at TJNAF, most significantly in implementation of site processes for forklift safety and some aspects of TJNAF feedback and improvement programs.

Site forklift operations and training do not meet several Worker Safety and Health Program Rule (10 CFR 851) and ES&H Manual requirements and have increased the risk of a serious accident. In an evolution at FEL, a forklift attachment for lifting an 856-pound magnet was not approved for the forklift, as required by the Occupational Safety and Health Administration (OSHA) and the ES&H Manual, and exceeded the forklift load capacity for the load configuration. Forklift operators were not trained on fork and attachment adaptation, operation, and use limitations, and operators were not aware of these limitations. In addition, the attachment nameplate and safety markings (load limits, cautions, model number, and serial number) were not maintained in a legible condition. TJSO identified a similar deficiency earlier in the year with illegible markings on a similar forklift attachment. The site disposed of the attachment identified earlier in the year, but continued use of the similar attachment in this incident indicates that corrective actions and extent-of-condition determination for the earlier deficiency were not effective. The number and severity of deficiencies observed in the forklift program indicate that increased management attention is needed to ensure safe forklift operations at the site. (See Finding #C-1.)

TJNAF feedback and continuous improvement processes are not fully effective. Assessments of safety-related programs, activities, and performance have been limited in number, scope, and rigor. Although many issues have been adequately managed using the site issues management process and tracking tool, some issues are not being formally managed, the issues management procedure has a number of deficiencies, and issues are not conservatively categorized for significance. Most first aid cases and some operational events have not been formally investigated or put into the issues management tracking system. ISM core functions for work planning and control are not always evaluated and addressed, and recurrence controls are not always adequately identified. Some events have not been reported to DOE as required. Analysis of events for recurrence and trends has not been performed at the frequency required by DOE documents, and trending information for issues and incidents lacks sufficient analysis and determination of needed recurrence controls. Procedures for these assurance systems need to provide unambiguous, complementary, structured, step-by-step processes that drive rigorous and compliant implementation. (See Findings #D-2, #D-3, and #D-4.)

TJSO oversight of contractor and site office corrective action management has not been fully effective. Causal analysis of site office issues has not been adequate, and there is no sustained method for providing oversight of the effectiveness of contractor corrective actions. Although TJSO staff check contractor actions to verify completion, TJSO has not adequately validated the effectiveness of TJNAF corrective actions in

addressing significant issues or adverse performance trends. The TJSO directives for corrective action oversight provide general guidance for effectiveness reviews, but TJSO historically has not scheduled or performed effectiveness reviews. (See Finding #D-1.)

4 Results

The following sections provide a summary assessment of the TJSO and TJNAF activities that Independent Oversight evaluated during this inspection.

4.1 Work Planning and Control Processes

The Independent Oversight review of work planning and control processes focused on the adequacy and implementation of institutional expectations and requirements for activity-level work planning and control. TJNAF uses several work control processes to govern work within the various divisions and facilities across the site. The processes include scheduling and work definition components such as task lists and work orders and a hazard analysis component beginning with a risk determination. One of five risk codes is assigned for each work activity based on a determination of accident probability and predicted property loss or injury consequence. The ES&H Manual provides several tables to assist in the risk determination; however, the actual determination of probability and consequence is expert based, and undocumented. Risk codes of two or less are considered skill of the craft, and no further hazard analysis is needed, although in some cases, a rudimentary hazard identification checklist is completed within the various task list items. For higher risk activities (risk codes of three or above), the ES&H Manual requires a more formal hazard analysis to be documented in a work control document (procedure, work permit, etc.). These analyses document the hazards of the work and associated controls. TJNAF recently issued a formal work control policy and flowchart to better integrate various components of the work control processes across the site. Some inconsistencies were identified in the implementation of the recently changed work control policy; for example, there are some TJNAF procedures and documents with incorrect or misleading references to DOE orders and manuals and the TJNAF ES&H Manual as “guidance” documents rather than requirements.

Free Electron Laser

The FEL Division of TJNAF operates the FEL, with matrixed support from several other site organizations, such as the Engineering and the ES&H & Quality Divisions. During the Independent Oversight inspection, the FEL was in an extended shutdown to install a new ultraviolet spectrum line and several upgrades to safety and operational systems, including a new optical transport system



Internal Components for the FEL Upgrade

to the user labs. Independent Oversight observed several work activities associated with the outage, as well as two specific ongoing experimental activities not directly related to the main laser; these involved boron nitride nanotube synthesis using a commercially available class 4 laser, and high-voltage operations associated with the gun test stand.

FEL has defined the scope of work activities in sufficient detail to permit adequate identification and analysis of activity-level hazards. Work is adequately scheduled. In most cases, hazards were adequately identified and analyzed. In two cases where they were not, FEL took prompt corrective action.

For most activities, FEL identified appropriate engineering and administrative hazard controls, but in several cases, the controls were not adequately implemented. In one case, the failure to appropriately implement hazard controls and OSHA requirements resulted in an unapproved modification to a forklift that led to significantly exceeding the forklift load rating, thereby exposing workers to an increased risk of injury. (See Finding #C-1.)

Activity-level work authorization is adequately controlled in FEL through a combination of the morning planning meeting, task scheduling, and a rolling two-week schedule. Workers, engineers, and scientists were actively involved in the work authorization processes. With the exception of the forklift operation discussed above, observed production work was authorized and performed in accordance with established controls. Workers were highly competent and knowledgeable, aware of their stop work authority, and did not hesitate to pause work and ask for help when problems were encountered.

Overall, FEL has adequately implemented the components of ISM. With few exceptions, work is adequately defined, hazards are adequately analyzed, and work is performed in accordance with established controls. However, some hazard controls were not adequately implemented, and in one of those cases, inadequate implementation of forklift controls increased the risk of injury to workers. Increased management attention is needed, particularly for forklift operations and other tasks deemed to be low risk, to ensure that the appropriate controls established in the ES&H Manual are known by workers and enforced.



Test Laboratory

Test Laboratory

Various TJNAF divisions run experiments at the Test Laboratory. The Test Laboratory is responsible for the cryogenic modules used in the TJNAF accelerator over their lifecycle, including operational support, and performs the testing, research, development, refurbishment, and design of cryogenic modules.

The Test Laboratory has defined the scope of work activities in sufficient detail to permit adequate identification and analysis of activity-level hazards. Task-level activities are appropriately defined in procedures for higher risk work. Long-term schedules

for Test Laboratory activities are effective in ensuring the coordination of planning activities, and at the task level, the scopes of work are adequately defined through temporary operational safety procedures, standard operational procedures, operational safety procedures, and task hazard analysis worksheet task breakdowns.

Experiment and production hazards are adequately identified and analyzed through the hazard analysis process. At the task level, task hazard analysis worksheets and operating procedures were used to adequately identify, analyze, and document hazards for the work observed by the Independent Oversight team.

The Test Laboratory uses an effective combination of engineered controls, administrative controls, and PPE to control hazards. Engineered controls are the preferred method of hazard control and are used extensively. For higher risk activities, procedures are used to document and implement applicable administrative controls and PPE.

Work is appropriately authorized, and pre-job briefs and meetings are used to ensure that the controls are understood. The workers are knowledgeable, and most work observed by Independent Oversight was performed in accordance with controls defined in procedures. In a few instances, workers did not follow some aspects of safety controls (e.g., they did not wear safety shoes).

Overall, the Test Laboratory has adequately implemented the ISM core functions. With few exceptions, work is adequately defined, hazards are adequately analyzed, controls are established, and work is performed in accordance with established controls. Continued attention to maintenance activities is warranted to ensure that workers fully implement safety requirements.

Facilities Management and Logistics

FM&L is responsible for maintenance, modification, and improvement of facilities at TJNAF. Most of this work is performed by subcontractors, with direction, coordination, and review by designated SOTRs.

FM&L subcontractor facility work activities are generally well defined in sufficient detail to establish the desired outcome and to facilitate adequate identification and analysis of activity- and task-level hazards. Facilities maintenance work requests and resulting subcontractor work orders identify the problems to be fixed but appropriately allow the subcontractor to define the scope of work, consistent with contract requirements and limitations.

In essentially all instances, work activity and task-level hazards were effectively identified and analyzed through the TJNAF work planning and hazard analysis process. SOTRs and subcontractors walked down requested work and met with facility tenants, subject matter experts, and managers, as appropriate, to determine the work scope and schedule, identify and analyze the hazards, and discuss the hazard controls that were or could be implemented. Subcontractors and SOTRs effectively use formal task hazard analyses (THAs) to analyze the hazards associated with higher risk work.

For most work activities, appropriate hazard controls were developed and effectively implemented. Electrical, mechanical, and fire protection subcontractor contracts and safety plans appropriately established generic work practices, training, and PPE to effectively mitigate identified and analyzed hazards associated with contracted skill-of-the-craft work. For higher hazard work, SOTRs develop and require implementation of hazard controls using formal THAs. All reviewed formal THAs were well written and effectively defined and communicated activity- and task-specific hazard controls required to mitigate the hazards identified in the formal THA.

Subcontractors were appropriately authorized to start work only after interactive pre-job briefings between the responsible SOTRs and subcontractor staff, and with a few isolated exceptions, electrical, mechanical, and construction subcontractor work was appropriately and safely implemented in accordance with established

controls. Essentially all subcontractor work activities were performed within established controls by competent, knowledgeable, well-trained, and safety-conscious subcontractor and SOTRs.

Overall, FM&L staff and subcontractors have effectively implemented the ISM process at the task and activity level. Work is adequately defined and scheduled with a team approach. Essentially all subcontractor work hazards were adequately identified and analyzed. In most cases, hazard controls for subcontractor maintenance activities were appropriately developed and implemented at the task level. Finally, work was appropriately authorized following effective pre-job briefings, and in essentially all cases, work was performed in accordance with established controls by highly competent and knowledgeable subcontractors with effective SOTR direction, coordination, and review.

4.2 Feedback and Improvement Systems

TJSO

In 2004, TJSO initiated a comprehensive effort to improve the safety culture and performance at TJNAF because of concerns about accident and injury rates, and other safety performance issues noted by the TJSO Manager and his staff. The initiatives and assessments have led to a series of TJNAF actions to improve the implementation of ISM at the TJNAF and have contributed to improved TJNAF safety management performance. The TJSO Manager and his staff are actively engaged in ensuring continuous improvement and have identified specific areas and tasks for future efforts.

The TJSO oversight program fully meets the intended objectives of DOE Order 226.1 and provides effective oversight of ES&H at TJNAF. The formal assessments and self-assessments that have been conducted were thorough and provided useful feedback and improvement. TJSO oversight and operational awareness practices and directives have undergone a number of recent improvements and include elements of necessary oversight, including formal and informal assessments, surveillances, for-cause surveillances, and walkthrough activities. TJSO directives also include requirements for reporting, trending, and tracking of issues and corrective actions for the site office, and the TJNAF issues identified by the site office.

The experienced ES&H staff members and the professional mentoring conducted by TJSO management provide a strong base of individuals who are able to provide oversight for the wide range of operations at TJNAF. Recent improvements in this area include development of a formal qualification program to support ES&H staff members' ability to conduct operational oversight. Facility walkdowns with senior management are scheduled and conducted, allowing less-experienced staff members to compare their assessment results with observations from more experienced staff. Additionally, TJSO requires peer mentoring of ES&H staff, which also contributes to a broad base of professional knowledge.

Coverage and staffing are adequate to achieve required oversight activities. Currently, the site office has one unfilled ES&H specialist position and one unfilled facility operations staff member position. Other staff members currently perform the duties of these positions. Specific expectations for staff members' assessment and operational awareness items are well defined. TJSO and ISC personnel have an effective and cooperative approach to ES&H oversight activities that has been a key element in the increased level of oversight conducted by TJSO.

TJSO staff's oversight activities ensure that the TJSO senior management is kept well informed about ongoing operations and hazards at TJNAF. The oversight program is flexible and responsive to current issues, and it is well supported by the TJSO staff, who are motivated and committed to the program. Walkthrough surveillances

are frequent and professionally conducted, are appropriately obtrusive into laboratory operations, and identify many ES&H deficiencies. TJSO is working to improve their process to review, track, trend, follow up on, and close findings from walkthrough surveillances and to review areas requiring additional attention.

TJSO ES&H program oversight has ensured that DOE requirements are met for the employee concerns program, the worker safety program for Federal workers, and the corporate operating experience program. Close coordination with ISC staff has provided effective assistance in implementing these program requirements and has provided TJSO with useful self-assessment information.

Although most aspects of TJSO oversight are adequate, two areas warrant further improvement. First, TJSO tracking of contractor and site office corrective actions is not always sufficient to ensure that appropriate corrective actions are managed and evaluated. Follow-up actions (event investigation and critiques) for unusual events and issues have been self-identified by TJSO as a TJNAF performance weakness that requires greater attention. Additionally, TJSO has not yet adequately implemented effectiveness reviews to determine whether completed corrective actions have effectively resolved and prevented recurrence of the same or similar findings. Second, some assessments required by DOE or local site office directives are not included within the assessment schedule. In addition, the TJSO process does not routinely identify necessary additions or changes to the assessment schedule based on contractor assurance results or performance issues that warrant additional for-cause assessments and walkthrough surveillance activities. (See Finding #D-1.)

Overall, TJSO oversight meets the intent of DOE requirements. Although further improvements in evaluating corrective action effectiveness and scheduling assessments are warranted, TJSO oversight is driving improvements in TJNAF safety management and provides TJSO management with adequate information about the status of ES&H programs and issues at TJNAF.

TJNAF

TJNAF has established and implemented all the elements of a contractor assurance system (CAS) as identified in DOE Order 226.1. In many cases, the implementation of these management systems is thorough and effective in providing feedback and continuous improvement. There has been much improvement in formalizing and strengthening CAS procedures and communicating requirements to persons responsible for implementation since JSA assumed Laboratory management in 2006. Much of this increased rigor has been incorporated in assurance system elements as a result of recent self-assessments of the ISM and CAS programs at TJNAF. However, in some cases, these management systems are not sufficiently defined, and implementation is not fully effective. In addition, implementation has just begun for some CAS elements

with respect to newly revised or established procedures or programs.



Cryogenic Module

TJNAF uses a variety of assessment activities to evaluate safety programs and performance and to drive continuous improvement, including formal independent and management self-assessments, facility safety inspections, and supervisor and manager work observations. Although some rigorous and effective assessments are being performed, many of these activities, primarily management self-assessments, lack sufficient scope and rigor, and do not appropriately support conclusions or

identify issues accurately or as required by governing site procedures. Although newly developed procedures and planning documents reflect a more comprehensive assessment program in the future, historically the topical scope and number of TJNAF self-assessments have been limited. (See Finding #D-2.)

Many safety issues are effectively managed using the site's Corrective Action Tracking System (CATS) tool and the associated issues management procedure, including significance ranking and assignment of causes. The procedure addresses the required elements of issues management, as described in DOE orders and associated guidance; identifies responsibilities; and describes the general process. However, it provides insufficient and inappropriate direction for effectively managing issues. Further, the implementation of the issues management program and documentation in CATS are not in compliance with the site issues management procedure, especially with regard to significance categorization and description of issues and actions. (See Finding #D-3.)

Events are identified, reported, and investigated and related issues resolved in accordance with formal processes defined in the ES&H Manual and issues management procedure. Although most events are properly identified, investigated, and managed, some events are not investigated, or the investigations are not documented or reported, as required by procedures. In some cases, DOE notifications are not always timely, and investigations and associated preventive actions do not sufficiently address work control deficiencies. (See Finding #D-4.)

OSHA recordable occupational injuries/illnesses and first aid cases are identified in a timely manner and recordable injuries, as well as some first aid cases, are investigated, documented, and reported using a structured process. Supervisors, managers, and ES&H subject matter experts are engaged in investigating injuries and illnesses and identifying corrective actions and recurrence controls. However, the TJNAF procedure only requires formal investigation of recordable injuries, and many first aid cases have not been formally investigated to determine whether corrective or preventive actions are required.

The JSA lessons-learned program has only recently been formalized and defined in a site procedure. The procedure defines a generally adequate and compliant operating experience program. However, the JSA lessons-learned program has not yet been fully implemented, and historically, there has been no formal screening and communication of external lessons learned.

TJNAF employees have both formal and informal means to communicate and obtain resolution of safety concerns, but the formal processes are rarely used. Responsibilities and processes for resolving employee concerns are described in site manuals. However, the ES&H Manual procedure is deficient in several areas, and the employee concerns processes do not adequately address the elements of anonymity and confidentiality.

Several other mechanisms at TJNAF promote feedback and continuous improvement. The Worker Safety Committee provides a valuable link between management and workers to communicate issues, initiatives, and management expectations. The Director's Safety Council provides another mechanism for communicating safety performance feedback and management expectations to, among, and from senior managers and senior safety staff. An employee behavior-based safety observation program and management safety observation program provide real-time feedback to workers on safe work performance attributes and at-risk behaviors, and also increase the safety awareness of personnel. At the activity level, TJNAF organizations use various methods, such as pre-job briefings and regular planning meetings, to solicit ES&H feedback and discuss lessons learned.

JSA workers perform assessments, inspections, and incident/accident investigations and often manage the associated issues in most cases, thoroughly and appropriately. However, these actions are not performed consistently in compliance with requirements. In many cases, the governing procedures provide ambiguous directions; therefore, the feedback and improvement elements are implemented based on individual, experience-based approaches rather than a well-defined, systems-based approach for which personnel have been adequately trained.

Overall, TJNAF has made recent and substantial changes to their contractor assurance processes and feedback and improvement methods that should assist effective ISM oversight. The ES&H Manual contains weaknesses in these institutional management system administrative procedures and processes that include inconsistent formatting and failure to always identify all responsibilities and action steps. Some processes described in the ES&H Manual are not in a standard procedure format with clearly defined sections for purpose, scope, responsibilities, action steps, definitions, etc. Procedures that use ambiguous terms and that lack complete, well constructed, and sequenced action steps increase the chances that requirements and management expectations will not be implemented as intended. These management feedback and improvement processes require additional attention to ensure the desired results.

Occupational Injury and Illness Recording and Reporting. TJNAF has implemented procedures and assigned responsibilities for recording and reporting occupational injuries and illnesses to employees and subcontractors. Employees who were interviewed by Independent Oversight confirmed that Laboratory employees are informed of their responsibilities to report all injuries and exposures. The individuals assigned the responsibilities for maintaining records for TJNAF were trained in the DOE requirements and authorized to utilize the DOE-wide Computerized Accident/Incident Reporting System (CAIRS) to report recordable cases. However, the site procedure did not include sufficient details to ensure ownership of responsibilities and that all requirements are met. With the exception of one case that was misclassified and not reported, monthly and quarterly reporting requirements are being met. As noted above, investigation reports are not required for non-recordable cases. The level of detail included in CAIRS reports from the Notable Event Reports was minimal and did not include investigation information that is needed to fully understand the events leading to the injury or to provide lessons learned. The OSHA 300A form, Summary of Work-Related Injuries and Illnesses, was properly prepared and certified annually. However, quarterly cross-checks of local records with CAIRS and periodic self-assessments of the recordkeeping and reporting program were not regularly performed as required. (See Finding #D-2.)

