

**Thomas Jefferson National Accelerator Facility (JLab)  
Senior Safety Advisory Committee (SSAC)  
Executive-Level Independent Assessment  
of the JLab  
Integrated Safety Management System (ISMS)**

**November 2006**



## **A. Introduction**

The Senior Safety Advisory Committee (SSAC) was created as a result of the 2004 Thomas Jefferson National Accelerator Facility (JLab) Safety Enhancement Strategy initiative. As its initial task, the SSAC assessed the effectiveness of the Integrated Safety Management System (ISMS) and the use and implementation of Work Smart Standards (WSS) at JLab in October 2005. After the recent award of the JLab operating contract to Jefferson Science Associates (JSA), DOE's Jefferson Site Office (JSO) has announced that it intended to perform a revalidation of the JLab Integrated Safety Management System (ISMS). JSO presently plans to have its team perform a scoping visit in July 2007, and perform the revalidation effort in August 2007. JSA requested that the SSAC assist the Laboratory in evaluating the effectiveness of its ISMS program and execution. This report documents the SSAC assessment performed November 13 – 16, 2006; covering the first three core functions of ISMS.

## **B. Background**

DOE is in the process of revising its set of ISMS requirements and guidance documents. These actions are part of the Department's Implementation Plan for Recommendation 2004-1 from the Defense Nuclear Facilities Safety Board (DNFSB). That recommendation addressed what the DNFSB believed were problems associated with safety oversight at high-hazard defense nuclear facilities. In its response, DOE expanded the scope of its corrective actions to encompass non-defense nuclear facilities for some aspects of its program to 'revitalize' Integrated Safety Management (ISM) within the Department. Several new documents have been issued, they include:

- DOE Policy 226.1, *Department of Energy Oversight Policy*
- DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*
- DOE Manual 450.4-1, *Integrated Safety Management Systems Manual*

Although the Secretary of Energy (in a letter dated July 24, 2006) delayed further implementation of the Order and Manual, pending revision of the Department's Implementation Plan (IP) for Recommendation 2004-1, for a time period this past Summer; the revised IP

submitted to the DNFSB at the end of September 2006 did not substantially alter commitments applicable to contractors.

In addition to the newer requirements and guidance that has been recently issued, there was a substantial set of existing DOE requirements to use in accomplishing this assessment. These include:

- DOE Policy 450.4, *Safety Management System Policy*
- DOE Guide 450.4-1, *Integrated Safety Management System Guide*
- DOE Handbook 3027-99, *Integrated Safety Management System (ISMS) Verification—Team Leaders Handbook*

### **C. Purpose**

The purpose of this assessment is to provide JSA senior management with an evaluation of the effectiveness of ISMS implementation at JLab. The previous SSAC ISMS assessment used the Continuing Core Expectations (CCEs) found in DOE G 450.4-1, which are intended for use in sustaining existing ISMS program effectiveness. Thus, the previous SSAC assessment looked at ISMS structure, management and continuous improvement. This new assessment is primarily intended to assist JLab in its preparation for the JSO revalidation review, which, in accordance with DOE guidance and requirements, is a more detailed and comprehensive review. Therefore, the sources of information, upon which the criteria and review approaches were developed, needed to be broader in scope.

### **D. Approach**

DOE's commitment to ISM remains strong; however, as discussed briefly above, the Department is in the process of revising the mechanisms that it has in place to assure effective implementation of ISM. The preponderance of the change is occurring in the areas of ISM that address the core functions of: "perform work within controls" (i.e., work planning and work control) and "feedback and improvement." Like other DOE sites, JLab has expended significant effort over the past months in evaluating its programs related to these two core functions. In August 2006, the Laboratory conducted an independent assessment of Feedback & Improvement

and it has also performed a management assessment of work management in August and September 2006.

In order to provide balance, the SSAC focused this initial assessment for FY 2007 on subject matter that supports the ISM core functions one, two and three, which lead up to the safe performance of work: i.e., define the scope of work, analyze the hazards and develop and implement hazard controls. This assessment approach is augmented by considering the evolving expectations of DOE; for example, the new ISMS Manual (DOE M 450.4-1), issued November 7, 2006, focuses on the seven Guiding Principles of ISM because they “have received less attention than needed to achieve the requisite environment for ISM implementation.” Therefore, appropriate aspects of the Guiding Principles were also incorporated into the criteria and review approaches developed for this SSAC review. The second planned SSAC review of ISMS (presently scheduled for May 2007), will assess the final two core functions that have been highlighted by DNFSB Recommendation 2004-1.

## **E. Assessment Schedule**

The on-site portion of this assessment was conducted November 13 – 16, 2006. The SSAC Team (see below) performed an in-briefing with senior JLab management at the beginning of the review. The JLab personnel interviewed are shown in Attachment 1. An out-brief review was held with the Chief Operating Officer, the Associate Director for Environment, Safety, Health and Quality, along with other members of senior management, at the end of the field portion of the review, on November 16, 2006. A draft of this report was provided to JLab management for a factual accuracy check on 12/06/06.

## **F. SSAC Team Members and Responsibilities**

SSAC Team member participating in the review were:

- Steve Krahn, Chairperson and Team Leader
- Bruce Matthews, Member
- Herb Berman, Member

The Team Leader was responsible for review and discussion of the assessment plan, managing the assessment, and providing the results of this assessment to JLab management. The SSAC

Team Members and Leader were responsible for conducting a comprehensive review based on DOE Policy 450.4, Safety Management System Policy, DOE Manual 450.4-1 Integrated Safety System Manual, DOE Guide 450.4-1, Integrated Safety Management System Guide, and DOE Handbook 3027-99, Integrated Safety Management System (ISMS) Verification—Team Leaders Handbook; and the SSAC members experience and background with ISMS programs from other sectors of DOE, along with safety practices from laboratory, commercial and naval nuclear environments. Team member short biographies and qualifications are provided in Attachment 2.

