Department of Energy
Thomas Jefferson Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

June 18, 2008

Ms. Mary Logue
Associate Director for ESH&Q
Thomas Jefferson National Accelerator Facility
12000 Jefferson Avenue
Newport News, VA 23606

Dear Ms. Logue:

FINAL SURVEILLANCE REPORT—LASER SAFETY PROGRAM OF THE THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

The attached Surveillance report covers the Site Office's review of the Laboratory's Laser Safety program, conducted April 22-24, 2008. We are committed to improving the quality of these reviews, and we encourage the Lab to provide feedback on ways to improve the efficiency and utility of these assessments.

For all P-2 Findings identified in the report, the Laboratory is expected to submit to the Site Office a corrective action plan by July 18, 2008. Corrective action plans are to minimally identify each P-2 Finding, a brief description of the actions taken or planned, and reference to the Laboratory's Corrective Action Tracking Systems (CATS) entry number. Please notify the Site Office upon closure of each P-2 Finding.

Within the corrective action plan, please include the disposition or proposed course of action for each P-3 Finding (Observation) identified in the report. It is expected that the Laboratory enter P-3 Findings into an issues management system in a timely manner to satisfy tracking and trending requirements.

If there are questions pertaining to this Surveillance, please contact Steve Neilson of my staff at extension 7215.

Sincerely,

James A. Turi, Manager
Thomas Jefferson Site Office

Enclosure

cc w/encl:
C. Leemann, JSA/TJNAF
M. Dallas, TJNAF
B. Lenzer, TJNAF
B. Manzlak, TJNAF

SJN:Fnl Laser Safety Rpt Ltr:6/12/08:631

U.S. Department of Energy
Thomas Jefferson Site Office

Final Report
Laser Safety Program Assessment
of the
Thomas Jefferson National Accelerator Facility
May 2008

Scott L. Davis, Team Leader
Oak Ridge Office

June 9, 2008
Date

Steve Neilson
TJSO Safety and Occupational Health Manager

June 9, 2008
Date

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ACRONYMS AND DEFINITIONS

ANSI	American National Standards Institute
ARC	Applied Research Center
CAP	Corrective Action Plan
CATS	Corrective Action Tracking System
CCTV	Closed Circuit Television
DOE	Department of Energy
ES&H	Environment, Safety, and Health
ESAF	Experiment Safety Approval Form
FEL	Free Electron Laser
FIND	Finding
FIND-P1	P1 Finding. Findings of major significance. (Examples include imminent threats to worker protection, public safety, or environmental quality or the presence of a major risk or vulnerability). Such findings can be a systematic breakdown in, or a failure to implement, a major work control element necessary for safety, quality, or the environment or a significant noncompliance with requirements.
FIND-P2	P2 Finding. Findings that represent nonconformances, deviations, and/or deficiencies in the implementation of requirements, procedures, standards, and/or regulatory requirements.
FIND-P-3	P3 Finding. Observations that the assessor deems to be an isolated, minor, quick fix or nonadherence to best practices/internal procedures/accepted standards.
JSA	Jefferson Science Associates, LLC
LSO	Laser Safety Officer
LSOP	Laser Standard Operating Procedure
LSS	Laser System Supervisor
MIS	Management Information System
OBS	Observation

OHP	Occupational Health Physician
PLC	Programmable Logic Controllers
PRO	Proficiency. A performance item that exhibits a level of performance deemed worthy of communicating to other organizations because it is innovative or may be indicative of the highest level of excellence. Formerly-used terms that meant essentially the same thing were Noteworthy Practice and Strength.
QA	Quality Assurance
RF	Radio Frequency
SOR	Special Operations Report
TJNAF, Laboratory, or JLab	Thomas Jefferson National Accelerator Facility
TJSO	Thomas Jefferson Site Office

Laser Safety Program Assessment of the Thomas Jefferson National Accelerator Facility