5

Conclusions

TJNAF has made significant improvements in safety management in the past few years. TJSO has driven some of the improvements through its oversight and contract management efforts. As examples, TJSO added performance measures to the most recent contract to incentivize JSA assessments of ES&H performance and initiated a comprehensive effort to improve the safety culture and performance at TJNAF, beginning in 2004, because of concerns about accident and injury rates and other safety performance issues noted by TJSO. In coordination with TJSO, TJNAF has taken a number of actions to develop a comprehensive safety strategy and improve ISM and safety performance at TJNAF. These efforts have contributed to safety management process enhancements and improvements in injury and illness rates at TJNAF, which are significantly lower than the DOE averages. In addition, with a few exceptions, work observed by Independent Oversight was performed safely and the higher-hazard work was performed in accordance with procedures or other approved work documents that adequately identified safety controls.

Although for most of the work observed by Independent Oversight, informal processes adequately identified appropriate safety controls, further enhancement of the risk determination process would provide greater assurance of proper categorization and that all hazards are adequately analyzed and controlled. In one instance, ineffective application of safety controls for forklifts resulted in an increased risk to workers; in a few other instances, forklift controls were not identified, communicated, and implemented with sufficient rigor. In addition, the CAS has some weaknesses in processes and implementation in such areas as assessments, issues management, and event investigation and reporting that need to be addressed to ensure that deficiencies in ES&H programs are identified and corrected to achieve continuous improvement. The absence of an adequate system for defining and communicating requirements contributes to some of the observed weaknesses in the CAS.

Areas of particular priority and emphasis for TJNAF should include:

- Evaluating and enhancing forklift safety programs in such areas as OSHA compliance, postings, operator training, and assessments
- Continue enhancement of the work control process
- Enhancing the CAS, with particular emphasis on performance-based assessments, and rigorous issues management and event investigation processes
- Establishing and implementing a well-defined infrastructure for document control and effective management and communication of requirements.

TJSO should closely monitor TJNAF's efforts and continue to improve its systems and line management oversight of TJNAF. Many of the TJNAF ISM programs are relatively new or have been recently enhanced and thus warrant continued management attention to ensure that they mature and are rigorously assessed and improved as operational experience is gained.

6 Ratings

The ratings (see below for purpose and definition of ratings) reflect the current status of the reviewed elements of TJNAF ISM programs.

Work Planning and Control				
ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	Core Function #2 – Analyze the Hazards	Core Function #3 – Develop and Implement Controls	Core Function #4 – Perform Work Within Controls
Free Electron Laser	Effective Performance	Effective Performance	Needs Improvement	Effective Performance
Test Laboratory	Effective Performance	Effective Performance	Effective Performance	Effective Performance
Facilities Management & Logistics	Effective Performance	Effective Performance	Effective Performance	Effective Performance

Feedback and Continuous Improvement - Core Function #5	
TJSO Feedback and Continuous Improvement Processes	Effective Performance
TJNAF Feedback and Continuous Improvement Processes	Needs Improvement

Ratings – Purpose and Definitions

The Office of Independent Oversight uses a three-tier rating system that is intended to provide line management with a tool for determining where resources might be applied toward improving environment, safety, and health. It is not intended to provide a relative rating between specific facilities or programs at different sites because of the many differences in missions, hazards, and facility life cycles, and the fact that these reviews use a sampling technique to evaluate management systems and programs. The rating system

helps to communicate performance information quickly and simply. The three ratings and the associated management responses are:

- Significant Weakness (Red)
- Needs Improvement (Yellow)
- Effective Performance (Green).

APPENDIX A

Supplemental Information

A.1 Dates of Review

Planning Visit	May 19-22, 2008
Onsite Inspection Visit	June 2-12, 2008
Report Validation and Closeout	July 8-10, 2008

A.2 Review Team Composition

A.2.1 Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
 Michael A. Kilpatrick, Deputy Chief for Operations, Office of Health, Safety and Security
 William Eckroade, Director, Office of Independent Oversight
 Thomas Staker, Director, Office of Environment, Safety and Health Evaluations
 William Miller, Deputy Director, Office of Environment, Safety and Health Evaluations

A.2.2 Quality Review Board

Michael Kilpatrick	William Eckroade	Thomas Staker
Dean Hickman	Robert Nelson	William Sanders

A.2.3 Review Team

Thomas Staker, Team Leader	
Jimmy Coaxum	Bob Guy
Janice Macon	Bob Compton
Tim Martin	Ed Stafford

A.2.4 Administrative Support

Mary Anne Sirk	Tom Davis
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APPENDIX B

Site-Specific Findings

Table B-1. Site-Specific Findings Requiring Corrective Action

FINDING STATEMENTS	
C-1	Site forklift operations and training do not meet several Worker Safety and Health Program Rule (10 CFR 851) and ES&H Manual requirements.
D-1	TJSO oversight of site office and contractor corrective action management does not provide assurance that problem resolution is fully effective at TNJAF, as required by DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> .
D-2	The TJNAF assessment program is not fully effective to provide sufficient frequency, scope, and rigor and assurance of the adequacy of safety programs as required by DOE Orders 226.1A, <i>Implementation of DOE Oversight Policy</i> , and 414.1C, <i>Quality Assurance</i> ; the TJNAF Contractor Assurance System; the ISM System Descriptions; and associated plans, policies, and procedures.
D-3	The TJNAF issues management program is not fully effective in ensuring that ES&H-related events, injuries, conditions, and program and performance deficiencies are rigorously categorized, analyzed, and corrected, and recurrence controls are established as required by DOE Orders 226.1A, <i>Implementation of DOE Oversight Policy</i> , and 414.1C, <i>Quality Assurance</i> .
D-4	TJNAF has not established sufficient processes nor implemented a fully effective event investigation and reporting program that rigorously identifies, investigates, reports, and prevents the recurrence of ES&H-related events and injuries as required by DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> ; and DOE Manual 231.1, <i>Occurrence Reporting and Processing of Operations Information</i> .

Validation Appendices
for the
Independent Oversight
Inspection of Environment,
Safety, and Health Programs at the



Thomas Jefferson
National Accelerator Facility

August 2008

Office of Environment, Safety and Health Evaluations
Office of Independent Oversight
Office of Health, Safety and Security
Office of the Secretary of Energy



**VALIDATION APPENDICES
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INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH
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**VALIDATION APPENDICES
FOR THE
INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH PROGRAMS
AT THE
THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY**

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Acronyms

AHU	Air Handling Unit
ATLis	Accelerator Task List
CAIRS	Computerized Accident/Incident Reporting System
CAS	Contractor Assurance System
CATS	Corrective Action Tracking System
CFR	Code of Federal Regulations
COG	Center of Gravity
CRAD	Criteria Review and Approach Document
DOE	U.S. Department of Energy
DPO	Differing Professional Opinion
ECP	Employee Concerns Program
ECR	Electron Cyclotron Resonance
ES&H	Environment, Safety, and Health
ESH&Q	Environment, Safety, Health, and Quality
FEL	Free Electron Laser
FEList	Free Electron Laser Task List
FEOSH	Federal Employee Occupational Safety and Health
FM&L	Facilities Management and Logistics
FY	Fiscal Year
HEPA	High Efficiency Particulate Air
HF	Hydrogen Fluoride
IH	Industrial Hygiene
ISM	Integrated Safety Management
ISC	Integrated Service Center
JSA	Jefferson Science Associates, L.L.C.
NSRC	Nanoscale Science Research Centers
OAPP	Operational Awareness Program Plan
ORO	Oak Ridge Office
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
OSP	Operational Safety Procedure
PAAA	Price-Anderson Amendments Act
PEMP	Performance Evaluation and Measurement Plan
PPE	Personal Protective Equipment
QA	Quality Assurance
QA/CI	Quality Assurance and Continuous Improvement organization
RDR	Radiation Deficiency Report
SC	Office of Science
SOP	Standard Operational Procedure
SOPP	Standard Operating Plan and Procedure
SOTR	Subcontracting Officer's Technical Representative
TCP	Technical Competency Program
THA	Task Hazard Analysis
TJNAF	Thomas Jefferson National Accelerator Facility
TJSO	Thomas Jefferson Site Office
TOSP	Temporary Operational Safety Procedure
UV	Ultraviolet
VTA	Vertical Test Assembly

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FOREWORD

These validation appendices are provided to the Office of Science (SC), Thomas Jefferson Site Office (TJSO), and Thomas Jefferson National Accelerator Facility (TJNAF) site contractor – Jefferson Science Associates, L.L.C. – to provide additional technical details regarding the May – July 2008 environment, safety, and health inspection by the U.S. Department of Energy (DOE) Office of Health, Safety and Security’s Office of Independent Oversight.

Two technical appendices (C and D) contain detailed results developed during the Independent Oversight inspection. Appendix C provides the results of the review of the application of the first four core functions of integrated safety management for work activities. Appendix D presents the results of the review of feedback and continuous improvement processes and management systems, and addresses the related focus area (implementation of DOE Order 226.1A, *Implementation of DOE Oversight Policy*). For each of these areas, Independent Oversight identified opportunities for improvement for consideration by SC, TJSO, and TJNAF. The opportunities for improvement are listed at the end of each appendix so that they can be considered in the context of the status of the areas reviewed.

SC, TJSO, and TJNAF need to address the individual deficiencies and specific examples contained in these appendices in their corrective action plan for the findings identified in Appendix B of the inspection report. The individual deficiencies and specific examples in these appendices are referenced to the specific findings in Appendix B. The causal analyses, corrective actions, and recurrence controls developed in response to the findings in Appendix B need to fully consider the specific deficiencies and specific examples in these appendices.

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APPENDIX C

Work Planning and Control

C.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight evaluated work planning and control processes and implementation of the core functions of integrated safety management (ISM) at the DOE Thomas Jefferson National Accelerator Facility (TJNAF).

The Independent Oversight review of the ISM core functions focused on environment, safety, and health (ES&H) programs and work planning and control systems as applied to various TJNAF facilities and organizations, including:

- Work activities at the Free Electron Laser (FEL) facility, which is a kilowatt-class, high-average-power, sub-picosecond FEL, used for research funded primarily by the Department of Defense. (See Section C.2.1.)
- Work activities at the Test Laboratory, which is a building at TJNAF where various TJNAF organizations perform a variety of experiments involving mechanical and electrical equipment, chemical and cryogenic materials, and lasers. (See Section C.2.2.)
- Facility maintenance and other work performed by subcontractors at the direction of the TJNAF Facilities Management and Logistics (FM&L) organization. (See Section C.2.3.)

Independent Oversight reviewed implementation of the core functions of ISM, observed ongoing operations, toured work areas, observed equipment operations, conducted technical discussions and interviews with managers and technical staff, reviewed interfaces with ES&H staff, and reviewed ES&H documentation (e.g., plant standards, permits, safety analyses). Work activities that were observed at TJNAF included various facility operations, maintenance and construction, and waste/environmental management activities.

C.2 RESULTS

TJNAF uses several work control processes to govern work within the various divisions and facilities across the site. The processes include scheduling and work definition components such as task lists and work orders, and a hazard analysis component described in the ES&H Manual, Chapter 3210, *Hazard Identification and Characterization*, beginning with a risk determination. One of five risk codes is assigned for each work activity based on a determination of accident probability and predicted property loss or injury consequence. The ES&H Manual provides several tables to assist in the risk determination; however, the actual determination of probability and consequence is expert based and undocumented. Risk codes of two or less are considered skill of the craft, and no further hazard analysis is needed, although in some cases, a rudimentary hazard identification checklist is completed within the various task list items. For higher risk activities (risk codes of three or above), the ES&H Manual requires a more formal hazard analysis to be documented in a work control document (procedure, work permit, etc.). These analyses document the hazards of the work and associated controls.

Prior to Independent Oversight's data collection visit, TJNAF implemented a formal work control policy and flowchart to better integrate various components of the work control processes across the site, but the work control process still often relies on the informal risk determinations. For the work observed by Independent Oversight, the processes adequately identified appropriate safety controls, in large part because of the expertise and experience of the facility personnel and subject matter experts. However, continued reliance on an expert-based approach can result in reduced assurance that hazards are adequately analyzed and controlled.

C.2.1 Free Electron Laser

The FEL is a user facility containing a kilowatt-class, high-average-power, sub-picosecond free electron laser, covering the mid-infrared spectral region. During the oversight inspection, the FEL was in an extended shutdown to install a new ultraviolet (UV) spectrum line and install several upgrades to safety and operational systems including installation of a new optical transport system to the user labs. In addition, the facility has several areas in the user laboratories that contain lasers or other research equipment, such as an electron gun test stand, that are independent of the main laser. The FEL Division of TJNAF operates the FEL, with matrixed support from several other site organizations, such as the Engineering and ES&H and Quality (ESH&Q) Divisions.

Independent Oversight observed several work activities associated with the outage as well as two specific ongoing experimental activities not directly related to the main laser. Observed outage work activities included installation of sextupole magnets (large magnets weighing 856 pounds used to control and condition the electron beam) and assembly of components of the optical transport system. Observed experimental activities included boron nitride nanotube synthesis using a commercially available, class 4 laser and high-voltage operations associated with the gun test stand. Associated hazards and hazardous materials included high voltage, lasers, hazardous chemicals, asphyxiant gasses, cryogenics, forklift operations, and other industrial hazards such as noise, pinch points, and sharps.

Concurrent with the inspection activities, Independent Oversight collected information specifically related to nanomaterial work practices in support of an Independent Oversight special study. In addition to discussing the results of the review of nanomaterial activities for the observed experiment in this appendix, the information gathered for nanomaterial work practices will be described in greater detail in a separate report.

Core Function 1: Define the Work

FEL work activities were generally well defined and appropriately scheduled. Long-term schedules for outage work were effective to ensure appropriate coordination of planning activities. For example, the FEL UV line installation schedule was well developed and broken out into reasonable tasks. Each of those tasks was addressed as a separate FEL Task List (FEList) item such that appropriate hazard identification could be made on a task-specific basis.

At the task level, the scopes of work for specific activities are adequately defined through FEList items, experiment safety approval forms, and/or technical procedures. The FEList is a computerized scheduling and coordination tool containing a hazard identification checklist. In the observed evolutions, tasks were adequately identified in FEList items, descriptions in applicable technical procedures, or experiment descriptions in the safety approval form.

Core Function 2: Analyze the Hazards

Hazards for higher risk work in FEL were adequately identified and analyzed through formal hazard analysis processes with one exception. Following identification of activities with an unmitigated risk level above the threshold value of 2 through the site's job hazard analysis process, hazards were extensively and formally analyzed. In the observed FEL higher risk activities (gun test stand operations and nanotube synthesis), a standard operating procedure or an operational safety procedure described the unmitigated hazards and risks for each operation in detail. The quality and comprehensiveness of these procedures were sufficient to demonstrate adequate activity-level analysis for most hazards. In the one exception, the oxygen deficiency hazard assessment for the gun test stand did not adequately address the risk of an oxygen deficiency condition from sulfur hexafluoride, an asphyxiant used in the process.

For lower risk work, hazard checklists in FEList items were adequate in most cases to identify the associated hazards. With one exception, hazard checklists appropriately identified the hazards for observed FEL tasks identified as skill of the craft. In the exception, a FEList hazard checklist for a skill-of-the-craft activity did not identify the potential for a hazardous waste stream from alcohol soaked wipes. Consequently, discarded wipes wet with alcohol, a hazardous chemical, were not being controlled as hazardous waste.

For both deficiencies mentioned above, management took prompt and effective actions to address the problems. In the case of the missed oxygen deficiency hazard, the facility suspended operations in the gun test stand area and initiated a new analysis. In the case of the wet alcohol wipes, the Industrial Hygiene (IH) organization initiated actions to analyze and characterize the activities for the potential for a hazardous waste stream.

Although the FEList has existed as a scheduling and coordination tool for some time, its use as a hazard identification and control mechanism is relatively new (less than a year). As such, Independent Oversight observed several errors in the implementation of the system in addition to the missed hazard discussed above. For example, risk categories were missing on a few of the FEList items. Although these were approved before the requirement to include the risk category was established, no mechanism for change control was implemented to ensure the FEList items were updated prior to the start of work. Newer FEList items did have the risk category included. In another example, several hazard identification questions for observed activities were answered incorrectly or left blank, indicating insufficient rigor in implementing the new system. The FEList hazard checklist for the sextupole magnet installation job contained errors and omissions, including missing answers to questions on familiarization with the work area and the need for a pre-job walkdown and incorrect answers related to effects on the FEL accelerator safety envelope and material safety data sheet requirements. Newer FEList items did not demonstrate the same types of deficiencies, indicating improved accuracy in use of the system over time.

Core Function 3: Develop and Implement Controls

FEL makes extensive and effective use of engineering controls to mitigate the potential for exposure to high-risk hazards such as high voltage, laser light, and asphyxiant gasses. Shielding, alarm systems, oxygen monitoring systems, and interlock systems are extensively used throughout the FEL to provide passive and/or active protection from and warning of the hazards.

FEL technical procedures were effective in identifying and implementing most hazard controls for higher risk activities as demonstrated by the following examples.

- The Personnel Safety System procedure for the gun test stand laser was comprehensive and, with one exception, reflected applicable specifications for system operation. The procedure was relatively new

and missed one specification for the need to periodically check a cooling water interlock. Facility management was notified of the discrepancy.

- The Laser Standard Operating Procedure for User Lab 3a provides extensive and appropriate controls for the laser used in nanotube synthesis.
- The Standard Operating Procedure for nanotube target preparation and sample handling provided appropriate controls for handling nanomaterials and was consistent with the recommendations in the DOE *Nanoscale Science Research Centers Approach to Nanoscale ES&H Revision 2 – June 2007* (referred to as the NSRC Approach).
- The FEL Gun Test Stand Operational Safety Procedure provided appropriate and effective controls for gun test stand operations with one exception. In one case, the procedure requires evacuation of the area in the event of ventilation failure, but there is no mechanism to know when the ventilation has failed.

FEL also uses facility-specific training as an effective method to control hazards. For example, modifications to the facility laser protection systems were presented in a laser operator training class on laser safety and the laser personnel safety system. The training was comprehensive, appropriately addressed the requirements of the FEL laser standard operating procedure, and included practical demonstrations. Because the facility was non-operational and the safety system could be exercised without affecting operations, the practical training was particularly effective in demonstrating the operation of the system including responses to use of crash buttons and other interlock challenges.

Although effective in most cases, Independent Oversight observed some deficiencies in hazard controls as further described below.

Although an IH noise survey for an equipment support area near the FEL gun test stand performed in January 2007 was comprehensive and provided a thorough survey of the area, it stated that a noise sign would be posted on the air compressor, but no sign had been posted. A later IH log entry indicated that an eight-hour survey had been performed and no signs posted; however, the later log entry did not provide any reference to the previous posting statement. Additionally, facility personnel were unaware that any of the readings were over 85 decibels. Following notification of this observation, IH performed additional noise surveys, determined that postings were indeed needed on two pieces of equipment, and installed postings on the equipment.