### **G. Assessment Performance Objectives**

The scope of this assessment covered the first three ISM Core Functions from DOE P 450.4, as enhanced by the ISM Guiding Principles detailed in DOE M 450.4-1. The performance objectives were derived from the DOE requirements and guidance discussed above; they were provided as part of the plan for this review, are restated in the “discussion” section below, and, therefore, are not repeated here.

### **H. Assessment Method**

Methods used to perform the assessment included: document reviews, interviews with cognizant JLab management and workers, observation of work coordination and planning meetings, review of prior assessments and associated corrective actions, and review of ISMS performance indicators. A list of documents reviewed is provided in Appendix 3.

## **I. Discussion and Observations**

### **1.0 Integrated Safety Management – Core Function 1 Define the Scope of Work**

#### **1.1 Objective**

Line management ensures that the personnel have and use specified mechanisms to define the scope, schedule, and cost of work and to identify and communicate associated risks and hazards.

#### **1.2 Performance Criteria**

- 1.2.1 Clear roles and responsibilities have been established and adequate personnel and equipment resources been identified for the performance of work, including facility operations and routine maintenance.
- 1.2.2 Work is defined at a sufficient level of detail, so that the individuals performing the work, supervisors, planners, and appropriate ES&H personnel can identify the hazards and risks associated with both the work activity and the environment/location in which it is performed.
- 1.2.3 Balanced priorities are utilized so that work activities are properly prioritized to allow adequate allocation of resources and scheduling based on the importance of the work, safety impact, and risk.
- 1.2.4 For R&D activities, sufficiently detailed planning information is available to envelop the scope of activities to permit the work planning process to commence.
- 1.2.5 For projects and modifications, plans are sufficiently detailed and complete (with appropriate procedures, instructions, drawings, etc.) to define the work/activity.

- 1.2.6 Work-planning processes provide for early involvement of affected personnel (researchers, workers, and safety and health personnel) to sufficiently define the scope of the work to allow identification of hazards.

### **1.3 Results**

- 1.3.1 Clear roles and responsibilities have been established and adequate personnel and equipment resources been identified for the performance of work, including facility operations and routine maintenance.*

#### **PARTIALLY MET**

Roles and responsibilities regarding the management of safety at JLab are discussed in Chapter 2210 of the ESH&Q Manual. These roles and responsibilities are generic; for example, the categories are Associate Directors, Division ES&H Officers, Supervisors, Safety Wardens, Experimenter/User, General Employee. Few of the interviewees were familiar with what was expected of them in the ESH&Q Manual and the manual does not yet appear to reflect the re-organization of the ESH&Q division. During interviews, personnel exhibited a lower than average familiarity with a number of the terms and concepts that are central to Core Functions 1, 2 & 3 of Integrated Safety Management (e.g., authorization basis, safety basis, controls); thus, potentially calling into question their capability to execute safety-related roles and responsibilities.

- 1.3.2 Work is defined at a sufficient level of detail, so that the individuals performing the work, supervisors, planners, and appropriate ES&H personnel can identify the hazards and risks associated with both the work activity and the environment/location in which it is performed.*

#### **PARTIALLY MET**

The current ISMS Program Description is presented primarily as a “compliance matrix,” with “pointers” to several sections of the ESH&Q Manual, along with mention of a number of other documents. It does not describe the methods that were discussed by personnel as being used by the laboratory to plan work, perform hazard identification and

development and implementation of controls (e.g., the Experiment Review Process, readiness review process, etc.).

The most frequently discussed work definition process was the Experiment Review Process, found in Chapter 3120 of the ESH&Q Manual for CEBAF and 3130 for the Free Electron Laser (FEL). Proposals are initially reviewed for the scientific merit by the JLab Program Advisory Committee (PAC). In parallel, the technical aspects of the proposal are reviewed by a Technical Advisory Committee (TAC); according to interviewees, it is a part of the TAC's responsibility to provide an initial safety review of the conduct of operations, radiation safety analysis, and overall experiment safety analysis. These documents are refined in the time period prior to being subject to a readiness assessment (see below).

In the case of projects, personnel discussed the processes that are gone through prior to having subcontractors do work on-site. For major projects the requirements of DOE Order 413.3 are used, which integrate safety into the project management cycle. For smaller projects, the ESH&Q Manual has a chapter (3110) that describes a graded approach to review the ESH&Q aspects of smaller jobs. In addition, it was noted that the "ALVis" data base, along with a similar systems in the Test Lab and FEL, are used to manage much of the major work on the accelerator and elsewhere on-site; short descriptions of the jobs in these systems are used by ESH&Q personnel to screen work.

For the work of the laboratory in general, the COO discussed a new work breakdown structure (WBS) that was being invoked by JSA to improve the consistency of work planning at JLab. The overall WBS for JLab is described in the transition briefing provided to the SSAC (page 85 - 88). The intent of this process is to ensure that the ESH&Q requirements for all laboratory work are integrated into the planning from the budget stage each year. The intent is to encourage integration of requirement and resources at early planning stages. The development of the WBS for FY2007 is in process and scheduled to complete in Spring 2007. Subsequent years' budgets will be built this way.