1.0 INTRODUCTION

As requested by the U.S. Department of Energy (DOE) Thomas Jefferson Site Office (TJSO), an assessment of the Thomas Jefferson National Accelerator Facility (TJNAF, Laboratory, or JLab) Laser Safety Program was conducted on April 22 and 23, 2008, by Scott Davis, DOE Oak Ridge Office, and Steve Neilson, DOE TJSO. The assessment was conducted to evaluate laser safety activities at Jefferson Laboratory and followed the Review Plan for the Laser Safety Program Assessment as closely as possible based on time constraints and available resources. The assessment primarily focused on program areas that were not evaluated in DOE's 2005 Laser Safety Program Assessment, including non-beam hazards. Furthermore, the status of corrective actions resulting from the 2005 assessment was reviewed. Program areas and operations assessed included laser labs, experiments and related activities, routine laser system(s) operations, and laser program documentation. Emphasis was placed on controls selection, posting, and equipment labeling "as found" in the field. Jefferson Laboratory is managed and operated for DOE by the Jefferson Science Associates, LLC (JSA). JSA is a limited liability corporation created by Southeastern Universities Research Association and Computer Sciences Corporation specifically to manage and operate Jefferson Laboratory.

2.0 SUMMARY OF RESULTS

The Laser Safety Program adequately identifies requirements, and program implementation was sufficient to support laser operations. A laser inventory of Class 3B and 4 lasers was requested, provided, and reviewed. Training requirements were established, and a system is in place to train, qualify, and track laser users. A corrective action and tracking system is in place, and previous issues and assessments were reviewed to ensure closures of corrective actions were accomplished. Jefferson Laboratory took the initiative to address interlocks and system controls well beyond industry practices in response to a recent "near miss," and these practices could serve as a model for other DOE facilities. However, several issues were identified during the assessment that should be addressed to strengthen the overall Jefferson Laboratory Laser Safety Program. Results of the program elements assessed are shown below.

2.1 Program Management

In accordance with 10 Code of Federal Regulations 851, Jefferson Laboratory is subject to the American National Standards Institute (ANSI) Standard Z136.1-2000, *Safe Use of Lasers.* Local policies and instruction on laser safety are contained within its Environment, Safety, and Health (ES&H) Manual, specifically Chapter 6410, *Laser Safety.*

The Laser Safety Officer (LSO) is designated by Jefferson Laboratory senior management via ES&H Manual Chapter 2210, *ESH&Q Rights and Responsibilities of Individuals*, and further delineates each individual by name in Appendix R-1, *Current ES&H Staff Assignments*, Table 1, dated March 19, 2007. This table was out of date and did not reflect the current LSO assignment. Additionally, Jefferson Laboratory documentation used to temporarily appoint the "Acting" LSO was handled via e-mail and given Laboratory-wide distribution. No evidence was found that laser users were unaware of the current temporary LSO appointment. However, the informal nature of the temporary assignment needs to be improved. The documented training and experience of the Acting LSO, as provided, was limited.

DOE Headquarters identified its expectations for laser safety in a Special Operations Report (SOR) 2005-01, which included specific examples of lessons learned concerning weaknesses found in LSO positions across the complex. The excerpts from this report are included within the Laboratory's ES&H Manual (Chapter 6410 Appendix T-6) and highlight the importance of having LSOs with sufficient resources and qualifications and ensuring that LSOs are given ample authority.

Over the last three years, Jefferson Laboratory has almost doubled its number of Class 3B and 4 lasers and has significantly upgraded some of the operational parameters of its lasers (i.e., Free Electron Laser [FEL] power). Jefferson Lab continues to be on the cutting edge in the complexity of laser equipment and associated experimental applications. The Laboratory's near miss event in December 2006 at the FEL provides additional evidence that a strong laser safety oversight presence is warranted. Based on the prior DOE lessons learned and the current trend in laser system numbers and complexity, it is recommended that Jefferson Laboratory consider improving the rigor and formality of the LSO appointment process commensurate with the level of hazard and authority required of the position. In order to satisfy the responsibilities of the position, it is imperative that the LSO be able to interact on a technical level with the laser system owners.