In the sextupole magnet installation, hazard controls for using the forklift to lift the load were not followed, including ES&H Manual requirements, manufacturer load limits, and Occupational Safety and Health Administration (OSHA) regulations, thereby increasing the risk of forklift failure and exposing workers to increased risk of injury. Although required by the ES&H Manual and OSHA, a forklift boom attachment was used that had not been approved by the forklift manufacturer and was not accurately matched to the forklift as specified by the boom manufacturer. The boom manufacturer load limit tables require at least a five-ton forklift to be used when using the three-ton boom attachment. In this case, a two-ton forklift was used. (See Finding #C-1.)

Title 29 CFR 1910.178(a)(4) requires that "Modifications and additions which affect the capacity and safe operation shall not be performed by the customer or user without manufacturers prior written approval. Capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly." The ES&H Manual reflects the manufacturer's approval requirement. In this case, no approvals were sought or obtained from the manufacturer, and no modified load limits were available to the operators. (See Finding #C-1.)

Based on forklift limits the site obtained from the manufacturer following this event, the load limit for this configuration would have been 766 pounds. The actual weight of the magnet was approximately 856 pounds, which exceeded the capacity of the forklift by over 10 percent. This is in excess of normal safety margins for the equipment and increased the risk of an accident. (See Finding #C-1.)

In other related deficiencies, the ES&H Manual requires booms to be attached to the forks with the supplied chain. The boom did not have a chain attached and was not hooked to the forklift in any way. The attachment's nameplate and markings (including attachment load limits for various load positions and cautions from the manufacturer) were not maintained in a legible condition. The site office identified a similar concern with a similar attachment several months earlier in the year and, in that case, the attachment was removed from service. However, the use of a similar attachment in a similar condition, in the instance observed by Independent Oversight, indicates that corrective actions for that concern were not effective in determining extent of condition. (See Findings #C-1 and #D-3.)

This incident also revealed deficiencies with the site's forklift training program. Forklift operators were not trained on fork and attachment adaptation, operation, and use limitations as required by 29 CFR 1910.178(i)(3)(i)(G) and 29 CFR 1910.178(i)(3)(i)(L), and operators and supervision were not aware of the requirements. Additionally, the site forklift training program does not include requirements for documented training for the specific forklifts to be used. Title 29 CFR 1910.178(1)(3) requires that operators receive training in the topics that are applicable to the safe operation of the truck in the employer's workplace. According to several OSHA interpretations, an operator must be trained and evaluated in the safe operation for the type of truck that the operator will be assigned. For example, the OSHA standard requires that operators be trained on operating instructions, warnings, and precautions for the types of truck the operator will be authorized to operate as well as any other operating instructions, warnings, or precautions listed in the operator's manual. There is no evidence of training on the specific operator's manuals for the various trucks on site. (See Finding #C-1.)

The site did not recognize these deficiencies until Independent Oversight pointed them out. The sextupole installation was the second evolution of this type, and several more installations were planned with the same forklift configuration. Following notification of the Independent Oversight concerns, the site suspended forklift operations involving any attachments without a specific engineering review and initiated an investigation into the event. The same attachment was subsequently used for other jobs that had job-specific engineering reviews prior to completion of the investigation. Although the engineering reviews were implemented to verify that forklift capacities were not exceeded, they were informal; did not compensate for other weaknesses in training and maintenance of attachment labeling; and in one case, contained an error that provided the operators with a non-conservative load limit for the lift. In this case, the engineering evaluation for a lift of a 500 pound compressor motor non-conservatively specified a load limit of 2300 pounds at position 9, approximately 145 inches from the fork mast, when the forklift nameplate specified a load limit of 1800 pounds at a center of gravity (COG) of 72 inches from the fork mast. For this configuration, the actual load limit at position 9 would have been approximately 810 pounds. Increased management attention is needed to ensure site forklift operations are performed in accordance with management expectations and regulatory requirements. (See Finding #C-1.)

Core Function 4: Perform Work Safely Within Controls

Activity-level work authorization is adequately controlled in FEL through a combination of the morning planning meeting, FEList scheduling, and a rolling two-week schedule. Workers, engineers, and scientists actively participated in morning meetings to ensure the work of the day was understood and controls were in place.

Most observed production work was performed in accordance with established controls. With the exception of the forklift operation outside of the ES&H Manual requirements and discussed in Core Function 3, workers followed established controls for all observed work. For example, FEL gun test stand area sweeps and high-voltage operations were performed effectively and in accordance with established procedures; nanotube synthesis workers performed activities in accordance with the established procedures and postings.

C.2.2 Test Laboratory

Various TJNAF divisions run experiments at the Test Laboratory. The Test Laboratory at TJNAF performs the testing, research, development, refurbishment, and design of cryogenic modules, and is responsible for the cryogenic modules used in the TJNAF accelerator over their lifecycle, including operational support.

Independent Oversight observed several Test Laboratory work activities. Observed work activities included cryomodule disassembly(grinding), cryomodule assembly(welding and mechanical assembly), material movements crane (the movement of a cyromodule using an overhead crane and the movement of a cyrounit using a motorized hand truck/pallet jack), the semi-annual personnel safety system testing, the testing of a spallation neutron source high beta cavity using low level radio frequency, electro-polishing operations using hydrofluoric acid, the deposition of niobium on a cavity (a cavity pairs are used to make cryo modules), and a dimensional measurement of a rework cavity pair using a coordinate measuring machine. Associated hazards and hazardous materials included high voltage, lasers, hazardous chemicals, asphyxiant gases, cryogenics, forklift operations, overhead crane operations, and other industrial hazards such as noise, pinch points, sharps, and grinding and welding sparks.

Core Function 1: Define the Work

Long-term schedules for Test Laboratory activities are effective in ensuring the coordination of planning activities. The Test Laboratory uses a commercial software tool to provide a long-term schedule for cryomodule refurbishment; the schedule is used for multi-year earned value control. The Test Laboratory also maintains a long-term schedule for a major accelerator upgrade project (the 12 giga-electron-volt energy upgrade from the current 6 giga-electron-volts). The Test Laboratory and other TJNAF projects provide input to an Annual Work Package.

The Cavity Production Group Leader has a weekly meeting to plan the work activities for the next two weeks. At this meeting, TJNAF personnel also review the activities in the past week to identified lessons learned and provide feedback for refining the planned activities. The Cavity Production Group Leader also leads a daily meeting to coordinate activities for the day. A status board is used to record planned activities for the week.

At the task level, the scopes of work for specific activities are adequately defined through temporary operational safety procedures (TOSPs), standard operational procedures (SOPs), operational safety procedures (OSPs), task hazard analyses (THAs) worksheet task breakdowns, or travelers. Risk codes are used to determine the required process. For risk codes greater than or equal to 2, an approved OSP, SOP, TSOP, or THA worksheet is required. For risk codes less than 2, travelers are used to perform work. Travelers do not contain and are not required to contain safety requirements.

Core Function 2: Analyze the Hazards

Task-level hazards for test lab work are adequately identified and analyzed through a formal hazard analysis process. At the task level, THA worksheets, TOSPs, OSPs, and SOPs were used to adequately

identify and analyze hazards for the work observed by the Independent Oversight team. For example, the Cavity Testing Procedure contains precautions to be used for High Power Cavity Testing; the precautions were adequately analyzed in the Vertical Test Assembly (VTA) OSP and workers who were interviewed were knowledgeable of the hazards associated with an observed electro polishing operations.

Core Function 3: Develop and Implement Controls

The Test Laboratory uses an effective combination of engineered controls, administrative controls, and personal protective equipment (PPE) to control hazards. Engineered controls, such as metal shielding and equipment design, are used in the Electron Cyclotron Resonance (ECR) Sample Deposition Facility and the VTA to protect personnel from radiation hazards. Equipment interlocks are used in the ECR Sample Deposition Facility and the Electron Beam Welding Facility to protect personnel from operating equipment. Guard rails are placed over electrical wires in the ECR Sample Deposition Facility. An electropolish cabinet is used to contain hydrofluoric acid in room 148. Administrative controls, such as lockout/tagout, postings, rotating beacons, signs, postings, training, and alarms, are used throughout the Test Laboratory. When a combination of engineering and administrative controls is not sufficient to protect workers, appropriate PPE is used. For example, PPE (a powered air purifying respirator and a chemical suit) was used for such activities as rinsing items in hydrogen fluoride (HF) and entering the electric power cabinet to install or remove items.

Although hazard controls are adequate for most of the work observed by the Independent Oversight team, one gap in the procedures was identified. Specifically, procedures have not been developed for the testing of safety interlocks used in the Electron Beam Welding Facility and the ECR Sample Deposition Facility. Some equipment in these facilities has interlocks that are used for personnel safety and/or equipment protection.

Core Function 4: Perform Work Safely Within Controls

Activity-level work authorization is adequately controlled through two morning meetings and a status board. Technicians and supervisors attend a morning meeting that coordinates activities in the Test Laboratory. At that meeting, safety feedback from the previous day is provided and safety is discussed as it pertains to the activities planned for the day. Safety is also discussed in a “take five” format; this method uses previous safety-related experiences to prompt personnel to focus on safety prior to performing work.

In most cases, work activities in the Test Laboratory were performed in accordance with procedures, and controls were properly implemented. Independent Oversight observed three complex work activities in the Test Laboratory that were performed in accordance with procedures and with no deviations from established safety controls. Specifically, an SOP was used for the niobium melting in the ECR Facility; the VTA Cavity Testing Using RF Test Stand was performed by a procedure that fell under the umbrella of the VTA Operational Safety Procedure, and the Chemical (HF) Cavity Processing was performed using the Electropolish Cabinet Operations SOP.

Most other work activities observed by the Independent Oversight team were also performed within established controls. However, in two instances, Independent Oversight observed deviations from established safety controls for work performed by crafts/maintenance personnel:

- A lockout/tagout of a 208/120 volt system did not fully comply with the ES&H Manual. A safety system engineer performed a lockout/tagout on a 208/120 V system but did not verify that the voltmeter was working properly by checking its response to a live voltage prior to performing a zero voltage check.

- A worker performing *Cutting a Vacuum Vessel with a Wachs Cutter* was working outside their THA. The worker had on tennis shoes, although the THA required safety shoes. Workers also performed a manual adjustment of a cutting bit while it was rotating and removed cut metal strips from the grinder while it was rotating; these activities were not analyzed in the THA and are contrary to good safety practices for rotating machinery.

TJNAF took appropriate corrective actions for these instances, including clarifying a procedure and providing additional training to operators.

C.2.3 Facilities Management and Logistics - Contracted Work

FM&L is responsible for maintenance, modification, and improvement of facilities at TJNAF. Most of this work is performed by subcontractors with direction, coordination, and review by designated Subcontracting Officer's Technical Representatives (SOTRs). FM&L also receives matrixed support from several other site organizations, such as the Engineering and the ESH&Q Divisions.

Independent Oversight observed selected electrical, mechanical, and construction subcontractor work and the associated activities of designated SOTRs. SOTRs are responsible for coordinating subcontractor work with affected TJNAF organizations, ensuring compliance with TJNAF policies, procedures, and the ES&H Manual, and providing clarification of expectations and technical direction, where needed. Observed work included installation, repair, and replacement of electrical equipment and distribution system components, repair of air conditioning units, placement of concrete, and routine preventive maintenance. Associated hazards and hazardous materials included high voltage, radiation and radioactive materials, oxygen deficiency, potentially hazardous chemicals, heat stress, falls, use of cranes and forklifts, and other physical hazards such as noise, sharps, and fire.

Core Function 1: Define the Work

FM&L subcontractor facility work activities were generally well defined and in sufficient detail to establish the desired outcome and to facilitate adequate identification and analysis of activity- and task-level hazards. Reviewed facilities maintenance work requests and resulting subcontractor work orders identified the problems to be fixed, but appropriately allowed the subcontractor to define the scope of work, consistent with contract requirements and limitations. Facility work requests were routed to the appropriate subcontractor-specific SOTR and subcontractor representative, who then walked down the requested job and coordinated with facility tenants, where needed, to develop a better understanding of the scope of work, the tasks to be performed, and the hazards involved. For example, observed SOTR and subcontractor walkdowns of pending electrical (oil filled transformer replacement) and mechanical (air conditioner repair) jobs demonstrated that details of the work, known hazards, and expected controls were appropriately discussed.

The scope and schedule of subcontractor work was effectively defined in interactive discussions during pre-job and in-process job meetings between the responsible SOTR and subcontractor workers and supervisors. Formal documentation of the scope of work determined to be skill of the craft is not required beyond that contained in the work order and the subcontractor's contract and safety plan; however, SOTRs kept brief notes on what was discussed during pre-job discussions.

Reviewed discipline-specific subcontractor contracts and safety plans adequately defined the contracted scope of work and generically identified and analyzed the hazards and the hazard controls to be implemented. The definition of the scope of subcontractor facility work that was above the level of skill of the craft was appropriately documented in formal THAs, SOPs, OSPs, and/or TOSPs that, once implemented, assured the remaining tasks and hazard controls were skill of the craft. Such documents

were appropriately provided to and discussed between the responsible SOTR and subcontractor workers and supervisors during pre-job meetings.

The schedule for most observed subcontractor work was based on requester-justified priorities and mutual agreement between the subcontractor lead and the designated SOTR. The schedules for more complex work (e.g., that could affect the operational status of workplace systems, affect workplace tenant safety or environment, involve many sub-tasks or people, or involve cross-divisional work) were effectively coordinated using schedules reflected in area-specific task lists. For example, the replacement of potentially degraded bayonet fuse holders in multiple oil filled power transformers that supported accelerator operations was appropriately scheduled in the Accelerator task list (ATLis) during a planned accelerator outage. Observed daily meetings between SOTRs and subcontractor personnel demonstrated that discussions with involved workers were held prior to authorizing the start of assigned work and were in sufficient detail to ensure understanding of the scope of the work, the hazards that were to be mitigated, and the hazard controls to be implemented.

In addition, the definition of the scope of work for repair of a large air conditioning unit was appropriately revised in-process, with SOTR and subcontractor input, when the planned sequence of activities had to be changed. The original planned sequence of work was documented in a formal THA and involved the use of a gantry crane that was intended as implementation of a lessons learned to enhance worker safety of the past practice for removing and replacing a heavy air conditioning compressor. Following discovery that the rented gantry crane could not be used to assist in the removal of the failed 500 pound air conditioner compressor from its enclosure, due to new safety, stability, and interference concerns, a new scope of work was developed that required use of a come-along anchored by a long length of chain to a roof structural member. The revised definition of scope was also documented in a formal THA enabling appropriate identification and analysis, mitigation, and communication of the new hazards.

Core Function 2: Analyze the Hazards

In essentially all instances, work activity and task-level hazards were effectively identified and analyzed through the TJNAF work planning and hazard analysis process. Further, all hazards associated with observed work activities were appropriately identified and analyzed prior to work implementation.

SOTRs and subcontractors walked down requested work and met with facility tenants, subject matter experts, and managers, as appropriate, to determine the work scope and schedule, identify and analyze the hazards, and discuss the hazard controls that were or could be implemented. For example, the walkdown of a planned transformer replacement included the subcontracting officer, SOTR, and a subcontractor manager, with focus on the work scope, schedule, hazards, and potential hazard controls. Additional walkdowns were performed to identify the location of buried utilities that needed to be protected during crossing with required heavy equipment. In another example, the walkdown of a request to repair a trailer air conditioning unit identified the need for a 12-foot ladder and the removal of items stored in the vicinity that would interfere with forklift truck operations.

The generic hazards associated with subcontractor skill-of-the-craft work were appropriately identified and analyzed in ES&H Manual-required subcontractor safety plans. Work that was not categorized as skill of the craft was analyzed in formal THAs that were generally comprehensive and appropriate to the work to be performed. Hazards identified in the analyses that were not adequately mitigated by a current SOP, OSP, or TOSP required development, approval, and implementation of additional hazard mitigation work control documents. Formal THAs were drafted by SOTRs and then reviewed, appropriately revised, and approved based on input from subcontractor workers and supervisors and appropriate ES&H staff. Reviewed formal THAs and SOPs appropriately defined the scope of work, and identified potential hazards and expected controls. For example, the formal THA for repair of a large air conditioning

compressor was documented on a spreadsheet in the sequence of the planned work activity. The resulting THA appropriately addressed the associated activity- and task-level hazards, the people or property at risk, and the mitigating measures to be implemented, including required lockout/tagout, hot work permit, refrigerant recovery, lift plan, tag lines and spotters, fall protection gear, exclusion area wardens and boundaries, associated training and qualifications, and PPE.

Similarly, the formal THA for replacement of bayonet fuse holders in multiple oil filled power transformers with nitrogen cover gas appropriately identified the significant tasks to be performed, most activity- and task-level hazards, those at risk, mitigation measures (including two SOPs), and additional controls (engineered, administrative, and PPE) to be implemented. The Independent Oversight team review of the original formal THA for the transformer fuseholder replacement identified one additional potential hazard to the worker (i.e., the potential for inadvertent entry into an oxygen deficient environment that could initially exist in the transformer's gas space during the task of disconnecting and reconnecting the fuseholder conductors). Subsequent discussion with the SOTR and the subcontractor supervisor, who had previously performed the planned work, indicated that entry into the transformer confined space was neither required nor likely, given the size of the available space above the fuse holders and the transformer oil surface. However, because a potential existed for the worker's face to inadvertently break the plane of the opening into the transformer confined space, the SOTR revised the original THA before work was performed to appropriately address the missing potential hazard and controls. In light of the otherwise comprehensive nature of this and other reviewed formal THAs for similarly complex tasks, the need to enhance this formal THA is not indicative of deficiencies in the work planning process, staff training or performance, but reflects differences in the degree to which Independent Oversight considered the risk of an unlikely scenario.

Core Function 3: Develop and Implement Controls

In almost all observed work activities, appropriate hazard controls were developed and effectively implemented. Electrical, mechanical, and fire protection subcontractor contracts and safety plans appropriately established generic work practices, training, and PPE to effectively mitigate identified and analyzed hazards associated with contracted skill-of-the-craft work.

The TJNAF work planning process requires the SOTR to informally determine whether subcontractor workers have appropriate understanding and training for requested work and whether the combination of basic PPE requirements and existing engineered safeguards are sufficient by themselves to deem the work as skill of the craft. In making that determination, SOTRs involve subject matter experts and ESH&Q professionals, where appropriate. No instance of misclassifying skill-of-the-craft work was identified.

For subcontractor work that does not meet skill-of-the-craft criteria, SOTRs develop and require implementation of hazard controls using formal THAs. As discussed under Core Function 2, all reviewed formal THAs were well written and effectively defined and communicated activity- and task-specific hazard controls required to mitigate the hazards identified in the formal THA. In particular, the hazard controls developed and implemented for the challenging repair of the large air conditioning unit on the roof of a building and the replacement of fuse holders in a transformer were effective in comprehensively mitigating identified hazards.