- 1.3.3 Balanced priorities are utilized so that work activities are properly prioritized to allow adequate allocation of resources and scheduling based on the importance of the work, safety impact, and risk.*

#### PARTIALLY MET

A fundamental source used in developing the prioritization of activities for a facility or site is the authorization basis; for JLab, the authorization basis is provided in the Final Safety Assessment Document (FSAD). For example, it is described in the ISMS PD as defining “the safety envelope of the approved work scope” for the Lab. Few of the personnel interviewed exhibited an awareness of the FSAD and the role that it played as the authorization basis for operations of the accelerator and FEL at JLab. A number of personnel were able to discuss the importance of the personnel access control system for the accelerators, but only one person was able to discuss in any detail the other safety-related systems that the FSAD takes credit for.

One of the responsibilities assigned to the Laboratory Director in Chapter 2210 of the EH&S Manual is to “Ensure that sufficient resources are being devoted to the maintenance of EH&S programs.” Chapter 2210 of the EH&S manual also states that AD’s are responsible to ‘establish and maintain division/office EH&S programs and procedures’; ensure the compliance of their division with EH&S requirements; appoint a division EH&S officer; and ensure that division EH&S programs contain provisions for identification and mitigation of hazards, emergency management and EH&S training of personnel. The requirement to ‘establish and maintain... programs’ can be construed to cover budgeting for safety-related functions, as was confirmed in the October 2005 SSAC review. The JLab Associate Director for ESH&Q assists the Laboratory Director and AD’s in executing their safety-related responsibilities and provides ESH&Q oversight and program definition.

The Institutional Budget for the Lab undergoes review by the Directors Council to ensure that “resources are effectively allocated to address all relevant considerations, including

ES&H” (quote from the ISMS Plan). The Directors Council has also formed a subsidiary group, the Directors Safety Council, which can provide additional focus to resource issues, should they occur. The revised WBS process (discussed in more detail above) should materially assist future ESH&Q resource planning.

*1.3.4 For R&D activities, sufficiently detailed planning information is available to envelop the scope of activities to permit the work planning process to commence.*

MET

All the personnel that were interviewed indicated that they believed that they had sufficiently detailed information to ensure that an adequate review was performed of experiments to be performed, including ESH&Q concerns. The team was shown material that had been used in the review process for several experiments. In addition, copies of the documentation for several experiments were provided for review in detail. This documentation addressed an experiment in Hall B and included the readiness certification, conduct of operations, ESAD and RSAD; each of these documents was specific to the particular experiment—with the exception of the ESAD, which was generic for one of the Halls. Early in the review process, in accordance with ESH&Q Manual Chapter 3120, a Physics Division Liaison is established with the prospective experimenter, along with an ESH&Q Coordinator (sometimes the same person); these personnel are responsible for ensuring that Physics Division expectations and ESH&Q Manual requirements are met. The information reviewed appeared to provide sufficient information for technical decisions to be made as to the hazards involved with the experiments and actions being taken to address them.

*1.3.5 For projects and modifications, plans are sufficiently detailed and complete (with appropriate procedures, instructions, drawings, etc.) to define the work/activity.*

MET

Chapter 3110 “describes the general approach for assessing new facility plans for ESH&Q implications,” the manual notes that this process is useful for new structures, system modifications and changes in a building relating to its “technical/scientific purposes.”

Personnel interviewed, who were familiar with the process, noted that this type of ESH&Q review is one of the tools used by the Subcontracting Officer's Technical Representative (SOTR) in evaluating the adequacy of plans and processes recommended by JLab subcontractors for work performance. For larger efforts, project-specific safety plans may be required from the subcontractor. The review procedure provides a table of potential ESH&Q concerns for use by the SOTR and facility personnel to use in determining the types of hazards that may be applicable to a given project, along with the JLab personnel to ensure are involved if that hazard exists. For major projects, such as the 12 GeV Upgrade Project, as safety officer has been assigned early in the project to ensure that ESH&Q insights are integrated throughout the design process.

*1.3.6 Work-planning processes provide for early involvement of affected personnel (researchers, workers, and safety and health personnel) to sufficiently define the scope of the work to allow identification of hazards.*

#### MET

Personnel interviewed indicated an understanding of the need to evaluate ESH&Q concerns along with the technical merit of experiments performed. These interviews indicated that the Division Safety Officer's were involved very early on in experiment reviews; for example, the Division Safety Officers from both Physics and Accelerator serve on the Technical Advisory Panel (TAP). A number of examples were described wherein ESH&Q subject matter expertise had been brought to bear on problems early in the experiment review process (introduction of Hydrogen targets, decision-making associated with whether or not to introduce Tritium into the facility). Integral parts of the information package that is reviewed by the TAC are the ESAD and RSAD, which undergo ESH&Q professional review (the RSAD must be approved by the Radiological Protection group). ESH&Q professional involvement is required during the readiness review process for experiments, which is performed many months before running the experiment, to catch any final concerns that may exist with as design equipment.

ESH&Q personnel have been involved throughout the design process of the 12 GeV upgrade, the 12 GeV safety officer is an additional duty of the Deputy Associate Director for ESH&Q. The CEBAF Center Addition, a major construction project, provided another example (discussed in the October 2005 SSAC Report) of the flow-down of line management responsibility for safety. In this case the Facility Management Department was the responsible line organization. During the project design phase, safety personnel were involved in multiple design reviews. In the procurement stage, the safety records of potential bidders were used as a discriminator. Corporate safety programs for bidders were reviewed and oral discussions were held to further evaluate the safety culture of bidders. Once selected, the winning bidder worked with JLab EH&S personnel and the SOTR to develop a project-specific safety plan.