The Jefferson Laboratory LSO appointment, documentation, and certification process should be improved to demonstrate formality and rigor commensurate with the position. **(FINDING [FIND]-P3-001)**

The Laser Safety Program documentation was reviewed to ensure it is current, addresses program requirements, and is being maintained consistent with site operations. Several documentation issues were identified that should be corrected to ensure the Laser Safety Program complies with recognized standards. Areas where improvements can be made include:

- ES&H Manual Chapter 6410, *Laser Safety*, appendices need to be reviewed, revised, and updated. For example, Appendix T-1, *Laser Bioeffects & Non-Beam Hazards*, page 5, the last bullet under non-beam hazards, indicates—"The attached schematic is a representation of non-beam hazards and their association with laser system components." The referenced schematic was not attached.

- Appendix T-2, *Laser Hazard Labels*, provides conflicting guidance on "who" and "where" labels can be obtained or provided. For example, the introduction indicates—"labels must be supplied by the Laser System Supervisor," three sentences later the same guidance indicates—"Any required labels may be obtained through the Jefferson Lab Safety Lab." Clarification is needed in identifying the correct resource for creating or obtaining labels and postings.

- Appendix T-5, *Alignment Guidelines*, has several acronyms that are not spelled out during the initial use of the acronym. Generally, laser users will know the terms presented; however, it is a good practice to first identify the acronym before using it later in the text. Item 7 is also not well written. The instruction to secure beam stops or optic mounts is confusing. Both should be secured to the table. Item 12 seems to allow intra-beam viewing provided it is evaluated by the LSO. This is not a practice that should be referenced.

- Appendix T-6, *Lessons Learned from Laser Accidents*, has taken the DOE Special Operations Report, dated February 2005, and included the report in its entirety as an

appendix to the Jefferson Laboratory ES&H Manual. While use of the report as a lessons learned tool is a good approach, it was not clear how the Appendix was to be used. The laser safety lessons learned, as presented, is accurately described in the SOR and can be a good tool for communicating root causes.

ES&H Manual Chapter 6410 and its Appendices should be reviewed, revised, and updated to reflect current practices and requirements. **(FIND-P3-002)**

Examples of FEL Experiment Safety Approval Forms (ESAF) were reviewed to ensure hazards and controls were being addressed in laser work control documentation. The ESAF is prepared by the lead scientist of a user group and is the document which details all non-standard safety hazards associated with a user's experiment. The FEL ESAF is used to meet the requirements of 6410-T4 and serves as the laser safety inspection checklist for FEL Class 3B and Class 4 lasers. The ESAF is used to describe the laser system, system hazards, performs a limited hazard analysis, and provides for system approval.

The ESAF for FEL Experiment ID# 07-015, for Lab 5, as reviewed, had several non-beam hazards not addressed. Section 6.a, Task Hazard Analysis, Question 2, indicated that a radio frequency (RF) hazard was not present. During the system walk down, it was noted that the laser system is powered by an integrated RF generator. This potential hazard was not captured in the Task Hazard Analysis. The Laser System Supervisor (LSS) was asked if an RF leakage evaluation was conducted to ensure the RF hazard was controlled by the manufacturer, and indications were that no evaluation was conducted. Also, Question 2 is rather broad, and it does not allow the preparer to address system hazards in a detailed approach. This should be clarified.

The ESAF requires the user to identify other applicable Laboratory Safety Operating Procedures (LSOP). The ESAF for Experiment ID# 07-013, for Lab 3A, Section 5, mentions another LSOP; however, it does not reference the LSOP (i.e., number or recognized title). Section 6.a, Task Hazard Analysis, has several questions that lead the user to address specific hazards. In Question 11, an attachment is referenced on a pressure vessel, and no attachment was provided. Section 6.b, Regulatory Requirements, is difficult to interpret, and it does not have the same formality of use as in 6.a above. Based on the potential impact regulatory requirements may have on the laser operation, it would be prudent for the Laboratory to organize these sections in the same consistent format. ESAF instructions should include writer instructions that provide clarity on the use of acronyms—they should be spelled out prior to use.

The ESAF for Experiment ID#07-005, for Lab 2, was difficult to follow and was not formatted properly. Review of the ESAF found that the laser parameters were not properly identified (i.e., power and wavelength range), and laser safety considerations were referenced as "Normal personnel safety for class IV laser."