Reviewed formal THAs frequently identified the need for additional administrative hazard controls that were addressed with just-in-time training (e.g., fall protection training for the mechanical subcontractor supervisor to facilitate his use of fall protection PPE). Where sufficient hazard controls to mitigate THA-identified hazards were not addressed by training or existing SOPs, OSPs or TOSPs, appropriate new work planning and control documents were developed and approved. For example, the electrical subcontractor SOTR, working with subcontractor personnel and technicians involved in acid use and

processing, appropriately developed a new SOP to resolve subcontractor safety concerns for work in areas where acids were used.

Formal THAs and pre-job meetings ensured that subcontractor workers and supervisors had the required training or understanding necessary for the work to be performed and had input into the selection of the hazard controls to be implemented. For example, electrical subcontractor personnel assigned to replace transformer bayonet fuse holders were provided instruction on and demonstrated in practice their ability as competent persons to erect, inspect, use, and disassemble the aluminum scaffold that was used in the job. The instruction was effectively presented and included a practical lessons learned to prevent unintentional disconnect of scaffold railing.

Core Function 4: Perform Work Safely Within Controls

Essentially all observed subcontractor work activities were performed safely and within established controls by competent, knowledgeable, well trained, and safety conscious subcontractor personnel with effective SOTR direction, coordination, and review. Subcontractors were appropriately authorized to start work only after interactive pre-job briefings between the responsible SOTRs and subcontractor staff. These briefings effectively ensured the subcontractors were aware of their work assignments, the scope of work, associated hazards, remembered lessons learned, hazard controls to be implemented, and required TJNAF facility coordination. In all observed cases, the assigned work was again walked down by the subcontractor to confirm the scope of work was still appropriate and no new task or hazards had been introduced.

The repair of a large air handling unit (AHU) air conditioner on the roof of the Continuous Electron Beam Accelerator Facility Center was performed by the mechanical subcontractor staff in a high heat stress environment with generally excellent regard for safety. The responsible SOTRs and subcontractor supervision actively promoted and were involved in safety activities, such as acting as safety spotters, verifying exclusion areas were clear, and inspecting fall protection PPE and anchorage. Other tasks performed by SOTRs and subcontractor personnel included briefing the Building Manager on planned activities including the need to evacuate the second floor during the lifting of compressors onto and off the roof; conducting a pre-start briefing with involved subcontractor personnel; securing power and disconnecting compressor wiring, including performing a lockout/tagout and appropriate zero voltage checks; recovering refrigerant; and setting up a tent, fan, and hydration station, and directing frequent breaks for personnel to protect against heat stress, considering the predicted 100+ degree heat index. During setup of a rented two-ton gantry crane (intended as an enhancement over the previous process for removal of damaged air conditioning compressors), the work crew discovered that there was interference between the crane struts and the AHU enclosure that prevented required positioning above the compressor's COG and that the gantry crane rented for this purpose was unstable and could not be safely used. The job was appropriately paused when the planned activities addressed in the formal THA could not be completed as planned. Subsequent walkdown of the job by the responsible SOTRs and an owner of the mechanical subcontractor company resulted in a decision to extract the compressor from the AHU enclosure onto a cart using a come-along anchored to roof stiffeners. The formal THA was revised to re-define the scope of work, hazards, and hazard controls. With a focus on performing the job safely, the job was again pre-briefed, an exclusion boundary for the mobile high lift crane was established, the exclusion area was cleared of unauthorized personnel and policed to prevent unauthorized entry, the crane and crane operator licenses were inspected, spotters were established, each lift used a tag line, planned use of a forklift truck was halted because of recognition of a flat tire, use of the high lift crane and the work tent were terminated because the wind picked-up, and portable lighting was established to facilitate continued work. With the isolated exception of one instance of daisy-chaining electrical extension cords, which is prohibited by the TJNAF ES&H Manual, the work was performed with a very strong focus on safety by all involved.

The replacement of the bayonet fuse holders in an oil filled 12,400 volt to 480 volt transformer with a nitrogen cover gas was also effectively performed while meeting all but one associated safety requirements. The responsible SOTRs and subcontractor supervision were observed to actively promote and be involved in safety activities, such as inspecting the installed scaffolding prior to use, performing lockout/tagout and zero voltage checks, and directing oil handling operations to minimize spill potential. Required hazard controls were effectively implemented, including securing the ladder for access to the scaffold platform and transformer top, using rags and absorbent pads to wipe down and absorb oil leaks and collections, and maintaining plastic sheets on the ground beneath oil containing equipment. Further, when several drops of vegetable-based transformer oil ran down a hose and dripped on the ground, the leakage was promptly secured and the small wetted area was removed by shovel into an awaiting waste disposal container. With the exception of one instance of using a 5 kilowatt portable electric generator to supply a portable oil transfer pump without an OSHA-required ground fault circuit interrupter, the work was performed with a very strong focus on work safety by all involved.

With the few isolated exceptions (discussed earlier), electrical, mechanical, and construction subcontractor work was appropriately and safely implemented in accordance with established controls. In particular, the electrical subcontractor craftsman and supervisor appropriately coordinated electrical power outages with facility tenants; implemented lockout/tagout of electrical power supplies and performed zero voltage checks as required; appropriately used a recently inspected man lift and fall prevention harness; selected and used appropriate ladders to access and repair electrical equipment; and used hard hats, safety glasses, and gloves where required. Further, the mechanical subcontractor craftsman and supervisor appropriately coordinated work activities with tenants, implemented lockout/tagouts appropriately, paused work to obtain a longer ladder to facilitate work without over-reaching or standing on top ladder steps, evacuated freon before dismantling air conditioner components, and wore appropriate PPE (e.g., gloves and safety glasses) as required while using power tools and working around sharp edges. Finally, construction subcontractor workers and supervisor wore required PPE and promptly addressed an Independent Oversight team concern that a backing concrete truck did not have a working audible warning alarm.

C.3 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

TJNAF:

1. Review and revise the ES&H Manual as necessary to ensure that workers can easily recognize and understand the distinction between minimum safety requirements and guidance. Ensure the following additional enhancements are addressed.

- Revise the electrical safety section to accurately reflect OSHA requirements for use of ground-fault-circuit interrupter devices with portable electric generators and ensure SOTRs and subcontractor personnel are trained on the updated requirements.
- Revise the forklift safety section to ensure all specific OSHA standards are addressed by requirements.

2. **Expedite the move to a single TJNAF work planning hazard identification and analysis process with appropriate program description documents, training, assessments, and feedback mechanisms to ensure consistent understanding and use.** Consider the following enhancements to the work control process:
 - Improve the mechanism to define, determine, and document skill-of-the-craft or skill-of-the-worker tasks. Include specific criteria for when multiple skill-of-the-craft tasks become complex enough to warrant a documented hazard analysis.
 - Simplify and enhance the risk determination process. While the current process is good for project-level activities, it is too complex for many routine tasks. Develop a simple determination for whether or not the work is skill of the craft, and only apply the additional risk determination after determining that it is beyond skill of the craft. Consider including criteria for the potential for chronic health effects in addition to injury consequences and property loss.
 - Revise the automated task lists (ATLis, FEList, Hall Lists, etc.) to include links to appropriate ESH manual sections or requirements when hazard checklist answers are “yes.”
 - Provide the capability to insert work instructions in cases where formal procedures are not necessary, but subtask listing or subtask sequencing would enhance the work control for a given task. Provide a mechanism to ensure that any work instructions provided in the comments section get transferred into the work instructions section.
 - Reorder the contents of the lists, giving consideration to presenting the most important information for work performance first (i.e., task description), followed by hazards and associated controls, followed by work instructions, with comments last.
3. **Enhance site forklift operator training to ensure complete worker understanding of the hazards.** Consider incorporating the following into the training program.
 - Include specific training on how COG is calculated. Improve training on ability to determine or verify the adequacy of forklift capacity de-rating based on a COG of the load that is different from the nameplate data.
 - Formally develop and incorporate methods for workers to qualify on specific forklifts. As required by the OSHA standard, include training on specific operational precautions and limits from the forklift nameplate data and operator manual.
4. **Establish expected routing and expected methods for retrieval and use of subcontractor lessons learned documented by SOTRs during daily pre-job briefings.**
5. **Clarify and communicate expectations for full compliance with PPE requirements and proper posting of areas where PPE is required.**

APPENDIX D

Core Function #5 – Feedback and Continuous Improvement

D.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight evaluated DOE Federal and contractor feedback and improvement processes at the Thomas Jefferson National Accelerator Facility (TJNAF). The Independent Oversight team examined the following areas:

- Thomas Jefferson Site Office (TJSO) feedback and improvement processes, including assessments, issues management, corrective action tracking, technical qualifications, and the employee concerns program (ECP). (See Section D.2.1.)
- Thomas Jefferson contractor – Jefferson Science Associates, L.L.C. (JSA) – feedback and improvement processes, such as assessments, corrective actions and issues management, injury and illness investigation and prevention, lessons learned, ECP, and activity-level feedback processes. (See Sections D.2.2.)

For each of the organizations above, Independent Oversight examined applicable institutional, facility-level, and activity-level feedback and improvement programs and processes, with primary emphasis on their application to TJNAF facilities and organizations reviewed on this inspection (see Appendix C). Independent Oversight interviewed TJSO and JSA personnel and reviewed various program documents and assessment reports.

D.2 RESULTS

D.2.1 Thomas Jefferson Site Office

TJSO ES&H Oversight Program. The TJSO Operational Awareness Program Plan (OAPP) addresses most needed elements of TJSO oversight activities, including formal and informal assessments, surveillances, for-cause surveillances, and walkthrough activities. It also includes directive requirements for reporting, trending, and tracking of issues and corrective actions for the site office and the lab issues identified by the site office. Day-to-day operational awareness actions, such as meeting attendance and walkthrough surveillance processes, provide effective operational awareness of site conditions and activities, and are discussed more completely in a later section.

The Operational Awareness Program is directed by TJSO Standard Operating Plan and Procedure (SOPP) 4.5, which has undergone a number of recent enhancements. The OAPP Program Coordinator is assigned by the Site Office Functions and Responsibilities directive. The Office of Science (SC) Integrated Support Center (ISC) conducted an implementation review prior to the Independent Oversight inspection to validate TJSO implementation of DOE Order 226.1A and evaluate TJSO SOPP 4.5. The assessment results led to additional staff training for the TJSO staff on the latest revision to TJSO SOPP 4.5, and has identified additional review of the requirements of DOE Order 226.1A for integration into the Annual Assessment Schedule for the upcoming year.

Environment, safety, and health (ES&H) staff competency for oversight duties has been developed through training for professional skills, training for operational awareness activities, and mentoring to

improve their capabilities. This expertise and competence has been developed primarily through informal staff development, but a formal qualification program for ES&H staff members has recently been developed. These formal qualification requirements have been implemented through the TJSO Technical Competency Program which supports their ability to conduct operational oversight, and are described in a later paragraph. Staff training for operational awareness skills and methods is required by TJSO SOPP 4.5. This training was provided with the recent revision to the directive, but is not required or scheduled as periodic training. Periodic discussion of oversight activities is covered in ES&H and Quality (ESH&Q) staff meetings, including discussion of site performance trends and management emphasis. There is no formally scheduled continuing training program to review areas such as lessons learned, TJNAF processes and procedures, assessment methods, or cross-training to develop ES&H generalists. Effective staff improvement has been accomplished by regular individual mentoring. Facility walkdowns with senior management are scheduled and conducted, allowing less-experienced staff members to compare assessment results with observations from more-experienced staff. Additionally, the site office directive TJSO SOPP 4.5 requires peer mentoring of ES&H staff, which also contributes to a broad base of professional knowledge.

Coverage and staffing is adequate to achieve required oversight activities. The site office has one unfilled ES&H specialist position, and one unfilled facility operations staff member position. Requirements for those positions are currently accomplished in portions by the other staff members. Specific expectations for staff members' assessment and operational awareness items are included within individual performance plans and appraisals, and provide a clear understanding of areas of responsibility.

Assessments. Most TJSO assessment reports are rigorous and of good technical quality. Issues are identified and clearly communicated to the contractor and effectively documented in the SC-supported ORION database. Assessments cover a wide range of TJNAF activities and requirements. Although generally adequate, two aspects of the TJSO assessment program warrant continued attention to ensure that TJNAF safety management continues to improve. First, TJSO assessments have not routinely evaluated some aspects of integrated safety management (ISM) work control processes; this area is important because some of the TJNAF work control processes are relatively new and/or not well documented. Second, TJSO ES&H personnel have placed limited emphasis on evaluating the overall effectiveness of TJNAF in implementing corrective actions, contributing to recurring deficiencies in such areas as forklift postings.

The TJSO Assessment schedule is developed collaboratively by the ES&H staff members and approved by the TJSO management. The SC Integrated Assessment Schedule includes most SC site office assessments. This integrated schedule has been a valuable tool that facilitates coordination of support from the Oak Ridge Office (ORO) ISC staff. TJSO and ORO ISC have an effective and cooperative approach to ES&H oversight activities, coordinated primarily by the TJSO Deputy Manager and the ORO ISC ES&H Manager. This arrangement has been a key element in an increased level of oversight actions conducted by TJSO.

The assessment scheduling process has received careful judgment and consideration by TJSO staff. However, some assessments, required by DOE or local site office directives, are not included within the assessment schedule. For example, required semi-annual quality checks of contractor injury and illness reports were not scheduled or performed. Also, SOPP 4.5 requires TJSO to conduct a self-assessment of the OAPP at least bi-annually, but this assessment is not included in the fiscal year (FY) 2008 or FY 2009 schedule. This omission was identified during the implementation review conducted by SC ISC, and is scheduled for corrective action within the TJSO management tracking list (TJSO Action Tracker).

The existing assessment scheduling process specified by SOPP 4.5 does not demonstrate a method to ensure that externally required assessments will be conducted as required in the future. Specifically, there

are no provisions for implementation of the SC list of directive-required assessments, a process to keep the schedule and list current, and a means of being able to reconcile the accomplishment of required assessments over multiple years. Additionally, the actual development process used to produce the current three-year schedule did not create a clear record demonstrating that a comprehensive review of external requirements and desired areas of coverage was performed in the development of the schedule. SOPP 4.5 also provides guidelines for prioritization and establishes an expectation for risk-based evaluations. The SOPP 4.5 process had not been implemented for the FY 2008 schedule, and the schedule development for the FY 2009 assessment has not yet considered that process. Although the new SOPP 4.5 has not yet been fully implemented, there is some confidence that key ES&H program requirements were evaluated in conjunction with the approval process for JSA plans because of the experience of the staff members; their understanding of current and projected areas of concern; and the use of Appendix D to TJSO SOPP 4.5, which provides a list of required JSA plans requiring TJSO approval.

TJSO has self-identified a need to improve their process for considering TJNAF contractor assurance activities. The TJNAF assessment plan was not reviewed prior to development of TJSO plans and assessment schedule. For FY 2008, the TJSO surveillance and assessment schedule was developed and provided to the TJNAF staff who then integrated the TJSO schedule with planned contractor assessment activities. TJSO has recognized that the assessment schedule for FY 2008 did not sufficiently consider the contractor assurance system (CAS). TJSO is now planning for the FY 2009 schedule and has indicated to TJNAF that the TJNAF will need to submit their assessment plan to TJSO for review before completion of the consolidated schedule, and that TJSO intends to tailor their assessment plan based on that review.

Analysis and review of completed assessment activities is one of the TJSO management focus areas for improvement. TJSO SOPP 4.5 specifies quarterly status reports of assessment activities to the Site Office Manager. Although inconsistent in quality and timeliness, these reports have assisted in improvements in oversight performance. Continued improvement in the quality and utility of these reports should lead to a more responsive oversight process and better focus on weakness in TJNAF ISM performance.

TJSO Self-Assessments. The use of self-assessments by TJSO has been limited and consists of two broad ISM system reviews and one recent self-assessment of the fire protection program. As discussed above, a SOPP 4.5 required self-assessment of the OAPP has not been scheduled. TJSO management recognizes the deficiencies in the self-assessment and has identified corrective actions, which are being tracked through the TJSO management administrative tracking system. TJSO recently reviewed a number of TJSO programs to evaluate their directives and administration. Although these reviews are not included with the TJSO self-assessment records and did not evaluate program results, they provided some aspects of programmatic self-assessments. These reviews were supported by the SC ISC to provide better program expertise. These program reviews are not documented through the TJSO assessment records (ORION database) but have been distributed and reviewed.

Operational Awareness. The actions by various TJSO staff members provide for operational awareness similar to activities conducted by Facility Representatives at other sites. The operational awareness activities ensure that the TJSO senior management is kept well informed about ongoing operations and hazards at TJNAF. This program is flexible and responsive to current issues, and is well supported by the TJSO staff, who are motivated and committed to the program. Day-to-day operational awareness actions, such as meeting attendance and walkthrough surveillance processes, effectively provide information about current site conditions and activities. Walkthrough surveillances are professionally conducted and are appropriately intrusive into laboratory operations. Although TJSO has a small number of ES&H staff, these individuals have conducted a substantial number of walkthrough surveillances within FY 2008, and have identified meaningful issues and observations.

TJSO ES&H staff and other TJSO staff members self-select areas of evaluation within TJNAF for routine and unscheduled walkthrough surveillances. Some TJSO staff members have been assigned a minimum required time in the field for oversight, which has promoted TJSO oversight presence within the facilities. Walkthrough surveillance activities were generally consistent among TJSO staff members and included observation of work activities, hazard identification and prevention, facility conditions, and contractor procedures. Documentation of these surveillance results within the ORION database has supported management oversight reviews. Selection of walkthrough areas of emphasis has not yet fully achieved the informal TJSO objective of focus on appropriate TJNAF activities (rather than just facility spaces), based on record reviews of the walkthroughs conducted to this point in FY 2008. However, the current situation is partly attributed to the need to train new staff members, and surveillances conducted within the current quarter have demonstrated greater emphasis on work activities.

The TJSO ES&H staff has unencumbered access to assigned facility spaces and operations, but some examples were noted where staff were not fully trained to enter all spaces that require special controls. Individual staff members have initiated actions to enable unrestricted access throughout the facility. Stop work authority has been specified by TJSO directive and is well understood by all staff members who were interviewed. Assessment and walkthrough surveillances do not generally evaluate the contractor self-assessment processes, unless specifically required as part of an assessment criteria review and approach document (CRAD).