## **2.0 Integrated Safety Management – Core Function 2**

### **Analyze the Hazards**

#### **2.1 Objective**

Work planning systems and processes are developed and implemented effectively; they ensure that hazards for defined work are identified and appropriately analyzed, and graded based on the significance of the hazard. Prior to the initiation of work, line management identifies, analyzes, and categorizes the associated hazards associated within the work activity so that the appropriate engineering and administrative controls can be put in place to prevent or mitigate those hazards.

#### **2.2 Performance Criteria**

2.2.1 EH&S procedures include identification of relevant safety standards and requirements and address the hazards analysis process down to the working level.

2.2.2 Hazards assessment processes and procedures are developed and graded in their approach, based on the complexity and risk of the activity or work; performance frequency; initial hazard screenings; personnel education, training and experience; and any other relevant factors

- 2.2.3 Procedures that guide the development of activity-level hazards analyses ensure that the hazards analyses are tailored to the specific work being performed and require appropriate involvement of support personnel, technical experts, and EH&S professionals.
- 2.2.4 The results of hazards assessment activities are integrated into technical work documents and work procedures, and work control processes assure that hazards assessments are reviewed for impact when work scope and technical work document tasks are changed or modified.
- 2.2.5 Planners, workers, researchers, EH&S staff, and facility management personnel tour work sites to identify activity-related hazards and co-located hazards; the approach is graded, based on the risk associated with the activity.

## **2.3 Results**

- 2.3.1 *EH&S procedures include identification of relevant safety standards and requirements and address the hazards analysis process down to the working level.*

### **PARTIALLY MET**

The ISMS Program Description correctly states the need to identify hazards associated with the JLab work or tasks and refers the reader to the ESH&Q chapters on hazard identification and classification. Chapter 3210 with Appendix 3210-T1 (Introduction to Workplace Hazards), and Appendix 3210-T2 (Hazards Identification Worksheet), provides a minimal framework for hazards identification, but is mainly a checklist of industrial safety concerns, with little reference to the applicable codes and standards. Although it is stated that the T2 Worksheet is intended as just a starting point, interviews indicated that there was a minimum of hazards analysis considered beyond the checklist. The ESH&Q chapters on hazard classification and identification appear to primarily be guides for writing procedures, with little information on codes and standards used for identifying hazards designing controls or methods for tailoring controls to the work being performed.

- 2.3.2 *Hazards assessment processes and procedures are developed and graded in their approach, based on the complexity and risk of the activity or work; performance frequency; initial hazard screenings; personnel education, training and experience; and any other relevant factors.*

**PARTIALLY MET**

The Hazard Analysis training and the timely involvement of safety professionals do not appear to be adequate for an effective ISMS program. There does not appear to be any specific training or certification on utilizing the hazard/risk analysis methodology in the ESH&Q manual or the Final Safety Assessment Document (FSAD). Involvement of safety professionals is usually only required near the end of risk code 3 (or higher) work activities, or if the individual setting up the analysis or controls “feels uncomfortable,” based on the interviews conducted. Routine required involvement of safety professionals at the beginning of task planning and hazard identification would seem to be a better safety and business model than the present methodology.

- 2.3.3 *Procedures that guide the development of activity-level hazards analyses ensure that the hazards analyses are tailored to the specific work being performed and require appropriate involvement of support personnel, technical experts, and EH&S professionals.*

**PARTIALLY MET**

There is a sharp division in rigor, with little formality, review or documentation required if Risk Code 2 is chosen for the proposed work activity. The adequacy and appropriateness of the task Risk Code determination does not appear to be assessed or sampled to improve performance or to determine any negative trends in selection of RC 2 or lower. This lack of documentation or safety professional inputs makes it difficult to determine if the conservative Risk Code assignments are being made. Experience at other sites has shown that a more graded approach is warranted (i.e., some controls and oversight at Risk Code 2 levels), as many of the historic notable problems occur during Risk Code 2 activities. A good example for such concern is hoisting and rigging, where only “Critical” lifts are subject to expert

inputs and documented controls. Formality of controls and safety professional inputs for Risk Code 2 activities needs to be reevaluated for a more tailored approach.

*2.3.4 The results of hazards assessment activities are integrated into technical work documents and work procedures, and work control processes assure that hazards assessments are reviewed for impact when work scope and technical work document tasks are changed or modified.*

#### PARTIALLY MET

While the hazards assessment system performs with the areas of improvement noted above, there is a notable lack of any formalized procedure to ensure that the basis of the JLab safety envelope, as detailed in the FSAD, is consciously maintained. The DOE Order for Accelerators (DOE O 420.2) and the J-Lab Final Safety Assessment Document (FSAD) require an Unreviewed Safety Issue (USI) screening process for work activities and equipment modifications/additions that could affect the safety envelope defined by the FSAD (e.g., any work on the safety systems defined in the FSAD, or any new hazard introduced that may produce unmitigated consequences outside of the accidents analyzed in the FSAD). Since J-Lab does not presently use a USI process, it cannot easily demonstrate that changes to safety systems (e.g., access controls) since the 2002 FSAD revision have not placed it outside of the FSAD requirements. While it is unlikely that the upgrades to the safety systems had any negative impacts, J-Lab does not have the process or records to document this status.