Jefferson Laboratory should review the task hazard analysis approach and make certain the questions used for development ensure that system hazards and information are not overlooked. Recognized system hazards should be evaluated and documented. Jefferson Laboratory should review and revise the ESAF to ensure system hazards are addressed. **(FIND-P3-003)**

Line management self-assessments are performed, documented, and appeared to be effective in helping ensure safe operations. The Management Self-Assessment, conducted in the April-May 2005 time period, was focused and documented. The majority of the opportunities for

improvement were captured in the Corrective Action Tracking System (CATS). The DOE Surveillance of the Laser Safety Program, conducted in September 2005, was reviewed to ensure that observations identified were addressed. During this assessment, several issues were identified concerning CATS. In reviewing the CATS reports for 2005, 2006, 2007, and 2008, it was determined that the majority of actions reviewed were inconclusive and corrective actions could not be determined.

The CATS reports provided did not present enough information to allow a decision for effective closure. The reports gave a description of the issue and a corrective action that merely repeated the issue. Closure dates were provided; however, no evidence or description of evidence needed for closure or used for closure was provided. The status update for each issue was primarily a date change notification and did not specifically reference actions taken.

There was no formal corrective action plan (CAP) provided to the DOE Site Office in response to the September 2005 Surveillance. The reply provided from the contractor was in the form of a CATS report with the same information as stated above. See Appendix D.

Jefferson Laboratory should ensure that every request for a CAP from the DOE Site Office is entered into its tracking system, and CAPs should be developed with more detailed information in order to facilitate a better understanding of closure of action items.
(FIND-P3-004)

Medical Surveillance of Laser Users at Jefferson Laboratory for all users of Class 3B or Class 4 lasers must have medical approval from the Jefferson Laboratory Occupational Health Physician (OHP). The OHP and staff members were interviewed to discuss the process for providing eye examinations to laser workers (both Laboratory staff and users), and on how the information is documented. The OHP conducts the majority of laser worker eye exams, and the initial exam for Jefferson Laboratory's user community. The OHP indicated he accepts the results of externally obtained eye exams, provided they were conducted in accordance with the ANSI standard, and a written report is furnished to the Medical Department. An example ophthalmologist report was available on the website. The Laser Safety/Medical Approval Form is completed by the employee's supervisor or user sponsor, and submitted to the LSO. The OHP indicated he performed an examination on the laser worker involved in the FEL "near miss" event in December 2006, and the results were in the file. The Occupational Health Program provides good support to the Laser Safety Program. It should be noted that when site medical programs are directly administered by a physician these programs are generally better managed than programs that have contracted support. ANSI Standard Z136.1-1993 is the referenced standard for medical surveillance on the Laboratory's website, and the website should be updated to reflect the 2000 standard.
(http://www.jlab.org/ehs/medical/laser/GeneralInformation.pdf)
(FIND-P3-005)

2.2 Training and Qualifications

2.2.1 Laser Safety Training

Laser safety training is provided by Jefferson Laboratory and supports both the initial orientation (lab-wide) and laser-specific training (division specific). Laser-specific training is a very important aspect of laser safety training because it brings systems specific configurations, use, and hazards identification issues to the laser worker and supervisor. Laser Standard Operating Procedures are issued for each laboratory using a Class 3B or 4 laser. Laser-specific training generally consists of reading the applicable

LSOP and a familiarization and walkthrough by the LSS. During the interview process, the LSS at the FEL indicated a test is administered to demonstrate user competency for the FEL and laser specific operation. Test results are then entered into the FEL training and tracking system and sent to the Jefferson Laboratory electronic training records system.