TJSO ES&H staff report findings, trends, or areas of concern (formally and informally) to the contractor. Walkthrough reporting is currently conducted by email after informal review with the cognizant lab employee or manager. This practice has required considerable staff attention and time, and is under evaluation by TJSO staff. TJSO ES&H staff track and informally follow up to determine if deficiencies have been corrected. They have good access and strong processes that provide access to SC ISC technical expertise (i.e., subject matter experts) regarding ESH&Q-observed issues. Most observations are appropriately recorded as P-3 (lowest level) findings; however, interviews indicate there may be reluctance among TJSO staff to use the P-2 category to identify non-compliances. For example, the lack of markings on a forklift attachment found in January 2008 was recorded as a P-3, even though the Occupational Safety and Health Administration (OSHA) considers attachments to be part of the forklift, and there are specific OSHA requirements for maintaining legible markings. In addition, there are no examples within FY 2007 and FY 2008 assessment records of multiple P-3 findings that resulted in a P-2 roll-up finding requiring greater contractor response.

Evaluation of surveillance results to better understand contractor safety performance and TJSO oversight performance is a TJSO management area of emphasis. Weekly ES&H staff meetings conducted by the TJSO Deputy Site Manager are a useful tool for evaluating weekly ES&H staff oversight activities. Planned surveillance activities and opportunities for activity walkthrough surveillances were discussed and prioritized at these meetings. Current ES&H program actions in progress by TJNAF were also reviewed. TJSO staff has effectively applied a tracking system database “dashboard” to monitor their assessment activities and contractor response to identified issues. This new practice provides a timely summary of oversight effectiveness. The current version of the dashboard does not provide any trending information regarding contractor performance. A quarterly review of surveillance results is used to develop performance trend information but that process is relatively new and not yet mature, and has not yet provided substantive information to refine and enhance the TJSO oversight process.

Corrective Action Process. TJSO oversight of the contractor corrective action process and the corrective action process for site office issues does not provide sufficient documented results to provide confidence that corrective actions are thorough and sustained. Tracking of contractor corrective actions and site office corrective actions is described in TJSO SOPP 4.5, but does not provide adequate confidence that actions are managed. No causal analysis has been conducted for most findings recorded

for TJSO self-assessments. Most items that contain identified cause statements within the assessment and surveillance records have only single word or very short cause statements such as “Communications” or “Management Weakness.” Additionally, use of effectiveness reviews to determine whether completed corrective actions have or have not effectively resolved and prevented recurrence of the same or similar findings at the performance level has not been documented or scheduled as required by DOE Order 226.1A, *Implementation of DOE Oversight Policy*, except as recently scheduled for FY 2009 assessments.

The method used for site office scheduling and attention to follow up evaluation for contractor corrective actions is not clearly defined. Current practices require that individual staff follow up by re-inspection or by informal reports from contractor staff of each reported issue to determine if contractor corrective action is completed, except when a formal corrective action report is submitted by letter. Improvements in this area could reduce the number of repeated issues.

Contract and Contract Performance Evaluation. TJSO has established several ES&H performance measures within the FY 2008 Performance Evaluation and Measurement Plan (PEMP). These performance measures are related to accident and illness reporting, radiation exposure, environmental incidents, and several feedback and improvement responsibilities. Additional and more rigorous measures are under consideration and review by the TJSO staff for the FY 2009 PEMP. TJSO’s use of contract performance objectives and measures to drive contractor performance improvements has been improving in recent years but warrants sustained management emphasis.

ES&H Reporting. The TJSO ES&H staff works closely with facility management in the preparation and review of occurrence reports to ensure that reports are accomplished in a timely manner. TJSO directives have one staff member as the TJSO Facility Representative Equivalent for Occurrence Reporting to provide a point of contact for contractor notification to TJSO for unusual events and issues. The current methods provide an adequate means to ensure that prompt notification occurs, and to allow appropriate involvement of DOE staff expertise. Follow-up actions (event investigation and critiques) have been identified as a contractor performance weakness, and have resulted in direction to TJNAF management to make improvements.

ECP and Differing Professional Opinions (DPO) Program. The TJSO ECP meets directive requirements, with exception of a DPO process. There are some administrative weaknesses within the programs, which had been partially self-identified during a recent program assessment conducted by TJSO. No ECP issues were identified for calendar year 2007 or 2008.

The ECP is conducted under TJSO SOPP 2.1, and the Employee Concerns Program Manager is specified by the TJSO Functions and Responsibilities directive. The assigned Employee Concerns Program Manager is familiar with the program requirements and able to respond if a concern is submitted to TJSO. The SC ISC supports this program and conducted a program review prior to the Independent Oversight inspection.

The TJSO Employee Concerns Program Manager does not provide oversight of the contractor ECP and expects the contractor program to be evaluated as part of an ISC assessment. However, the expectation for the ISC to review the contractor ECP is not clearly specified in the site office directive or support agreement. TJSO has self-identified the lack of an annual program assessment as required by DOE Order 442.1. An ISC assessment planned for 2009 may meet the directive requirement for 2009 (assuming that it provides adequate coverage of the ECP requirements), but there is no definitive ongoing requirement for the annual assessment in the TJSO and ISC processes. TJSO has an action plan to correct missing assessments and self-assessments through the Site Office Action Tracker, as discussed in paragraphs above. The TJSO SOPP references the DOE DPO Policy (DOE Policy 442.1), but does not provide any implementing direction for submission and resolution of a DPO issue.

TJSO Federal Employee Occupational Safety and Health Program (FEOSH). The TJSO FEOSH program meets applicable requirements of DOE Order 440.1B, *Worker Protection Program for DOE (Including NNSA) Federal Employees*. The FEOSH program is conducted under TJSO SOPP 4.8, and the FEOSH Program Manager is assigned by the TJSO Functions and Responsibilities directive. The SC ISC supports this program, and has supported TJSO self-assessments of the program.

The TJSO Manager and his staff have an effective and visible program to establish clear expectations for safety standards and compliance. Annual FEOSH goals and objectives are not specified by any directive or document as specified by DOE Order 440.1B; however, leadership emphasis has been established by informal methods. For example, management emphasis on Federal worker protection is demonstrated by the guidelines and methods to procure safety glasses, safety shoes, and hard hats for TJSO personnel who are involved in inspections of facilities.

An evaluation of workplace hazards was conducted for each TJSO Federal worker. This hazard assessment also included an inspection of the office areas to meet the DOE Order 440.1B requirement. Scheduling for the upcoming and future years is not defined because the annual unannounced workplace inspection is not identified on the Integrated Annual Assessment Schedule.

Technical Qualification Program. TJSO has recently established a Technical Competency Program (TCP) to establish a formal method of qualifying technically trained staff personnel to support oversight functions. Although not yet fully implemented, the program provides a well thought out process for the small numbers of staff members, and accounts for the breadth of responsibilities of the TJSO ES&H staff. The TJSO Manager and Deputy Site Office Manager leadership is evident and these managers have provided appropriate support to this program.

All technically trained TJSO ES&H staff personnel participate in the TCP. Job-specific qualification cards have been issued for each individual with ES&H responsibilities, as well as other TJSO staff members. The program requires that job-specific qualification cards be updated when job description or program descriptions change. TJSO staff members have not yet completed qualification beyond the General Technical Base standard.

The TCP is not yet supported by any formal continuing training program for ES&H staff members. Although informal training is conducted, when practical, during routine staff meetings, there is currently no formal long-term continuing training schedule, nor has a rigorous training needs assessment been conducted.

TJSO Corporate Operating Experience Program. The TJSO corporate operating experience program is an adequate process, with a recently approved implementing procedure (TJSO SOPP 4.11) that meets the requirements of DOE Order 210.2, *DOE Corporate Operating Experience Program*. Responsibilities for the TJSO Manager and the Operating Experience Program Coordinator are well defined and provide a reasonable approach to oversight of the program.

The TJSO Program Coordinator provides an effective conduit of information to the contractor for further distribution to the TJNAF workforce. He reviews each incoming description (lesson learned) and reviews it for applicability. Where appropriate, he forwards the document to the TJNAF Program Coordinator for distribution and application to TJNAF activities. The TJNAF Program Coordinator provides a response with the planned distribution of the lesson-learned report. The transmittal and response are maintained in a working file held by the TJSO Program Coordinator. A reasonable number of lessons-learned reports have been transmitted from TJSO to TJNAF (38 documents on file for FY 2008).

The program, as it is currently implemented, relies on transmission of DOE program information, such as occurrence reports, safety bulletins, and other established systems. TJSO oversight review of the contractor actions has not identified any routine use of the lessons-learned database for training or planning purposes by the TJNAF staff. The TJSO staff is considering establishing a FY 2009 PEMP performance measure that would challenge TJNAF staff to use their database in job planning.

TJSO staff has been directly involved in frequent communications with the contractor during the recent contract implementation of DOE Order 210.2. This communication has been formal, and has provided clear expectations for the actions required. The TJSO process to track TJNAF compliance with their commitment is informal and, as yet, TJSO has not scheduled oversight activities to confirm that TJNAF completes the necessary follow-up actions.

D.2.2 TJNAF Feedback and Improvement Systems

Assessments. TJNAF has established a variety of assessment programs and activities that evaluate safety programs and performance and drive continuous improvement, including independent assessments and management self-assessments required of line and support organizations, facility safety inspections by facility Safety Wardens and ES&H, and supervisor and manager safety observations using a behavior-based safety process.

TJNAF has recently established procedures for independent assessments, management self-assessments, and development of an integrated assessment schedule, incorporating TJSO planned assessments and surveillances. The new assessment scheduling procedure appropriately requires development of a multi-year "assessment topic document" that identifies mandatory assessments (regulatory or contractual), assessments based on trend analysis, and assessments requested by management. The assessment topic document has been drafted and reflects a generally comprehensive listing of ES&H topical programs and safety management systems (including mandatory assessments), and identifies assessments performed or targeted for years 2006 through 2010. The management self-assessment procedure requires review and signature by the organization Associate Director and the approval by the Quality Assurance and Continuous Improvement (QA/CI) manager, and approval by the Chief Operating Officer or Chief Scientist – an approach that promotes engagement and awareness by senior management.

In October 2007, TJNAF established and implemented a less formal assessment program in which TJNAF managers at all levels conduct documented visits to work areas, observing physical conditions and work activities and interacting with workers about job safety. These safety observations are conducted and documented using a basic behavior-based safety observation process and checklist, identifying safe and at-risk behaviors and providing real-time positive and constructive feedback. Over 130 supervisors and managers have received training on the process and, in the first 8 months, approximately 85 managers have documented about 800 observations. An extensive protocol document describing the purpose, process, expectations for this program, drafts of a program description document, a procedure, and an instruction for the documentation application have been prepared; however, none have yet been completed and approved for issue.

Designated Safety Wardens in each facility and organization are required to perform workplace safety inspections as described in ES&H Manual Chapter 5100, *Inspections and Assessments*. These routine monthly inspections of the workplace, including specific inspections and testing of eyewash stations, safety showers, and fire extinguishers, are required to be performed by Area Safety Wardens, with quarterly participation by ES&H staff. Since September 2007, these inspections (with the exception of the Physics Division) have been logged into a site database, with monitoring of dispositions by the Accelerator Deputy Safety Officer. While not a manual or procedural requirement, this monitoring and

analysis is an appropriate and proactive feedback and continuous improvement mechanism. The Physics organization maintains a separate program for managing workplace inspections.

Although some assessments activities are being performed effectively, there are also many assessments, primarily management self-assessments, that lack sufficient scope and rigor and do not appropriately support conclusions or identify issues accurately or as required by governing site procedures. Independent assessments and management self-assessments conducted in 2006, 2007, and 2008 were seldom performance based and included little observation of work activities or completed documentation that reflects performance (e.g., assessment and issues management reports, Occurrence Reporting and Processing System or ORPS, and non-reportable event reports, lessons-learned documents, inspection data, committee meeting minutes, etc.). For example, the specified purpose of the independent assessment of feedback and improvement programs conducted in August 2006 was to evaluate the programs “documentation and implementation,” but no performance-related documents were identified in the listing of documents reviewed. The only documents that were identified as reviewed were those that defined program requirements and parameters (e.g., procedures, charters, training plans, ES&H Manual chapters, and the PEMP). The recently completed management self-assessment of ISM Implementation and Oversight (approved May 30, 2008) did not adequately evaluate implementation, although such an evaluation was part of the stated purpose. The report did not identify any work observed or performance documentation reviewed and did not identify any of the implementation problems in the issues management process, assessment programs, and event investigations identified by Independent Oversight during this inspection. The report identified over 30 needed actions, but all of these were procedural deficiencies. (See Finding #D-2.)

Many of the TJNAF assessments were based on interviews or reviews of procedures and processes, with analysis and results focused on describing how things were done rather than how well they were done. Many recent management and independent assessments were not sufficiently rigorous or self-critical. For example, the March 2007 assessment of ESH&Q oversight did not identify the basis for the evaluation and ratings or the specific improvements needed in most cases. The December 2007 annual mandatory independent assessment (lockout/tagout) identified that 10 of the 16 lockout/tagout installations inspected in the field were deficient and required corrective actions, but the conclusions of the assessment were that the program was effective and only the ten individual deficiencies were entered into the issues management tracking tool. The report for the December 2007 assessment report did not address the unreadable tags and missing labels in a manner that would lead to preventive actions for the systemic issue. Also, the results section of that report only addressed the inspection of installed locks and tags; it did not address the remaining seven elements of the assessment described in the scope, although the summary of the assessment did discuss interviews with an unspecified number of authorized employees. Further, the scope of the assessment did not meet the OSHA requirements in 29 CFR 147 in that the review of procedure understanding was not conducted with all authorized and affected employees, and the employees interviewed or observed were not identified. The installed locks and tags and interviews with employees were all performed in the Accelerator and in the Test Laboratory. Installations by subcontractors of Facility Management and Logistics (FM&L) and other line organizations that adhere to the TJNAF lockout/tagout program requirements were not reviewed. Similar problems with unreadable tags and missing labels were also identified in previous lockout/tagout assessments. Further, the last two annual assessments have been conducted when the accelerator was online, significantly limiting the number and scope of installations and involved employees. (See Finding #D-2.)

The October 2007 TJNAF assessment of their CAS is another example of an assessment with insufficient rigor and performance assessment. This assessment, which “evaluated the implementation and effectiveness of the contractor assurance system,” identified no findings or observations, but the TJSO review of the TJNAF CAS conducted one month later identified six findings and 10 observations, and this Independent Oversight inspection has identified a number of process and implementation deficiencies.

Also, in a number of assessment reports, conditions that met the TJNAF definition of a finding (i.e., deviations from requirements) were only identified as observations or opportunities for improvement. (See Finding #D-2.)

Although the FY 2008 schedule and indications in the draft topic document indicate a broader and more ambitious formal assessment program for the future, the scope and number of TJNAF self-assessments to date have been limited. Few assessments have been performed over the past two years, especially by line organizations. Most of those performed have been focused on ISM or were regulatory driven mandatory assessments. The assessments that were performed have not reflected a tailoring of line self-assessments to organization/facility operations, management systems, and problem areas. The FY 2008 schedule does not identify any safety management self-assessments to be performed by a specific line or support organization other than ESH&Q. Only three management self-assessments related to safety have been completed in the first eight months of FY 2008, with two of those performed by the ESH&Q organization. In FY 2007, only nine management self-assessments were performed, three ISM system assessments in preparation for this Independent Oversight inspection, and four identical mandatory QA assessments of calibration at four different facilities. Only four independent assessments were performed in FY 2007, including two mandatory 10 CFR 835 radiation program assessments, a mandatory accelerator safety assessment, and a 10 CFR 851 review in the Free Electron Laser (FEL) facility. The assessments performed over the last few years do not reflect a planned, comprehensive review of processes, management systems, and activities but consisted primarily of assessments mandated by regulations and ISM reviews. (See Finding #D-2.)

The minimal number of management self-assessments and the lack of engagement of TJNAF line and support management, other than the ESH&Q organization, are also reflected in the procedures and training associated with the TJNAF assessment program. The action steps in the procedure for the development of the integrated assessment schedule do not identify the position or organization responsible to perform each step. The "Responsibilities" section of the procedure identifies no responsibilities for the line or support organizations, such as ES&H or FM&L, in development of an assessment schedule: QA develops the schedule, "consulting" with other organizations, and the Laboratory Director approves the schedule. In addition, integrated assessment schedules reflect a color code system for "responsibilities" reflecting "QA/CI," "JLab and TJSO joint," and "no TJNAF responsibilities," but do not reflect line or other support organizations as having responsibilities. Further, the management self-assessment procedure and associated training on assessment basics identifies substantial responsibilities for the QA/CI organization for all phases of line management assessments. These documents identify responsibilities for QA to schedule, plan (i.e., QA/CI reviews assessment-related documents, develops CRADs and lines of inquiry, and prepares the assessment plan), prepare (i.e., conducts "kickoff" meetings), and closeout (i.e., conducts post-assessment debriefings) management self-assessment activities and to classify observations and noncompliances and develop corrective action plans for observations and findings. The assessment program training plan states that QA "does most of the work" for assessment planning. The responsibilities of line and other support organizations (e.g., ES&H and FM&L) management primarily consist of having their people conduct assigned assessments and review and approve completed reports. DOE Guide 414.1-1A states that planning of management assessments should be done in a systematic manner by individual managers to address all areas under their responsibility and to focus on those areas presenting the greatest risk; senior management should retain overall responsibility for planning and performance of management assessments. (See Finding #D-2.)

Although the management assessment procedure specifies that QA/CI is responsible for reviewing submitted management self-assessments for "quality, completeness and credibility and provides the appropriate endorsement," there are no steps in the procedure for this review or to specify any review criteria, feedback to the performers and managers, or the meaning and action for "appropriate

endorsement." Although QA-provided examples of completed management self-assessment feedback forms reflect several evaluation criteria, they were unsigned and undated and do not reflect who was provided the feedback information. In some cases, follow-up was warranted, but was not reflected (e.g., cases where findings and observations had not been put into the Corrective Action Tracking System (CATS) or the report had not been signed by the assessor or the Associate Director). There is no indication that problems identified by these evaluations were identified as separate issues or collectively, as institutional issues to identify the extent of condition or specify corrective action. (See Finding #D-2.)

The Independent Oversight team identified several other weaknesses in the management and planning of assessments. The assessment schedule for FY 2006 could not be located, and the schedule for FY 2007 has not been kept up to date (i.e., it was last revised in August 2007, with some reports listed as "Pending" as far back as December 2006). The TJNAF document sharing website assessment listing for completed assessments from 2007 also is not up to date; there are independent assessments shown as completed on the integrated schedule, but not on the website. Although the QA program and the CAS are identified as topics for assessment on the current assessment topic data sheet, specific management systems are not identified for scheduling, including programs for issues management, assessment, document control, management safety observations, events/ORPS, employee concerns, injury and illness investigation and prevention, and the worker behavior-based safety observation program. (See Finding #D-2.)

Deficiencies were also identified in the Safety Warden workplace inspection program. This section of the manual improperly uses the term "should" extensively, and the scope states that it provides "guidelines" "to be considered" for performing inspections that assess the implementation of ES&H Manual "requirements." It also identifies that Associate Directors have general responsibilities for establishing expectations for the documentation and tracking and resolution of deficiencies rather than defining a sitewide approach to managing issues identified by an institutional inspection process. The applicability, or when CATS and site issues management procedure applies, is not addressed. This manual chapter also states that the ESH&Q Reporting Manager, who has responsibility for oversight/decisions on ORPS, Price-Anderson Amendments Act (PAAA), and 10 CFR 851, is to review the resulting reports for cross-cutting issues and adverse trends. However, no analysis and trending of inspection results have been performed. Similarly, although the safety observation protocol describes the intention to analyze and trend observation data and data on over 360 unsafe acts have been tabulated into categories, no analysis or determination of any needed preventive actions has been performed. (See Finding #D-2.)