*2.3.5 Planners, workers, researchers, EH&S staff, and facility management personnel tour work sites to identify activity-related hazards and co-located hazards; the approach is graded, based on the risk associated with the activity.*

#### PARTIALLY MET

The normal job site visit protocols for JLab work appear to be adequate for Risk Code 3 work, but as discussed in Criterion 3 above, there is a lack of this kind of check and balance on work rated at Risk Code 2 or lower. The recent training in the Dupont STOP

safety process, with its emphasis on looking for workplace hazards is a very positive step in this arena. Additionally, the maturing of the JLab management assessment/observation program will also strengthen the identification of work site hazards. Issues with the present “Stop Work” process are discussed under CRAD 3.

### **3.0 Integrated Safety Management – Core Function 3**

#### **Develop and Implement Hazard Controls**

#### **3.1 Objective**

Management systems for work control are developed and implemented effectively for work activities and ensure the development and implementation of adequate hazard controls for safely performing the work.

#### **3.2 Performance Criteria**

- 3.2.1 Hazard controls are developed and used in a graded approach, with balanced priorities, based on project/work complexity and risk, performance frequency, training or experience of personnel, and initial hazard screenings.
- 3.2.2 The types of controls (engineering, administrative, and personal protection equipment) are applied in the correct sequence. Hazard controls are comprehensive, tailored for the work being performed and adequate for maintaining planning efficiency, while ensuring hazard elimination or mitigation.
- 3.2.3 Training requirements are incorporated into controls and hazards assessments.
- 3.2.4 Workers'/supervisors' stop-work authority and responsibilities are clearly defined for emergent situations or unexpected hazards or safety concerns.
- 3.2.5 Procedures address interfaces between facility management, facility users, and subcontractors to ensure that conflicts and overlapping work activities are properly coordinated and resolved.

### 3.3 Results

3.3.1 *Hazard controls are developed and used in a graded approach, with balanced priorities, based on project/work complexity and risk, performance frequency, training or experience of personnel, and initial hazard screenings.*

#### PARTIALLY MET

During the interviews and associated document reviews, the Senior Safety Advisory Committee found that the basic concepts and requirements of safety controls do not seem to be well understood, or at least articulated, at either the facility or work activity level. The five safety related controls for the accelerator are defined in the FSAD and the Accelerator Operations Directives. Most understood their functions; however, only one of the interviewees could define the five controls without prompting. When questioned about the importance of maintaining the operability of the controls, few seemed to understand the concept of configuration control of safety systems.

3.3.2 *The types of controls (engineering, administrative, and personal protection equipment) are applied in the correct sequence. Hazard controls are comprehensive, tailored for the work being performed and adequate for maintaining planning efficiency, while ensuring hazard elimination or mitigation.*

#### PARTIALLY MET

The ISMS Program Description correctly states that engineered controls are preferred to administrative controls, and directs the reader to chapters 3310 and 3320 in the EH&S Manual. These chapters are guides for writing procedures and very little information on codes and standards used for designing controls or methods for tailoring controls to the work being performed was found. We also note that when queried about how safety controls were developed and implemented at the activity level, most of the interviewees defaulted to descriptions of administrative controls; which might give an incorrect or distorted image of the JLab controls protocol. On a more positive note, most interviewees demonstrated an intuitive understanding of the importance of safety controls when prompted to describe

specific experiences. For example, a “pull the plug” test was used to prove that an experiment could shut down in a safe mode.

*3.3.3 Training requirements are incorporated into controls and hazards assessments.*

NOT MET

There does not appear to be any specific training or certification on utilizing the hazard/risk analysis methodology in the ESH&Q manual or the Final Safety Assessment Document (FSAD), or for establishing appropriate hazard controls. Also, there does not appear to be any evidence of training for off-normal events, or QA training or basic ISM training. The last emergency response exercise was several years ago. Emergency response is discussed at meetings, but nothing formal to prepare for off-normal events. JLab management should review the content and effectiveness of the JLab emergency management, response, and preparation programs.

The Senior Safety Advisory Committee senses that the long standing and expert-based experience in designing, building, and safely operating accelerator facilities and complex experiments has the solid foundations necessary for meeting ISM Core Function 3 and thereby mitigating most hazards found in accelerator operations and experiments. However, the formality of many JLab operations could be improved, the ISM expectations need to be clarified and communicated to employees, and training on how to do a hazard analysis and maintain controls should be developed. Finally, line managers need to become familiar with ISM requirements and the ISM “language” used by DOE to succeed in the upcoming ISM audit.

*3.3.4 Workers'/supervisors' stop-work authority and responsibilities are clearly defined for emergent situations or unexpected hazards or safety concerns.*

PARTIALLY MET

The Jefferson Lab stop-work order is clearly defined in the ESH&Q manual, but appears to be rarely used because it is very rigorous, requires justification and formal reports, and

is primarily focused on life-threatening situations. The JLab stop work order - as currently written – does not appear to be in the spirit of safety-first. A revised stop work order has added a “Suspend and Stop-Work Process” that is aimed at correcting the rigid nature of the current order. The suspend work order requires the worker to categorize the risk before calling for a stop work and could continue to discourage effective use of this fundamental worker safety responsibility.

In order for a stop work policy to be effective, workers need to understand their responsibility and authority to stop work without fear of reprisal, and management has to clearly communicate that expectation. A viable stop work policy should be based on two fundamental attributes found in highly reliable organizations: (1) individuals demonstrate a questioning attitude by challenging assumptions and considering potential unintended consequences, and (2) activities are ensured to be safe before starting work rather than proving that activities are unsafe before stopping work. A stop work can be called for something as simple as a procedure that can't be followed, up to and including imminent dangers. Line supervisors should be notified of every stop work action. While a formal report may not be necessary, the action should be noted in a management observation or contractor self-assessment program and evaluated for lessons learned.