2.2.2 Training Records

Training records for randomly selected laser users were requested (see Appendix E) and reviewed against the available records. Instances were noted where both the central training record/system **(ASPEN)** and the laser specific training record was not current for some laser workers; furthermore, eye examination records maintained by the Medical Clinic were not consistently carried over to the central training records system. These instances have identified "shortcomings of the electronic training records system" at Jefferson Laboratory. The necessity of the LSS to ascertain the qualifications of laser users is paramount, and the current system may not support this need. FEL uses an automated system that controls FEL laser lab access, and if someone's training expires, their access is denied. FEL appears to be controlling access to its laser labs by entering training expiration dates via a manual system and performing audits on this system. During the assessment, laser workers were identified that did not have records supporting completion of the requisite training and qualifications. Laser workers at the Laboratory and researchers that come to the Laboratory have a wide range of experience in laser operations. The LSS is responsible for ensuring the laser-specific training is commensurate with the laser worker's experience and the hazard of the laser application. The FEL card reader system is interfaced with an FEL database to control personnel access into FEL labs, in certain modes of operation. Maintaining an accurate training database is necessary to meet both internal and external requirements. Previous laser safety training and laser user authorization concerns have been identified at Jefferson Laboratory. In addition, during the September 2005 surveillance, it was noted that training records were available via the Laboratory's intranet, except for the FEL which maintains its own database.

Jefferson Laboratory should review the current practice of laser user training documentation and ensure that one system is used to track and approve laser users. Laser user training records are not being maintained in a manner that permits the LSO to execute their responsibility of assuring safety education and training requirements are met for laser area personnel, in accordance with ANSI Standard Z136.1-2000, 1.3.2.9. **(FIND-P2-001)**

2.3 Software QA and Changes to the FEL PLCs

Discussions with FEL staff concerning operational modes of laser labs (i.e., alignment mode, hutch mode, etc.) centered around laser light control and systems used to control the introduction of laser light into each lab. FEL uses several systems to protect personnel from accidental exposure. The Laser Personnel Safety System is used to prevent access to the lab during lasing operations. The Programmable Logic Controllers (PLCs) are used to operate shutters that allow laser light into the labs. Discussions about the PLCs raised the issue of changing the software on the PLC to accommodate different system configurations and who is allowed to make those changes. Also, the question of "if" these changes were subject to internal quality assurance (QA) requirements concerning documentation was not clearly defined. Further, it was stated that two PLCs must agree before laser light is allowed into a

lab. Based on these discussions, it was not clear if the PLC software changes met the QA requirements for control and documentation. FEL Division documentation that was reviewed was inclusive to answer this requirement.

For example, the Quality Assurance Plan states:

6.2.9 Control of Software

"6.2.9. A. Procedural requirements for design, development, and control of computer software shall be developed and applied by the affected division in a manner commensurate with the risk (graded approach) involved in developing and using that software."

It could not be determined if FEL computer software documentation, as described in FEL documentation, *Diagnostics/Safety/Controls*, Computer Software 5.12, addressed control and documentation requirements. Jefferson Laboratory should establish a quality assurance program governing computer software configuration control and ensure implementing procedures on a safety dependant software system, such as the FEL PLCs, are compliant. **(FIND-P3-006)**

2.4 Laser Systems, Facility Conditions, Equipment Inspections, and Postings

The Jefferson Laboratory's laser inventory was reviewed, and it appears to reflect an accurate status of lasers within the facilities reviewed. No laser systems were operating at the time of the walkthrough; however, each facility visited was reviewed for applicable access controls, procedures, non-beam hazards, and posting requirements.

FEL Optical Control Room

The FEL Control Room was visited during a non-operational mode. Access was granted by our escorts, and protective eyewear and postings were found consistent with FEL guidance. Based on the number of postings on the door, FEL may want to consider reducing the number and amount of information to ensure that only required information is available at the entrance and additional information is provided nearby or at a central location.

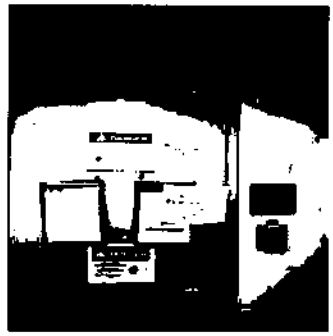

Figure 1. FEL Laser Posting

FEL Labs 1, 3a, and 5

FEL Lab 1 walkthrough was conducted to ensure the identified controls and corrective actions from the "near miss" event had been implemented. Sweep buttons have been installed in each of the three labs visited, and these controls will help prevent the recurrence of the event. FEL laser users have been trained on the purpose and use of the sweep buttons. FEL took the initiative to install closed circuit television (CCTV) cameras in these three labs as an extra precaution to ensure that personnel are not present in the labs when lasing is permitted. Installation of CCTV is