Issues and Corrective Action Management. Many safety issues are being effectively managed and tracked to resolution at TJNAF. Issues management is governed by a formal procedure (updated in February 2008) and a tool for documentation (CATS). The TJNAF issues management procedure also requires identification of Significance Levels to establish whether actions must be tracked in CATS and the level of rigor applied to management of the issue and associated actions. The Significance Levels are determined, in general, using the work planning risk code matrix of severity and frequency in the ES&H Manual, Chapter 3210, with examples and additional guidance provided in the issues management procedure. The issues management procedure specifies that all issues of any Significance Level from independent and management self-assessments and external assessments are to be entered into the CATS tool for management. Issues classified as one of the top three Significance Levels/risk codes of 4 (high), 3 (medium), or 2 (low) from management walkthroughs, inspections, and other routine evaluations are required to be entered and managed in accordance with CATS and issues classified as Significance Level/risk code 1 (minor) or 0 ("tracking only or continuous improvement") may be managed in CATS if directed by management.

In most cases sampled by Independent Oversight, issues and associated actions for ORPS-reportable and below-reportable threshold events, injuries and illnesses, and assessment findings were put into the CATS tracking tool, evaluations/analysis of the issues were reasonable, and corrective/preventive actions were

appropriate. The CATS tool has fields for, and causes were generally documented for, issues or actions for all Significance Levels, although the procedure states that only level 3 and 4 "issues" need causal analysis. TJNAF has made a concerted and successful effort recently to reduce the number of overdue corrective actions tracked in CATS and is developing a more meaningful and accurate metric to monitor the timeliness of corrective actions.

Although the TJNAF procedure addresses the required elements of an issues management program as described in DOE Orders 226.1A and 414.1C and associated guidance, there were deficiencies in the process and implementation of issues management at TJNAF. The issues management procedure provides insufficient, inappropriate direction for effectively managing issues. Further, the implementation of the issues management program and documentation in CATS is not in compliance with the issues management procedure, especially with regard to significance categorization and the description of issues and actions in CATS. Procedural deficiencies and weaknesses included the following (see Finding #D-3):

- **Omitted action steps and insufficient detail.** Specific weaknesses in this area include:
 - There are conflicts and unclear direction on the responsibility and action steps for putting issues from external assessments into CATS and in identifying issue owners and responsibilities for developing corrective actions. The requirements for wording or altering issue statements from internal and external sources are not clearly articulated (i.e., must findings and observations from assessments be input verbatim or can they be clarified and how are events and associated issues to be described). The procedure states that entering data in CATS is the responsibility of the individual finding the issue (without consideration of external assessments or injuries and operational incidents and events) and requires a statement of the "proposed" corrective action, without further discussion of the responsibility for establishing and documenting the actual "required" corrective action.
 - The action and assigned responsibility for determination of Significance Levels is not specified in the responsibilities section or the action steps.
 - There is no action step to develop corrective actions or direction/guidance on developing corrective actions or linkage to identified causes.
 - The development and documentation/management of corrective action plans (vs. individual corrective actions) that are developed for issues from external assessments, per direction of TJSO, and from independent assessments, per the assessment procedure and configuration control (i.e., updating) of action plans in relation to CATS changes are not addressed in the procedure.
 - The procedure states that using "the graded approach, the level of documentation detail shall be commensurate with the Significance Level of the issue" without further description of examples, criteria, or guidance.
 - Procedure steps/requirements on extension requests for actions are incorrectly identified as extensions to "issues." Although there are instructions on the closure of corrective actions, there are no instructions on the closure of the "issue," which may have multiple corrective actions.
 - There is no requirement to document the rationale for Significance Level determinations (e.g., severity and frequency choices) or to document Significance Levels of issues from non-assessment activities that do meet the criteria for entry into CATS (Significance Levels 1 or 0).

- Although there are fields for “primary” and “secondary” causes for each issue/action entry in CATS, which are completed for all items in CATS, the procedure contains no action steps to determine these causes, no requirements for training, and provides no guidance on the selection of causes.
- The issues management procedure states that the Significance Level determinations for issues are made using the methodology for Risk Codes in the ES&H Manual, Chapter 3210, the same process used to characterize risks for work planning and control. However, the correlation of the work control Risk Code matrix to issue Significance Levels (as described in the issues management procedure) is insufficiently explained and the examples provided are in conflict with the Risk Code matrix and not conservative. Examples provided, cited as “program related” as opposed to “safety related” issues, include adverse trends and repetitive events that have not been adequately resolved, procedural violations, and repeated failures to follow a work control document, which are all safety concerns. An example of a Significance Level 3 (medium) issue, provided in the issues management procedure, is any event resulting in classification as a lost-time accident. However, when the Risk Code matrix is applied to this example, the resulting Risk Code is either a 1 or 2. The criteria for a personal injury Risk Code severity level II includes “less than 5 lost work days,” (i.e., a lost-time accident). If the likely frequency of the lost-time accident is determined to be above 10 years, the Risk Code (significance level) would be classified as a 1 or “minor.” A “minor” issue is defined as a “situation that does not justify abatement action except as part of other planned improvements or “quick fix” items that are not part of a pattern of minor safety issues.” This level of attention to “abatement” of a lost-time accident is inadequate. If in applying the Risk Code matrix the likely frequency is determined to be between 10 days and 10 years, the lost workday injury would be classified as a Risk Code (Significance Level) 2 or “low risk.” Abatement actions for a “low risk” event “can usually await normal preventive maintenance and can be managed with customary supervisory efforts and administrative procedures.” No causal analysis would be required by TJNAF procedures for such a lost workday injury. Again, this level of “abatement” for a lost time accident is insufficient.
- The Independent Oversight team notes that the terminology used in defining the corrective actions for various significance levels appears to be directed at hardware or maintenance issues and does not address performance or process deficiencies. For example, as described above, actions are typically referred to as “abatement”. Also, the definition of a Significance Level 2 issue states that “abatement actions can usually await normal preventive maintenance.”
- The responsibilities section specifies that the ESH&Q Reporting Coordinator (referred in other procedures as the Reporting “Manager”) screens “actions” rather than issues for ORPS and PAAA, but does not reference associated procedures or reference 10 CFR 851. The procedure action step in paragraph 4.3.1.4 incorrectly states that the QA/CI Lead Assessor, rather than the Reporting Manager, screens items against the criteria of ORPS, PAAA, and 10 CFR 851.
- The definition of the term “issue” does not address whether observations or opportunities for improvement that are not deviations from requirements are considered issues. These terms are not independently defined either.
- **Inconsistent and misuse of terminology.** Terms such as events, issues, actions, and items are used interchangeably or incorrectly. Starting in paragraph 4.3.1.2, the procedure changes the reference to Significance Levels from issues to actions. In paragraph 4.5.1.1, significance levels are for both items and issues. The term “event” is used in the CATS tool as the numbered descriptive term for the source of associated sub-issues and actions that are linked, including operational and injury events/incidents as well as findings and observations from assessment activities. However, the

definition in the issues management procedure only describes the classical “event” (i.e., incident resulting in injury, release of radiation, equipment loss, and harm to the environment) without including other issue types such as assessment findings.

- **Insufficient and inconsistent determination of causes and extent of condition and validation of effectiveness.** Specific weaknesses in this area include:
 - Although causes are being identified and documented in CATS for each issue/action, regardless of significance level, the procedure only requires identification of causes for Significance Level 3 and 4 issues (apparent causes for the former, root cause for the latter). DOE Orders 414.1C and 226.1 and ES&H Manual Chapter 5300 (for reportable events) require that the causes of problems be determined and recurrence controls for those causes are included in action plans, using a graded approach for the rigor of causal analysis.
 - Although there is a field for identifying whether an extent-of-condition review is required in the CATS tool, it is not addressed in the procedure except to require an extent-of-condition review for Significance Level 4 issues, a level that has only been assigned to two issues at TJNAF in the past two years and to no issues in the past year. Extent of condition should be considered for all deficiencies, with the rigor of the analysis determined on a graded basis, as is required by DOE Order 226.1.
 - The validations performed (i.e., effectiveness reviews of corrective actions in resolving issues) are extremely limited, as the procedure only requires validation for Significance Level 4 issues.
- **Inconsistencies between the procedure and the CATS tracking tool.** The field in the CATS tool for the action description is titled “Recommended” Corrective Action. At the point of entry into CATS, the actions are required/directed, not recommended. Further, many times, when specified actions require a study or evaluation, the results of the study and additional actions to be taken are not subsequently identified as additional actions, but are addressed in the narrative for status update for the research action. When the results of an interim corrective action (e.g., a review, analysis, or study) identify additional issues requiring actions, these issues should be managed in accordance with the issues management procedure rather than managed through status updates that preclude elements such as significance levels, causes, extent-of-condition determinations, action due dates, and extensions.

In addition to, and as a result of, the procedural weaknesses and deficiencies cited above, implementation of the issues management process was also inadequate in the following areas (see Finding #D-3):

- **Significance levels assigned to actions rather than issues.** Contrary to procedure requirements, Significance Levels are not determined for each issue (i.e., operational events, findings, observations, accidents, injuries, and associated subordinate issues), but for each CATS entry, which are variously entered as issues, either individually or as a subordinate issue to an event or assessment finding, or as corrective actions. The application of the risk code/Significance Level information in this procedure and in the ES&H Manual to establish the Significance Levels assigned to an action, rather than a deficient condition or issue, is not sufficiently defined. Assignment of Significance Levels and causes to each action, when one event or issue requires multiple corrective actions, provides redundant data that prevents meaningful trend analysis.
- **The significance categorization process is not applied in a conservative or consistent manner.** In the 12 months preceding this inspection, 84 percent of issues/actions were classified as less than “minor” and 97 percent were classified as “minor” or less. Therefore, in accordance with their

procedures, only 3 percent of the issues identified at TJNAF in the past year required “abatement” beyond “as part of other planned improvements.” No Significance Level 3 issues have been identified by management self-assessments in the past two years. Seventeen of the 28 issues/actions classified as Significance Level 3 or 4, resulted from reportable occurrences, accidents/incidents, and independent assessments. The remaining 11 Significance Level 3 issues appeared to be incorrectly categorized. They resulted from “inspections” and included loose carpeting that was a hazard, a rollup door safety switch that did not work, and a florescent light that needed new bulbs. Other examples of non-conservative assignment of Significance Levels were identified in a review of a sample of 31 actions resulting from 12 “notable events” and ‘accidents/incidents.’ Six of these actions were classified as less than minor (Level 0), 14 were classified as “minor” (Level 1), ten were classified as low (Level 2), and only one was classified as medium (Level 3). This included one “notable event” with one action classified as proficiency, four classified as less than minor (Level 0), and one recordable injury with three actions classified as minor (Level 1). Establishing these low Significance Levels for an operational event and an OSHA-recordable injury, such that the procedure would require no defined actions other than “as part of other planned improvements,” is inappropriate.

- **Inadequate descriptions of events, issues, and actions.** The CATS tool descriptors, and in many cases the application of this tool, further confuses matters by identifying fields called "issues" under each "event" which are used to document individual corrective/preventive actions. For each of these sequentially numbered issue/action entries, CATS contains a field titled "Issue Description" which is variously completed with: 1) words from the "event" (which, in the case of issues from assessments, is the statement of the issue); 2) a new statement of an issue subordinate to the “event” resulting from subsequent analysis of the overarching event or problem (determined either by the person entering the data or previously identified in some other documents such as a Incident/Notable Event/Injury Investigation and Causal Analysis Worksheet); or 3) a statement of the corrective/preventive action to be performed. Further, in many cases, the descriptions for issues and actions in CATS are incomplete (i.e., truncated sentences or paragraphs), apparently due to input errors.
- **Failure to include or reference/link formal causal analysis.** The CATS tool does not reflect the causal analysis determination for Level 3 and 4 issues as required, although they may be identified in ancillary reports, such as ORPS or notable event reports or Incident/Notable Event/Injury Investigation and Causal Analysis Worksheets, which are not identified or linked.
- **Issues and uncompleted actions are not always put into CATS as required.** Examples include:
 - Two of three actions identified as not complete in Notable Event Report COO-06-1031-NEW were not put into CATS.
 - The event and associated corrective actions for ORPS report SC-TJSO-TJNAF-TJNAF-2006-0002 were not put into CATS.
 - No issues and actions identified in Notable Event Report A-07-0511-NEW for the May 2007 overflow of the acid neutralization tank in Building 31, which flowed outside of the building, a precursor to same event that recurred in December 2007, were put into CATS.
 - The issues and actions identified in Notable Event Report PHY-08-0306-NEW, a lifting activity involving magnets and attached fixtures in Hall A in March 2008 that exceeded the crane’s capacity, were not entered into CATS.

- **Inadequate trend analysis.** See discussion of trend analysis in the Event Investigation and Reporting section of this Appendix.

The management of issues from a TJSO hoisting and rigging surveillance, conducted in January 2008 and detailed in a formal report provided to TJNAF in March, identifies weaknesses in the TJNAF issues management process, similar to those identified above. This surveillance identified four findings and 11 observations. TJNAF submitted a corrective action plan to TJSO on May 13 addressing each finding and observation. However, the corrective actions specified for several of the observations were insufficient. For example, Observation OBS-P3-010 stated that the capacity markings had been obliterated on a forklift boom attachment. The specified actions were to remove the forklift boom attachment without capacity markings from service, and to locate all other similar devices, catalogue them, and incorporate them into the annual crane and rigging inspection program. However, the plan noted that the removal from service of the boom, identified in the surveillance, could not be confirmed at the time of the action plan – four months after the deficiency was identified. In addition, the estimated completion date to take the boom out of service was documented in CATS as July 31, 2008, which was over six months after the deficiency was detected. It is not known how many times the deficient boom was used prior to the observation of another unmarked boom by the Independent Oversight team on June 3, 2008, that resulted in tagging all booms out of service on June 9, 2008. Further, the specified actions did not require that similar devices would be inspected for proper markings and also taken out of service if deficient, which may have contributed to an event observed by the Oversight Team where a forklift lifting capacity was exceeded while using a similar boom with obliterated markings (See Appendix C.2.1 for further discussion). (See Finding #D-3.)

Observation OBS-P3-009 identified unmarked shackles available for use in a shop tool crib. The specified action plan cited two previous procurement process changes (not corrective actions): 1) that the crane operator would be reminded to be vigilant during their inspections, and 2) FM&L would "continue to identify and control the infiltration of rigging devices such as through experimental apparatus deliveries," an action that is irrelevant to shop tool crib contents. The actions did not include any further inspection of the tool crib in the building where the deficiencies were identified or a broader extent-of-condition review to identify and purge unmarked or suspect/counterfeit lifting gear in other site locations. The Significance Level assigned to both of these issues was "minor" and no cause codes were identified (block marked as "tracking only") for each issue/action. The Independent Oversight team notes that both of these "observations" were non-compliances with OSHA and DOE requirements and should have been identified by TJSO and TJNAF as such. (See Finding #D-3.)

The following sections in this appendix discuss additional deficiencies in the management of issues related to events and injuries and illnesses. (See Finding #D-3.)

Event Investigation and Reporting. Many incidents and events are identified, reported, and investigated and related issues are resolved in accordance with formal processes defined in the ES&H Manual and the issues management procedure. The process for reporting events to ORPS is described in Chapter 5300 of the ES&H Manual. The investigation of all but one of the events selected for review by Independent Oversight (reportable and below reporting threshold events occurring in 2006, 2007, and 2008) had been documented on the Incident/Notable Event/Injury Investigation and Causal Analysis Worksheet, of Chapter 5200. Event investigation reports reviewed were, in general, sufficiently rigorous, with causes identified and appropriate corrective and preventive actions identified and put into CATS for management in accordance with the site issues management process.

The Radiation Control Manual supplement to the ES&H Manual specifies that Radiation Deficiency Reports (RDRs) be used to document deficiencies in radiological control performance and structured plans for improvement. Most RDRs were written to address incidents or events, and the RDR format is

similar in content to the TJNAF notable event reports. RDRs include detailed descriptions of the violation/event and immediate actions taken, an investigation including analysis of the causes, and follow-up corrective and preventive actions. Most of the RDRs that were reviewed were sufficiently rigorous to identify causes and appropriate corrective/preventive action. Corrective and preventive actions identified during these analyses were entered into CATS for tracking to closure.

Although most events were properly identified, investigated, and managed, there are procedural and implementation deficiencies in the TJNAF occurrence reporting program. Chapter 5300 of the ES&H Manual and its appendices provide a fragmented process description and procedures with several errors and omissions. Chapter 5300 in its description of the process and the reporting and notification procedure of Appendix T1 does not include any reference to formal investigation of the event described in Appendix T2. These documents do not refer to CATS or the TJNAF issues management process as a requirement for managing corrective actions. Appendix 5300-T2 Occurrence Documentation specifies that the ESH&Q Reporting Manager is to gather event information to analyze the event including causal analysis and the development of “possible” corrective actions as well as preparing notification, updating, and finalizing ORPS reports. However, Chapter 5200 of the ES&H Manual and the associated report template does not identify these responsibilities for the ESH&Q Reporting Manager, assigning responsibility for investigation and analysis to line management. Further, the Independent Oversight team’s review of notable event reports indicates that, in practice, TJNAF line organizations are completing the investigation and analyses that are approved by line managers. DOE Manual 231.1 specifies that facility managers are responsible for determining causes and generic implications and taking actions to prevent recurrence, and preparing the written notification, updating, and finalizing reports. However, Chapter 5200 does not address the role of the Facility Manager in this process as required by the DOE Manual, and Chapter 5300 assigns these responsibilities to the ESH&Q Reporting Manager. A further confusion in Chapter 5300 is the definition of the term “notable event,” for which Chapter 5200 and the associated report template provide investigation documentation requirements, as an “incident that does not fully meet DOE occurrence reporting criteria.” This is a qualification not specified in Chapter 5200 and raises questions about the appropriateness of Chapter 5200 for investigation and documentation of reportable occurrences. (See Finding #D-4.)