The new Suspend Work Action is to be implemented when a serious hazard defined as Risk Code 3 (Hospitalization required or > 5 lost workdays) is observed. While this action promotes a less formal stop work process, the Suspend Work Action still seems to put the responsibility on the worker to categorize the risk before stopping work. Furthermore, the Stop Work Process flow sheet in Figure 1 does not have a Suspend Work Action decision box, but does include an “On-the-spot resolution if possible” decision box that is not discussed in the text. Individuals are likely to be confused by this seeming inconsistency.

*3.3.5 Procedures address interfaces between facility management, facility users, and subcontractors to ensure that conflicts and overlapping work activities are properly coordinated and resolved.*

## PARTIALLY MET

Activities during accelerator shutdowns are coordinated with the ATLI's web-based system, the Accelerator and Engineering Divisions enter their work on ATLI's; however physics division does not. The interfaces appear to be well managed with daily planning meetings, coordination among groups, and cooperation between individuals. However, inconsistent planning and safety processes between divisions sometimes cause conflicts in safety support resources. We note that QA aspects of work do not appear to be applied to or integrated with ISM as required by DOE. Also, ISM is not being applied evenly across JLab; Hall Coordinators, who appear to be the key line managers responsible for safety, seem to properly manage safety and intuitively apply ISM principles; however, they are not familiar with the common ISM terms and concepts. The SSAC notes that safety of activities by sub contractors seem to be tightly controlled, and DOE requirements and JLab expectations flow down through contracts and subs are held accountable for performing work safely.

However, while there is considerable effort made to ensure the proper interfaces are formalized for work and safety controls, the Lifting and Handling program seems to lack the same type of attention and controls given to other hazards, such as electrical. Interviewees noted that material handling is a frequent and hazardous activity, and the recent toolbox incident is receiving the attention of the Material Handling Safety Committee. However, when queried about how the lab plans to implement controls to mitigate the lifting and handling hazards, the responses were less crisp. Currently the lab has no manual detailed procedures for hoisting and rigging.

Training and certification for using lifting and handling equipment is cursory in most divisions. Lifting hazards are not routinely analyzed, and controls are not tailored to mitigate the risks. In fact only critical lifts are required to have procedures. While it is important to allow flexibility, especially in an R&D environment, and not create a situation where "three hours of paper work is required to do a 15 minute job," lifting accidents can be frequent and serious; JLAB management should continue the new emphasis on hoisting and rigging program improvements.

## **4.0 Opportunities for Improvement**

### **4.1 CORE FUNCTION 1**

4.1.1 During interviews, personnel exhibited a lower than average familiarity with a number of the terms and concepts that are central to the Core Functions 1, 2 & 3 of Integrated Safety Management (e.g., authorization basis, safety basis, controls). In addition, the majority of the personnel interviewed did not mention, at least until prompted, that safety-related responsibilities could be found in Chapter 2210 of the ESH&Q Manual. It was noted that this section of the ESH&Q Manual has not been updated to reflect the re-organization of JLab that has occurred since JSA took over the contract. [Criterion 1]

4.1.2 The current ISMS Program Description is presented primarily as a “compliance matrix,” with “pointers” to several sections of the ESH&Q Manual, along with mention of a number of other documents. It does not describe the methods that were discussed by personnel as being used by the laboratory to plan work, perform hazard identification and development and implementation of controls (e.g., the Experiment Review Process, readiness review process, etc.). [Criterion 2]

4.1.3 Few of the personnel interviewed exhibited an awareness of the Final Safety Assessment Document (FSAD) and the role that it played as the safety basis for operations of the accelerator and FEL at JLab. A number of personnel were able to discuss the importance of the personnel access control system for the accelerators, but only one person was able to discuss in any detail the other safety-related systems that the FSAD takes credit for. [Criterion 3]

### **4.2 CORE FUNCTION 2**

4.2.1 The ESH&Q chapters on hazard classification and identification appear to primarily be guides for writing procedures, with little information on codes and standards used for identifying hazards, designing controls or methods for tailoring controls to the work being performed was found. [Criterion 1]

4.2.2 The Hazard Analysis training and the timely involvement of safety professionals do not appear to be adequate for an effective ISMS program. There does not appear to be any specific training or certification on utilizing the hazard/risk analysis methodology in the ESH&Q manual or the FSAD and involvement of safety professionals is usually only required near the end of Risk Code 3 (or higher) work activities, or if the individual setting up the analysis or controls “feels uncomfortable.” [Criterion 2]

4.2.3 There is a sharp division in rigor, with little formality; review or documentation required if Risk Code 2 is chosen for proposed work activity. The lack of documentation or, potentially, safety professional inputs (See above) makes it difficult to determine if the conservative Risk Code assignments are being made. [Criterion 3]

4.2.4 The DOE Order for Accelerators (DOE O 420.2) and the J-Lab FSAD require an Unreviewed Safety Issue (USI) screening process for work activities and equipment modifications/additions that could affect the safety envelope defined by the FSAD (e.g., any work on the safety systems defined in the FSAD, or any new hazard introduced that may produce unmitigated consequences outside of the accidents analyzed in the FSAD). Since J-Lab presently does not have a USI process, it cannot easily demonstrate that changes to safety systems (e.g., access controls) since the 2002 FSAD revision have not placed it outside of the FSAD requirements. [Criterion 4]