TJNAF did not report to ORPS several events occurring at TJNAF and documented on notable event reports in accordance with Chapter 5200, although these events met the DOE ORPS Manual definition of management concerns and near misses. Examples included the following (see Finding #D-4):

- On the off shift in May 2007, the Building 31 acid neutralization system waste water holding tanks overflowed the collection trenches, with water with a pH of 2 flowing through and outside the building. Although a notable event worksheet was completed, this event was not reported to ORPS. Although this did not meet reporting thresholds for an injury or reportable environmental release, the potential existed and the event had safety significance and reflected a lack of compensatory measures for a known problem and therefore met the Group 10, Management Concerns/Issues criterion as a near miss, where no barrier or only one barrier prevented an event from having a reportable consequence.
- In April 2006, a supervisor was potentially exposed to hydrofluoric acid in an event with a number of administrative barriers that were bypassed. The work was performed outside of standard operational procedure (SOP) requirements (i.e., not wearing prescribed personal protective equipment), involved insufficient work planning for changing conditions, involved an intentional deviation from an SOP step in connecting flush water lines, and revealed that emergency treatment personnel were unprepared for and lacked sufficient knowledge of the potential harm from exposure to hydrofluoric acid. This event was formally investigated, but was not reported to ORPS. Although this did not meet reporting thresholds for an injury, the potential existed and the event reflected numerous work

control barriers that were bypassed, and therefore also met the Group 10, Management Concerns/Issues criterion as a near miss.

- In February 2008, a high efficiency particulate air (HEPA) vacuum cleaner used in cleaning of a contaminated component was subsequently tested and after it failed the test was found to have a standard filter installed. This event was investigated, but not reported. The investigation identified the longstanding knowledge of the lack of a program for controlling HEPA filters, numerous weaknesses in HEPA equipment management, and the failure of reliance on “corporate” knowledge. Although this did not meet reporting thresholds for a contamination/radiation control event, the potential existed and the event reflected numerous management system deficiencies and work control barriers that were bypassed, and therefore also met the reporting criterion as a near miss.

For several ORPS reports reviewed, notification of DOE was not timely and the justification reflected a misunderstanding of the definition of discovery dates and times and notification timeframes by facility managers and reporting staff. For example, the event in ORPS 2007-0001 was reported to facility staff on April 3, 2007, but the discovery date was identified as 23 hours later in the ORPS report on April 4. The event in ORPS 2007-0004 occurred on August 29, but the discovery date cited in the report was the date a calculation was completed that showed the event met reporting Significance Category 3 reporting requirements. The event in ORPS 2006-02 occurred on June 23, but the cited discovery date was June 28, the date the ESH&Q Reporting Manager, a Facility Manager designee, reviewed a report of the event and determined it met reporting criteria. DOE Manual 231.1-2 specifies that the discovery date and time is when the facility staff discover or become aware of the event or condition. (See Finding #D-4.)

For several ORPS and non-reportable events, the investigation report evaluations and/or corrective actions did not address the work control aspects of the event. Examples of these events include the following (see Finding #D-4):

- The corrective actions specified for ORPS 2007-0004, involving unlabeled radiological material found in a storage unit, did not adequately address the work planning and documentation issues involved, and no actions were specified for the lessons learned described in the ORPS report. The report described and cited inadequate advance work planning and documentation as the lesson learned, but the corrective actions only specified an all-hands meeting for current workers and changes to radiation worker training to emphasize radiological control and release procedures. No corrective/preventive actions addressed the cited “ambiguous instructions” in the radiological work permit, nor were there any actions to address the fact cited in the causal analysis that since the task performed that resulted in the unsurveyed material was “simple,” it “was not formally evaluated.”
- ORPS-reportable event 2006-0004 did not address the failure of TJNAF personnel to conduct adequate activity hazard analysis for a new activity to perform a manual cooling tower system blowdown that resulted in discharge of acidic water that exceeded local regulatory agency permit limits.
- The investigation report and associated corrective actions of January 2007 OSHA-recordable injury to subcontractors did not address inadequate informal hazard analysis and inadequate controls and allowed unsafe actions after the event (i.e., allowing a single worker to resume work after the assemblies being worked on with two workers had collapsed, resulting in a treated injury to one and an untreated injury to the other).
- The investigation report and specified corrective actions for an April 2006 event did not address why changes in the scope of work (i.e., a larger configuration of a niobium cavity and fixture) were not subjected to additional hazard analysis which resulted in configuration control issues and potential

exposure to hydrofluoric acid. Although failure to perform an adequate task hazard analysis (THA) for the new configuration was identified as the root cause, the investigation report did not identify the reasons for not performing a THA. Recurrence control was limited to revising this one SOP to conduct a new THA if a cavity configuration is changed.

- The events and causal factors tree in the notable event report regarding use of a fall protection net in FEL, identified in January 2008, identified several issues that were not addressed by the recommended actions or were addressed by the actions already put into CATS in March. For example, the report did not address the question of why the 2006 CATS action was closed in January 2007 without documentation of the action taken/basis for closure; the fact that work planning/hazard analysis allowed the Administrative Control Tag to be removed, and the net to be reinstalled in 2008 and used three times for fall protection without testing or approval by ES&H; and the possible suspect/counterfeit item issue being investigated.
- The description of the event, analysis of causes, and specified follow-up actions for a March 2008 event in Hall A, where a lifting activity involving magnets and attached fixtures exceeded the crane's rated capacity, documented on Notable Event Report PHY-08-0306-NEW, was not sufficiently rigorous. The description of, reasons for, and actions to prevent recurrence of the three identified causes (e.g., the magnet weight from an engineering drawing was misinterpreted, the marking on the magnet was incorrect, and the weight calculation made before the lift was incorrect) were not identified. No issues were put into CATS.

TJNAF event response and evaluation processes do not include provisions for critiques or collective fact-finding meetings to facilitate accurate and timely determination of event timelines and details in support of subsequent causal analysis and corrective action development. Although the Radiation Control Manual mentions the use of critiques to gather information related to events involving radiological requirements deviations, there are no specific expectations or requirements for methods for conducting or documenting these fact-finding meetings. (See Finding #D-4.)

A number of issues are being put into CATS using a source identification designator of Accident/Incident, a term that is not defined in site procedures. Most (but not all) of these issues reflect events or non-injury accidents, and no "notable event" investigations were documented as required by Manual Chapter 5200. These incidents, including AIs-2007-03, 04, 05, 15, and AI-2008-02, had not been posted to the Notable Events website. (See Finding #D-4.)

DOE Manual 231.1-2 requires that each site contractor perform ongoing, at a minimum of quarterly, analysis of events covering a 12-month period to look for trends and recurring events. This review is to include contractor determined non-reportable events and must be reported to contractor and DOE line management. Although trend analyses of events, non reportable notable event reports, and CATS were documented in December 2007 and 2008, these analyses are not being done quarterly. Further, although these trend analyses identified the frequency of causes identified for events and CATS items, these reports contained no analysis of the significance of this data, nor did they identify if any corrective or preventive actions were required, only that no recurring events were identified. (See Finding #D-4.)

Several deficiencies were also identified in the Radiation Control Manual section on RDRs and in its implementation. The manual articles do not include links to CATS and the site issues management procedure for the management of identified issues and actions. The articles do not address the TJNAF independent assessment program. Article 125 of the manual incorrectly describes the use of notable event reports instead of RDRs for "isolated, minor radiological concerns that do not have the potential for a significant reduction in radiation safety." This description is in conflict with the expectations specified in ES&H Manual, Chapter 5200, *Incident/Notable Event/Injury Investigation and Causal Analysis*, which

does not limit the notable event reporting to minor concerns. Chapter 5200 does not reference RDRs or the Radiation Control Manual. (See Finding #D-4.)

Non-conservative significance levels were assigned to issues/actions for RDR 2007-05, which was one of the five examples of radioactive material control problems reported in a Noncompliance Tracking System report, TJNAF-2007-0002 issued in July 2007. This RDR resulted in 12 issues/actions in CATS, ten identified as "Minimal" significance ("less than minor") and two identified as "minor." Minor (Significance Level 1) issues are described in the Issues Management procedure as situations that "do not justify abatement actions except as part of other planned improvements." Minimal issues (Level 0) "do not rise to Significance Level 1." Issues identified in this RDR and CATS as "minimal" (less than minor) included such concerns as the activated viewer stored inside a building for several months, workers who were complacent or unaware regarding requirements for RadCon release surveys, personnel not keeping training up to date, and work that was not adequately planned. Issues identified as "minor" included "the need to conduct an extent of condition inspection to identify if other radioactive materials were improperly stored" and "incomplete or nonexistent formal task planning." Issues serious enough to report to DOE as PAAA noncompliances should not be categorized as minor or less than minor. TJNAF management subsequently held a stand down of radiological work and required a read and sign re-training for radiation workers on radioactive material controls, but these actions were not entered into CATS. (See Findings #D3 and #D-4.)

The incident details, investigation, and recommended actions for radiation safety events/incidents assigned RDR numbers are not always documented on RDRs as specified in the Radiation Control Manual, Section 126. The incident and associated corrective actions are sometimes put directly into CATS under an RDR source identifier, but without the description of immediate actions taken and analysis of the causes. Examples include RDRs 2007-02, 2007-04, and 2008-01. The incident for RDR 2007-02 resulted in seven corrective actions, including two classified as Significance Level 2, and involved accelerator personnel entering a radiation areas (Halls A and C dump cooling water buildings) with dose rates in excess of 100mr/hr without required supplemental dosimetry. For the RDR 2007-4 case, the third radioactive material control event/incident/condition that prompted the 2007 Noncompliance Tracking System report, did not have an RDR or a notable event investigations report issued. A draft (unsigned) notable event report does exist, and two actions were entered into CATS under source RDR-2007-04. In the third (2008-01) case, a January 2008 event identified as RDR 2008-01 was another example of violation of radioactive material controls as reported to DOE by TJNAF as a non-compliance with PAAA in July 2007, and that also reflected significant work control deficiencies that warranted the documentation of causal analysis provided in an RDR. In addition, on May 30, 2008, another unlabeled activated piece of equipment was identified in a cabinet in the Test Laboratory. These events indicate inadequacies in the corrective/preventive actions for the Noncompliance Tracking System report and associated events, such as training, communication, controls, and extent-of-condition inspections. (See Findings #D3 and #D-4.)

The notable event report regarding use of a fall protection net in FEL was identified in January 2008, but issues for this event were not put into CATS until June 2008 when the Independent Oversight inspector asked if such an investigation had been performed and documented. No issues were put into CATS for issues and actions identified in Notable Event Report A-07-0511-NEW for the overflow of the acid neutralization tank in Bldg 31, a precursor to same event reoccurring in December 2007. (See Findings #D3 and #D-4.)

Injury and Illness Investigations. OSHA-recordable occupational injuries/illnesses and first aid cases are being identified in a timely manner, and recordable injuries, as well as some first aid cases, are investigated, documented, and reported using a structured process. Management of occupational injuries and illnesses is governed by ES&H Manual Chapter 5200, *Incident/Notable Event/Injury Investigation*

and Causal Analysis. This manual chapter generally describes an adequate process for managing OSHA-recordable injuries, including an investigation worksheet (i.e., a report template). Employees are directed to report all injuries promptly and to report to medical with their supervisors and the processes for responding to various types of injuries and illnesses, both emergencies and non-emergencies, and conditions (i.e., dayshift or back shift) are detailed in the procedures. ES&H safety and health professionals are engaged throughout the investigation and management process and in identifying corrective actions and recurrence controls. Most of the investigation reports reviewed by Independent Oversight reflected a thorough review of the injury and identification of appropriate corrective and preventive actions.

However, the TJNAF procedure only requires formal investigation of OSHA-recordable injuries, and many first aid cases have not been formally investigated to determine if corrective or preventive actions were required. In addition, there were other procedural weaknesses, and the investigations for some cases reviewed by Independent Oversight did not adequately address the work control aspects of the injury. Contrary to the stated policy in manual Chapter 5200 that "it is Jefferson Lab policy to investigate all accidents involving personal injury," the manual chapter only requires investigation of OSHA-recordable cases, not first aid or "no treatment" cases. In the sample of 11 first aid cases from 2006, 2007, and 2008 selected for review by Independent Oversight, only six had documented injury investigation worksheets on file. Incidents where workers are exposed to chemicals or electric shock may be seen at the clinic with no first aid treatment, and these cases are not identified/managed by the occupational injury and illness program, although they may have work control/ISM issues and may be precursors or near misses to events with more severe consequences. DOE orders for QA and safety oversight require that problems be analyzed for causes and actions identified to prevent recurrence. (See Finding #D-3.)

Other deficiencies and weaknesses in the TJNAF injury and illness management process, as described in ES&H Manual Chapter 5200, included the following: (See Finding #D-2.)

- The ES&H Manual states that causal analysis is to be "commensurate with the incident's hazard(s) or potential hazard(s)" without any criteria or guidance or reference to the issues management process. Training requirements or use of standardized cause codes are not addressed.
- Although the manual specifies in the responsibilities section that the Division Safety Officer is responsible for using CATS to coordinate tracking and documentation of divisional corrective actions, actions required to be taken at the institutional level and support organization actions are not addressed, and the procedure steps in the manual do not address the use of CATS or the TJNAF issues management procedure.
- The procedure steps only require the investigation team to "recommend" actions to prevent recurrence, although the injury and causal analysis worksheet identifies follow-up actions as "required."
- Chapter 5200 makes several references to ES&H "guidance" rather than requirements.
- The use of the investigation and causal analysis worksheet of Appendix 5200-T1 is only "recommended" for use, although the subsequent action steps in the manual chapter flowchart address the completion and approval of this worksheet in documenting the investigation.
- The action steps in the flowchart do not specify putting identified corrective and preventive actions into CATS or reference the site issues management procedure.

- Rather than prompting the investigation to identify actions that could have been employed to prevent the injury or illness, the investigation worksheet solicits information from a positive perspective in the form of the question “What practical means of prevention were employed?” Neither the text of the manual nor the worksheet focus investigation information and analysis on ISM elements, such as identifying and determining the adequacy of the applicable work control elements (e.g., pre-job briefings, work document identification of hazards and controls, and adherence to work control requirements, and supervision/oversight).

The investigations and associated actions for some injuries reviewed by Independent Oversight did not adequately address the work control aspects contributing to the injury. Examples include (see Finding #D-3):

- The investigation report and specified corrective actions for an April 2006 event that resulted in a potential exposure to hydrofluoric acid did not address the work planning issues. Issues not addressed included changes in the configuration of a niobium cavity (the scope of work) that was not subjected to a hazard analysis and the intentional deviation from an SOP in installing connecting rinse piping.
- The investigation report and specified corrective actions for a March 2008 event, where an employee cut his finger with an Exacto knife while modifying equipment during troubleshooting for the FEL gun test stand, did not address the work control aspects of the injury, including the lack of hazard analysis that resulted in the injury. The notable event worksheet stated that this was an internal organizational report for continuous improvement and “this event will not be tracked in CATS.”

Occupational Injury and Illness Recording and Reporting. TJNAF has implemented procedures and assigned responsibilities for recording and reporting occupational injuries and illnesses to employees and subcontractors. Employees who were interviewed by Independent Oversight confirmed that Laboratory employees are informed of their responsibilities to report all injuries and exposures. Although classification, recording, and reporting of cases are assigned to the ESH&Q Division, case management begins in the Occupational Medicine Division. In addition to patient care, the Medical Director conducts employee safety and health training and ergonomic assessments, and performs worksite evaluations for some cases to help determine how the injury occurred and to help prevent reoccurrence. Timely notifications from Occupational Medicine of all new cases and follow-up information on offsite and onsite treatment are provided to the ESH&Q Division and various site managers.

The individuals assigned the responsibilities for maintaining records for TJNAF were trained in the DOE requirements and authorized to utilize the DOE-wide Computerized Accident/Incident Reporting System (CAIRS) to report recordable cases. However, the site procedure did not include sufficient specific details of responsibilities and reporting requirements.

With the exception of one case that was misclassified and not reported, monthly and quarterly reporting requirements are being met. However, the case files maintained by the ESH&Q Division did not fully facilitate the review of employee injuries/illnesses and whether all injuries/illnesses were properly identified and classified. Classification decisions were validated using information maintained in Occupational Medicine files and online notable event reports. As noted above, investigation reports are not required for non-recordable cases. The level of detail included in CAIRS reports from the notable event reports was minimal and did not include investigation information that is needed to fully understand the events leading to the injury or to provide lessons learned. (See Finding #D-3.)

The OSHA 300A form, Summary of Work-Related Injuries and Illnesses, was properly prepared and certified annually. However, quarterly cross-checks of local records with CAIRS and periodic self-

assessments of the recordkeeping and reporting program were not regularly performed as required by DOE Manual 231.1-1A. (See Finding #D-3.)

Lessons Learned. The TJNAF lessons learned program has only recently been formalized and defined in a site procedure. The May 2008 procedure defines a generally adequate and compliant operating experience program as required by DOE Order 210.2. An interim site lessons-learned coordinator has been appointed and division-level coordinators have been designated. The procedure identifies a base set of sources for screening and frequency by the site lessons-learned coordinator. In May, TJNAF began to use a newly-developed, robust database of both external lessons learned and internal lessons from line and support organizations. The new corporate lessons-learned database, with the initial approved entry on May 22, 2008, is a searchable tool for entering, evaluating, approving, and researching safety and non-safety related lessons learned from both internal and external sources. The interim site lessons-learned coordinator had screened, approved, and posted 11 externally generated lessons as of the middle of June 2008. This database contains pertinent links to external operating experience databases and to internal sites and an optional user/viewer one-to-five star rating feedback mechanism, with the average automatically recalculated and posted. This database has the capability to provide an extensive library of operating experience supporting future planning and training activities. A “work instruction” has also been developed that provides additional details and guidance for implementing the lessons learned procedure and includes identification of division coordinators and designated subject matter experts.

Internal lessons learned from accelerator operations cycles have historically been identified, documented, and addressed for subsequent operating cycles, and there is much evidence of sharing lessons learned from incident and injuries. There is also anecdotal evidence that some external lessons learned have been identified and disseminated by subject matter experts. The Independent Oversight team observed sharing of lessons learned during safety meetings and pre-job briefings in line organizations and FM&L. Historically, only four lessons learned have been forwarded to DOE Headquarters for sharing with the DOE complex, one each in 2001 and 2006 and two in 2007.

Although DOE Order 210.2, *DOE Corporate Operating Experience Program*, was added to the TJNAF contract on November 1, 2006, program development and full implementation has been delayed. The new TJNAF lessons learned program has not yet been implemented, and historically, there has been no formal screening and communication of external lessons learned and, in the near term, the new operating experience database lacks historical information for planning purposes.

The Independent Oversight team identified several deficiencies and weaknesses in the new lessons learned program. The new procedure does not include sufficient process steps for documenting and monitoring compliance with directed actions (e.g., inspect all division work spaces for the presence of recalled widgets made by XYZ Corp), uses the term "guidance" to describe DOE orders and the site ES&H Manual, and limits formal tracking of needed corrective actions to assigned a Significance Level of 2 and above for internally identified issues. Special safety reports from DOE, including Safety Bulletins and Safety Advisories, are not included on the source listing for lessons-learned screening by the site coordinator.

A recently completed gap analysis between the planned TJNAF program and DOE Order 210.2 concluded that no actions were required for the contractor requirement in the order to incorporate DOE and contractor lessons learned into operations, training, maintenance, design, and construction because the draft procedure addressed the requirement. It did not confirm that procedures for these programs included appropriate requirements and process steps for this required incorporation. (See Finding #D-2.)

Employee Concerns Programs. TJNAF employees have informal and formal means to communicate and obtain resolution of safety concerns. Responsibilities and the process for resolving ES&H concerns

are described in ES&H Manual Chapter 2310, and the formal ECP administered by Human Resources is detailed in the TJNAF Administrative Manual Section 210, *Employee Concerns and Grievances*. Expectations regarding the reporting of ES&H concerns are identified in the “Safety Toolbox” booklet described in the new employee and user orientation and provided to all employees and users. Workers are encouraged to report concerns at the lowest level through supervisors or ES&H staff. Posters citing the hotline number and internal website address are posted on many site bulletin boards.

The formal TJNAF concerns processes have rarely been used. There are only four ES&H concerns in the ES&H hotline/report log; there were three in 2006 and one in 2007, only two of which were related to safety concerns. The two minor safety concerns in the ES&H log were adequately resolved. Employee Relations management in reviewing records for recent years could not identify any formal grievances related to ES&H.

The formal TJNAF employee concerns procedures are deficient in several areas. Neither ES&H Manual Chapter 2310, nor the Employee Relations administrative manual procedures address the elements of anonymity and confidentiality that are essential to an effective concerns program. In addition, although the Administrative Manual describes the use of the ES&H Manual Chapter 2310 process for ES&H concerns, its Employee Concerns and Grievance process as described does not provide a protected environment for employees to report safety concerns. The Employee Relations process for reporting and seeking resolution of concerns is for the employee to file a formal grievance, “if a satisfactory informal resolution of an issue, complaint or problem fails.” Further, the manual states that before filing a formal grievance, the employee “shall” discuss the issue informally with the immediate supervisor. Additional weaknesses in the concerns process described in ES&H Manual Chapter 2310 include the following:

- The concern resolution process as described does not address identifying concerns anonymously or any process/attempts to maintain confidentiality if desired.
- The process requires the ESH&Q Reporting Manager to receive and log documentation of only “substantial” concerns and their resolutions, but does not define “substantial” and provides no responsibilities for Safety Wardens, who are designated as responsible for resolving and logging ES&H concerns, to forward concerns to ESH&Q.
- The process refers to a flowchart that maps the process that is not in the manual.
- There is no linkage to the site issues management process for managing any needed corrective/preventive actions.

In addition to the above, the “Safety Toolbox” booklet section on concerns reporting does not reference the ES&H Manual Chapter, does not provide the “hotline” number, does not provide a link to the ES&H Concern Form, does not identify that concerns can be expressed anonymously, and does not reference the DOE concerns program or phone number. The “Problem Resolution” page in the basic safety training for new employees and users refers to ES&H Concerns Reports on ES&H bulletin boards around the site, but few boards on site have these forms. The page does not identify any phone numbers for reporting employee concerns (TJNAF, TJSO, or DOE Support Center or Headquarters) or refer specifically to reporting concerns to the TJSO.

Other Feedback Mechanisms. TJNAF has established and effectively employs other mechanisms that provide two-way feedback between workers and management that promotes continuous improvement. A chartered Worker Safety Committee meets regularly to discuss and provide feedback to management and to communicate management expectations to employees. A meeting attended by the Independent Oversight Team included extensive discussion of a recently completed accelerator shutdown safety

meeting, recent ISM system changes, work planning and control improvement team progress, and issues related to the administrative lock and tag program. The committee meeting was attended by the Laboratory Director, the Associate Director for ESH&Q, and the ES&H Director. The Director's Safety Council, which meets monthly, provides a mechanism for communicating safety performance feedback and management expectations to, among, and from senior managers and senior safety staff. An employee behavior-based safety observation program provides real-time feedback to workers on safe work performance attributes and increases safety awareness of personnel trained in the process and conduct of observations.

Activity Level Feedback. The TJNAF organizations/facilities that were reviewed on this inspection (i.e., FEL, Test Laboratory, and FM&L subcontracted work) were performing a number of activity-level feedback activities, such as pre-job briefings and daily meetings. At the Test Laboratory, the Cavity Production Group Leader holds weekly meetings where the previous weeks lessons learned are routinely incorporated into the planning cycle. For subcontracted work, FM&L has established Subcontracting Officer's Technical Representative (SOTR) positions; the SOTRs are active in ensuring that lessons learned from work activities are solicited, communicated, and documented. At FEL, activity-level feedback and improvement occurs through several mechanisms. The staff at FEL is small, so much of the feedback occurs informally through discussions between staff members on a real-time basis, and feedback and lessons learned are also discussed through the morning meetings. Additionally, FEL is active in other mechanisms such as the behavior-based safety program and the Worker Safety Committee. Across the site, most of the processes for activity-level feedback are not documented in procedures or other requirements.

Requirements Management and Document Control. TJNAF has not established an adequately defined and effective system for communicating management expectations and DOE and regulatory requirements down to the task level. This deficiency was evident in the review of JSA contractor assurance requirements but is also applicable to some other JSA requirements, such as requirements for work planning and control.

This lack of an effective requirements management and document control system is reflected in processes and procedures that do not distinguish between requirements and guidance, documents for which the authority is unknown, and confusing and inconsistent format in instructions to workers. TJNAF has not established a defined and structured hierarchy of documents (e.g., policies, plans, procedures, instructions, and manuals), and associated identification/number scheme, standard formats, and configuration control mechanisms for communicating accurate, timely expectations and requirements to TJNAF employees and contractors. TJNAF is currently creating numerous new administrative procedures for management systems, and many ES&H Manual Chapters are scheduled for review and revision. JSA does not have a structured hierarchy, standardized formats and contents, and defined configuration control mechanisms to effectively manage change in a way that results in clear communication of requirements and expectations to the worker. A "Document Management Team" formed to develop and implement tools and processes for TJNAF documents has identified similar issues and proposed a path forward in a draft document but a definitive action plan and timeline have not been formalized and approved.

A generic deficiency in many TJNAF procedures and documents involves references to DOE orders and Manuals and the TJNAF ES&H Manual as guidance documents rather than the "requirements" documents that they are. Repeated reference to requirements documents as providing guidance conveys the wrong message to all readers. ES&H Manual chapters do not always clearly identify information as requirements or guidance. In some cases, even requirements statements are phrased such that wide interpretation of expectations is allowed, without further guidance or criteria. For example, "the level of required documentation shall be commensurate with the Significance Level of the issue," and "a

firewatch is required....unless only a minor fire could develop.” The inspection of eyewash stations and safety showers in ES&H Manual Appendix 6610-T7 states the following: “Activate emergency showers and eyewashes **weekly** to flush the line and verify proper operation. Annotate **monthly** inspection on tag” (emphasis added).

Recently developed administrative procedures (e.g., for issues management, assessments, lessons learned) and procedures contained in the ES&H Manual are inconsistently and inappropriately formatted. These procedures, including new QA procedures, do not always address all responsibilities, and some responsibilities are not included in the action steps. Action steps often do not identify who or what organization is responsible to perform the action. Processes described in the ES&H Manual, including the Radiation Control Manual supplement, are not in a standard procedure form with clearly defined sections for purpose, scope, responsibilities, action steps, definitions, etc. New “work instructions” and “administrative procedures” have been written by ES&H and QA that expand on and interpret institutional documents (i.e., the ES&H Radiation Control Manual and the new lessons learned procedures). However, these types of procedures and their status and authority are not defined. They are written as organizational procedures, but contain/describe requirements for other organizations.

D.3 OPPORTUNITIES FOR IMPROVEMENT

The Independent Oversight review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

TJSO

1. Continue improvements in the planning, scheduling, conduct, and review of formal ES&H assessments. Specific actions to consider include:

- Complete the current review of externally required assessments. Add appropriate items to the current and future year assessment schedules.
- Develop a process to document the review and decision making for the TJSO assessment schedule. This process would be useful to document any decision to combine, condense, or waive any external requirement that may not be necessary at TJNAF. Additionally, the ability to review the scheduling process would provide a valuable feedback and improvement tool for future year planning.
- Modify the scheduling process to ensure that cyclic assessment requirements are scheduled and conducted at appropriate intervals, including records of past accomplishment and planned future events.
- Fully implement the TJSO SOPP required risk-based assessment planning during the development of the upcoming FY 2009 schedule.
- Consider clarification of the TJSO SOPP to identify the need for assessments based on: external requirements, TJSO periodic requirements, TJNAF ES&H performance reviews, TJNAF ES&H emergent problems, and effectiveness reviews of TJNAF and TJSO corrective actions.

- Continue the current TJSO assessment dashboard and weekly review meeting, and consider additional areas of coverage including:
 - Continue the current reviews of assessment and walkthrough accomplishment by TJSO.
 - Consider addition of reviews of contractor assurance-based assessment and walkthrough accomplishment.
 - Consider addition of periodic trend reviews of TJSO walkthroughs and assessment results.
 - Consider addition of periodic trend reviews of data provided by TJNAF contractor assurance results such as safety walkthrough reports.
 - Consider addition of trend reviews of performance indicators developed during corrective action implementation to assist effectiveness reviews.
 - Consider periodic review of planned and upcoming oversight actions based on performance results and trends.

2. Continue improvements in TJSO self-assessments. Specific actions to consider include:

- Continue the review of required self-assessments based on program requirements.
- Consider periodic self-assessment of oversight effectiveness, particularly where external sources can provide comparison and benchmarking.
- Fully implement self-assessment within the assessment scheduling process improvements discussed above.

3. Enhance oversight of TJNAF Contractor Assurance. Specific actions to consider include:

- Consider direction to TJNAF management regarding data availability and transparency of TJNAF assessment results.
- Consider direction to TJNAF management regarding format of assessment results to assist in evaluation and trending. As an example, look for alignment of assessment reporting of causal factors to allow effective comparison of TJSO assessments and TJNAF self-assessments.
- Consider joint reviews of assessment results as part of the current periodic ESH joint TJNAF-TJSO management meeting. These results could include review of common performance indicators including contractor assurance management assessment and safety observations accomplishment performance, trend reviews of safety walkthrough observations, and other indicators beyond the current review of accident and injury rates.
- Consider additional performance measures for the FY 2009 PEMP to incentivize implementation and open reporting of contractor actions such as use of lessons learned in work planning, safety observations, employee reporting of ES&H improvement recommendations, and employee reporting of ES&H concerns.

4. Enhance the Corrective Action Management Process. Specific actions to consider include:

- Continue emphasis on quality and timeliness of TJNAF critiques of unexpected events. Consider addition of an unscheduled review (place holder) in the current FY assessment plan to evaluate likely future TJNAF critiques. Ensure that TJNAF management directives clearly state expectations for notification and concurrence regarding need for event critiques.
- Consider methods to streamline the review and trending of TJSO walkthrough observations. Simplify resolution and reporting by contractor of P-3 findings with standard format that allows verification of condition, designation of apparent cause, and report that the condition has been corrected. Use existing contractor database to record corrective actions for TJSO reported P-3 issues, and allow TJSO access to database records to provide necessary review of corrective actions.
- Consider addition of periodic assessments of contractor corrective action processes based on TJNAF records. Results of these assessments could be used to support trending of contractor performance and to support P-2 roll-up issues associated with performance trends.
- Consider frequent review of TJNAF corrective action reports of both TJSO and TJNAF reported issues to ensure that appropriate subsequent effectiveness review is conducted by TJSO.

5. Enhance the TJSO ES&H program management and general oversight approaches. Specific actions to consider include:

- Revise the TJSO ECP SOPP to clearly define role of ECP Coordinator in oversight of contractor ECP, or define method for SC ISC to provide information to TJSO management.
- Establish DPO process within the existing ECP directive.
- Shift focus of Lessons Learned Coordinator to oversight of contractor actions away from direct facilitation and communication. Schedule an effectiveness review of the current TJNAF implementation plan for compliance with DOE Order 210.2.
- Continue the effective cooperation with SC ISC to support ES&H program effectiveness.
- Consider a more detailed support agreement that specifies which on-going program requirements will be met by the SC ISC staff, or provide a periodic summary of current requests to ensure there is clear understanding of oversight coverage and responsibilities.
- Continue attention on the quality and consistency of assessments and walkthrough surveillance reports with less experienced staff members through review and mentoring.
- Consider periodic self-assessment of training needs and appropriate formal staff training to improve knowledge and skills of staff members.

TJNAF

1. Strengthen the TJNAF assessment programs to ensure that safety programs, topical areas, management systems, and work activities are rigorously assessed on an appropriate frequency and with a sufficient emphasis on performance. Specific actions to consider include:

- Review and revise procedures and training to ensure that line and support organization management takes ownership of all aspects of the self-assessment program, especially the selection of assessment topics and verification of a quality effort before approving assessment reports. Reduce the current active involvement in the management of management self-assessments to a facilitating, mentoring, and monitoring role.
- Provide practical training and mentoring in the planning, conduct, and documentation of assessments. Consider incorporating actual team management self-assessments into training/mentoring regimen. Consider more extensive training to a core group of employees who could then act as mentors for future assessments.
- Ensure that the focus of assessments is on performance, relying on observation of work and review of records and documents that demonstrate performance rather than process reviews and interviews.
- Review and revise inspection procedures in the ES&H Manual to more clearly define requirements for performing and documenting inspections. Consolidate the collection of workplace inspection data.
- Establish formal requirements for periodic analysis of worker and manager safety observation and Safety Warden workplace inspection results to identify adverse trends and most frequent deficiencies and at-risk behaviors with analysis to determine if and what actions are needed to address performance weaknesses.
- Review, strengthen, and formalize the QA monitoring and feedback process to ensure the adequacy of management assessment schedules and completed assessments until all organizations are consistently achieving management expectations. Focus/weight grading towards quality and rigor of assessment, documentation, and results rather than administrative elements. Include routine reporting of collective and organizational performance and trending to senior management and the Director's Safety Council.

2. Significantly strengthen the issues management program to ensure safety problems are formally managed to resolution with effective analysis and identification of recurrence controls. Specific actions to consider include:

- Review and revise the format and content of the issues management procedure, and the CATS tool, as required to clearly communicate the responsibilities, action steps, and other requirements to persons responsible for implementation. Revise and strengthen requirements for determining causes and extent of condition. Identify training requirements for conducting more rigorous causal analysis.
- Clarify the use of terms such as “event,” “issue,” and “action” and ensure their consistent and appropriate use in managing issues.
- Ensure the use of terminology such as “issues,” “observations,” and “findings” are consistent and appropriately used to ensure the requirements for managing externally generated issues are clearly communicated.
- Review and simplify the use of the risk matrix for determining significance levels to ensure that significance levels are being properly and effectively used to apply a graded approach to managing safety issues. At a minimum, ensure that examples, guidance, and training result in

appropriate and consistently applied significance ranking. Review the use of the terms “minimal,” “minor,” “low,” and “medium” and ensure examples and criteria reflect these terms.

- Review, strengthen, and formalize the QA monitoring and feedback process of CATS information to ensure the adequacy of issues management until all organizations are consistently achieving management expectations. Focus quality reviews on assignment of significance levels, cause determinations, and the adequacy of actions to address extent of condition and causes to prevent recurrence. Include routine reporting of collective and organizational performance and trending to senior management and the Director’s Safety Council. Include metrics on quality and issue data (e.g., most frequent types of deficiencies) in addition to performance data for closing and managing issues.

3. Strengthen processes for incident/accident investigations, reporting, and documentation incidents and events, including injuries and illnesses. Specific actions to consider include:

- Review and revise procedures in the ES&H Manual to clarify the format, content, and requirements for the conduct of investigations and reports for all types of incidents and events (i.e., injuries, exposures, operational, and radiological). Include requirements for support organization review and concurrence and management approval to ensure quality. Establish mechanisms to ensure that all issues associated with an event are input into CATS for management to resolution.
- Establish a formal process and defined thresholds for conducting critiques/fact-finding meetings with established protocols and a template for documenting minutes.
- Revise the title of the *Incident/Notable Event/Injury Investigation and Causal Analysis Worksheet*, to reflect a formal investigation report rather than a “worksheet.” Revise the format, content, and instructions to specifically address ISM elements of work control in the description of the events and analysis. Ensure that the adequacy of pre-job planning, including defining the scope of work, hazard identification, and specification of hazard controls and work performance such as pre-job briefings, adherence to procedures and controls, and supervision are evaluated and factored into corrective actions and recurrence controls.
- Ensure that mandated quarterly analyses of reportable and non-reportable events are analyzed for recurrence and adverse trends and are reported to senior management and TJSO.

4. Ensure the initial rollout and application of the new operating experience program is managed and monitored to ensure effective implementation. Specific actions to consider include:

- Strengthen the feedback mechanisms to provide meaningful metrics to assist in the evaluation of program effectiveness. Require division coordinator feedback to the site coordinator on the disposition of posted safety lessons learned. Include a discussion of the generation and application of lessons learned in annual performance reports to senior management (e.g., the Director’s Safety Council) by line and support organizations.
- Consider and monitor the potential risk of overwhelming the new corporate operating experience database with lessons learned information that impedes effective search capabilities and use by planners and training personnel. Consider distinguishing safety lessons learned from operational lessons learned.

- Ensure that the recommended actions for lessons learned from external sources posted to the database are rewritten and tailored to TJNAF and do not include references to other site-specific facilities, organizations, processes/procedures, and management systems.
- Ensure that all safety-related reports and reviews that are posted to DOE Headquarters Health, Safety, and Security websites are included in the source documents for lessons learned screening.

5. Improve processes for reporting employee concerns. Specific actions to consider include:

- Revise the “Safety Toolbox” and SAF 100 training course materials to provide more specific information on the means and options for reporting employee concerns such as phone numbers and information on reporting to DOE.
- Revise ES&H Manual Chapter 2310 and the Administrative Manual to more fully describe the employee concerns processes and to address that concerns can be reported anonymously and that confidentiality can and will be maintained to the extent practical.
- Conduct an anonymous survey of the workforce to ensure that the avenues available to express employee concerns are fully understood by employee, users, and contractors, and determine whether there is reluctance or reservations by the workforce to report safety concerns.

6. Significantly strengthen requirements flowdown and communication mechanisms. Specific actions to consider include:

- Establish a formal site document hierarchy that defines the purpose, content, authorities, and requirements for the collection of documents (e.g., policies, program descriptions, plans, procedures of all types, manuals, instructions, and guides) used to manage Laboratory activities and communicate requirements and expectations from source documents and management decisions to the persons responsible for implementation.
- Establish predetermined structured numbering/identification schemes for each type of document.
- Establish a set of standard formats and writers’ guides for the various documents to ensure complete and consistent content and to foster clear communication of requirements and expectations and procedure compliance.
- Establish a formal document control system that addresses issues such as review and approval requirements, formal owner/subject matter expert periodic review frequencies and scopes, change control mechanisms that provide criteria and processes for formal temporary changes, and criteria for review and approval of permanent revisions.
- Conduct a comprehensive review of all current documents to identify and eliminate ambiguities regarding requirements and guidance and the consistent use of essential terminology.