4.2.5 The normal job site visit protocols for JLab work appear to be adequate for Risk Code 3 work, but as discussed in criterion 3 above, there is a lack of this kind of check and balance on work rated at Risk Code 2 or lower. [Criterion 5]

### **4.3 CORE FUNCTION 3**

4.3.1 During the interviews and associated document reviews, the Senior Safety Advisory Committee found that the basic concepts and requirements of safety controls do not seem to be well understood, or at least articulated, at either the facility or work activity level. The five safety related controls for the accelerator are defined in the FSAD and the Accelerator Operations Directives. Most understood their functions; however, only one of the interviewees

could define the five controls without prompting. When questioned about the importance of maintaining the operability of the controls, few seemed to understand the concept of configuration control of safety systems. [Criterion 1]

4.3.2 The ISMS Program Description correctly states that engineered controls are preferred to administrative controls, and directs the reader to chapters 3310 and 3320 in the EH&S Manual. These chapters are guides for writing procedures and very little information on codes and standards used for designing controls or methods for tailoring controls to the work being performed was found. We also note that when queried about how safety controls were developed and implemented at the activity level, most of the interviewees defaulted to descriptions of administrative controls. [Criterion 2]

4.3.3 There does not appear to be any specific training or certification on utilizing the hazard/risk analysis methodology in the ESH&Q manual or the Final Safety Assessment Document (FSAD), or for establishing appropriate hazard controls. Also, there does not appear to be any evidence of training for off-normal events, or QA training or basic ISM training. The last emergency response exercise was several years ago. Emergency response is discussed at meetings, but nothing formal to prepare for off-normal events. JLab management should review the content and effectiveness of the JLab emergency management, response, and preparation programs. [Criterion 3]

4.3.4 In order for a stop work policy to be effective, workers need to understand their responsibility and authority to stop work without fear of reprisal, and management has to clearly communicate that expectation. A stop work can be called for something as simple as a procedure that can't be followed, up to and including imminent dangers. Line supervisors should be notified of every stop work action. While a formal report may not be necessary, the action should be noted in a management observation or contractor self-assessment program and evaluated for lessons learned. [Criterion 4]

4.3.5 While there is considerable effort made to ensure the proper interfaces are formalized for work and safety controls, the Lifting and Handling program seems to lack the same type of

attention and controls given to other hazards, such as electrical. Material handling is a frequent and hazardous activity, and the recent toolbox incident is receiving the attention of the Material Handling Safety Committee. However, when queried about how the lab plans to implement controls to mitigate the lifting and handling hazards, the responses were less crisp. Currently the lab has no manual or detailed procedures for hoisting and rigging. [Criterion 5]

**ATTACHMENT 1**  
**Personnel Interviewed**

1. The Gwyn Williams, FEL – DSO
2. Larry Cardman, Physics – AD
3. Christoph Leemann, Lab Director
4. Todd Kujawa, Electrical Safety Committee
5. Andrew Hutton, Accelerator – DSO
6. Kees de Jager, Physics – Hall Leader
7. Craig Ferguson, ESH&Q – AD
8. Kelly Mahoney, Accelerator – PSS
9. Erik Abkemeier, RadCon Manager
10. Bruce Lenzer, QA/CI Manager
11. Bob May, ESH&Q – Deputy AD
12. Rusty Sprouse, Facilities & Logistics
13. Tony Thomas, Chief Science Officer
14. Will Oren, Engineering
15. Claus Rode, 12 GeV
16. Mike Dallas, Chief Operating Officer
17. John Hogan, Material Handling Safety Committee
18. Bert Manzlak, ES&H – Physics
19. Ned Walker, ES&H –Industrial Safety
20. Steve Benson, FEL

**ATTACHMENT 2**  
**Senior Safety Advisory Committee Member**  
**Short Biographies**

<b>Dr. Steve Krahn</b>
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<b>Total Years of Experience: 28</b>
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<b>Education:</b>
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PhD, Public Administration, University of Southern California, 2001
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MS, Materials Science, University of Virginia, 1994
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BS, Metallurgical Engineering, University of Wisconsin, 1978
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Bettis Reactor Engineering School (USDOE) 1980
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Steve Krahn is a Senior Technical Director and Senior Vice President in PSGS's National Defense Division. He has more than 25 years of general, program, and technical project management experience in positions of increasing responsibility in government, private industry, and the military. His technical and project management highlights include management of a \$140 million complex overhaul of a nuclear submarine; technical direction of the research and development program for a major DOE reactor program; leading the nuclear safety oversight of the nation's nuclear weapons manufacturing and research and development complex; and direction of the design and construction efforts for two major safety upgrades at DOE nuclear facilities. In general management, Dr. Krahn's general management highlights have included providing overall direction and leadership as the Chief Operating Officer for the Defense Nuclear Facilities Safety Board (DNFSB) with an annual budget of \$18 million; producing the first-ever strategic plan for a federal agency. Each of these endeavors required the use of the full spectrum of his management skills, including strategic planning, technical analysis and decision-making, budget preparation and justification, financial analysis, staff recruitment and training, and project management. Dr. Krahn has led many consulting projects for DOE and its contractors in nuclear safety, engineering, ES&H and project management.

<b>Dr. R. Bruce Matthews</b>
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<b>Total Years of Experience: 33</b>
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<b>Education:</b>
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Ph.D., Materials Science, 1970, University of Wales, Swansea, Glamorgan, UK.
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MS, Materials Science, 1966, University of Denver, Denver, Colorado. BS, Metallurgy,
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1964, BS, Pennsylvania State University, University Park, Pennsylvania.
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R. Bruce Matthews served a Presidential appointment as a Member of the Defense Nuclear Facilities Safety Board. In addition to his DNFSB oversight responsibilities, Matthews focused on safety management of high-hazard nuclear facilities and implementation of Integrated Safety Management. Matthews worked at national laboratories as a scientist, line manager, and project leader and has been involved in Department of Energy programs in stockpile stewardship, nuclear materials disposition, environmental management, and space and terrestrial nuclear power systems. He has direct experience in nuclear facilities management including operations, construction, regulatory compliance, integrated safety management, and safeguards and security. Matthews is the author or co-author of over eighty journal publications, conference proceedings and technical reports. He initiated the international Plutonium Futures Conference and is a Fellow of the American Nuclear Society. Matthews is an independent consultant to Perot Systems Government Services. In addition he serves on the National Nuclear Accrediting Board for the Institute of Nuclear Power Operations, the University of California's ES&H Panel, and the Safety Oversight Subcommittee for Sandia National Laboratory.

<b>Herb Berman</b>
<b>Total Years of Experience:</b> 34
<b>Education:</b> SB, Metallurgy and Materials Science, Massachusetts Institute of Technology, 1961 Doctoral Course work in Solid State Physics, University of Pennsylvania, 1963-1966 Executive Management Program, Kellogg School of Management, Northwestern University, 1990

Herb Berman brings more than thirty years of experience in the management, supervision and performance of nuclear/radiological work and the establishment of appropriate safety basis controls to his work as a Senior Technical Director with PSGS. He was brought in to lead engineering organizations at the Rocky Flats and Pantex facilities of the DOE. In turning around their performance, he demonstrated exceptional skill in instilling the levels of technical rigor required in nuclear facilities; managing and directing the institutional and cultural changes necessary to transform previously troubled organizations into fully functional, standards-based entities; and doing so using the tenets of integrated safety management. He has also been the senior manager directing nuclear engineering at a naval shipyard, in addition to his DOE technical management experience. Mr. Berman has a comprehensive understanding of the engineering, environmental and safety requirements and practices in the DOE Weapons Complex and the Naval Nuclear Propulsion Program. In addition, he has significant experience in client, community and regulatory agency interaction. He possesses a proven track record of managerial and program management accomplishments, successfully directing successively larger, more complex organizations and projects.

## **ATTACHMENT 3**

### **References Reviewed for ISMS Assessment**

1. Comprehensive Laboratory Safety Strategy, December 22, 2004
2. The Princeton Plasma Physics Laboratory Integrated Safety Management System Reverification, U.S. Department of Energy Office of Science, Princeton Site Office, June 2006.
3. Thomas Jefferson National Accelerator Facility Ten-Year Site Plan 2007 – 2016, dated May 2005.
4. Final JSA Transition Plan, January 25, 2006
5. Thomas Jefferson National Accelerator Facility Institutional Plan FY 2004 to FY 2008 dated October 2003.
6. Thomas Jefferson National Accelerator Facility, Integrated Safety Management System Program Description, Revision 9 of December 15, 2005.
7. Jefferson Lab Quality Assurance Program Manual, Revision 6 of October 2005.
8. Jefferson Laboratory Independent Assessment Procedure dated November 2005.
9. U.S. Department of Energy Integrated Safety Management System Manual, DOE M 450.4-1, November 2006.
10. U.S. Department of Energy Order, Safety of Accelerator Facilities, DOE O 420.2.
11. Thomas Jefferson National Accelerator Facility, Final Safety Assessment Document, Revision 5 of November 2002.
12. FY06 PEMP Measures 5.0, 6.4, and 8.1.1 Commentary.
13. The Jefferson Laboratory Accelerator Operations Directives, March 2006.
14. The Jefferson Laboratory Electrical Engineering Operations Directives, November 2004.
15. The Jefferson Laboratory Procedures for Nuclear Physics Experiments, January 2003.
16. The Jefferson Laboratory EH&S Manual, Chapter 3210, “Hazard ID and Characterization.”
17. The Jefferson Laboratory EH&S Manual, Chapter 3210, “Hazard ID and Characterization,” Appendix 3210-T1, “Introduction to Workplace Hazards
18. The Jefferson Laboratory EH&S Manual, Chapter 3210, “Hazard ID and Characterization,” Appendix 3210-T2, “Hazard Identification Worksheet.”
19. JLab User Group, Proposal Template, PAC 30.

20. JLab User Group, Hall A Proposal of December 3, 2001, “Measurement of the Neutron Electric Form Factor Gen at high $Q^2$ .”
21. The Jefferson Laboratory EH&S Manual, Chapter 3120, “The CEBAF Experiment Review Process.”
22. JLab Technical Review of Hall A Proposal PR12-06-114, “Measurements of Electron-Helicity Dependent Cross Sections of Deep Virtual Compton Scattering with CEBAF at 12 GeV.”
23. JLab Readiness Review of Hall A Experiment E02-013, “Measurement of the Neutron Electric Form Factor Gen at High  $Q^2$ ”, January 5, 2006.
24. Notable Event/Incident Investigation Worksheet A-06-1024R1-NEW, “Test Lab Toolbox Crane Incident,” October 2006.
25. The Jefferson Laboratory EH&S Manual, Chapter 2210, “ESH&Q Responsibilities of Individuals.”
26. JLab Readiness Certificate for the G13 Experiment in Hall B, October 17, 2006.