Figure 2. FEL Laser Lab Access

beyond the ANSI Standard for personnel protection for a laser application of this power and is a model for the rest of the Department.
(PROFICIENCY [PRO]-001)

Lab 3a walkthrough was conducted to address access controls, non-beam hazards, housekeeping, and postings. Access controls were similar to those identified for Lab 1 above and were adequate to support operations. The laser application in this facility utilizes an RF generator to support laser operations. Review of the ESAF did not identify this RF hazard because the source was located inside the manufacturer's housing. Further investigation of the equipment did not reveal an RF survey that supported personnel safety; therefore, the ESAF did not capture all hazards associated with this operation. See FIND-P3-003 for ESAF documentation concern. Postings for these labs appear to be rather confusing based on the number of postings; however, the required postings were present.

Figure 3. FEL Laser Lab Access

Housekeeping throughout the FEL labs reviewed was good with very few items noted; i.e., excess equipment. Several non-beam hazards were identified that were shared with Jefferson Laboratory personnel; i.e., compressed gases. These issues were addressed during the walkthrough.

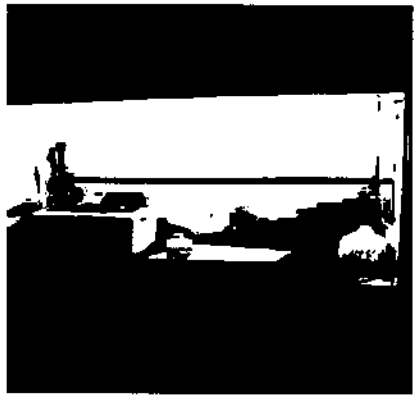

Figure 4. FEL Non-Beam Hazards

Lab 5 walkthrough was also conducted as part of the assessment. Review plan aspects covered non-beam hazards, access controls, and postings. There were a few maintenance items being conducted in the facility, and postings were found consistent with FEL practices. Two non-beam hazards were identified and shared with FEL staff; i.e., electrical equipment and compressed gases. These issues were addressed by FEL staff during the walkthrough. The electrical equipment application should be reviewed by the Jefferson Laboratory electrical authority having jurisdiction, and a determination made on the equipment use and availability.

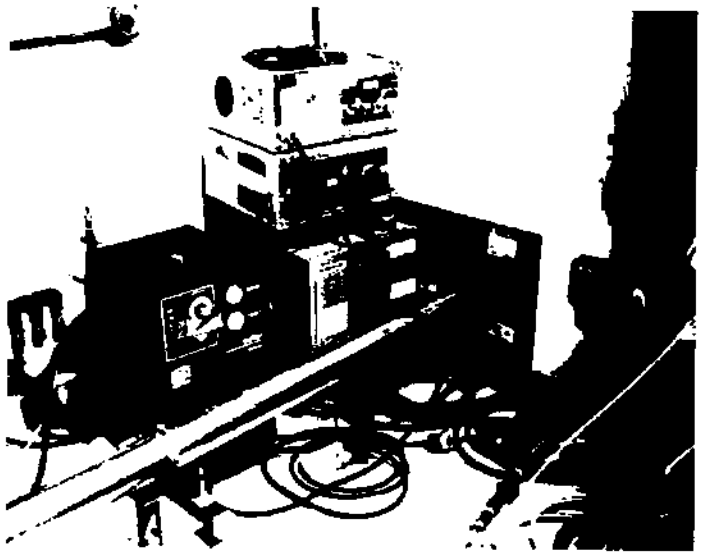

Figure 5. Excess Electrical Equipment

Test Lab

A walkthrough of the laser facility located in the Test Lab known as "the cave" was conducted to address other laser applications at Jefferson Laboratory that were not located in the FEL Division. This facility and the laser application are managed by the Injector Group and was found overall to be well maintained. The entrances to the facility are well posted and monitored.

Figure 6. Test Lab

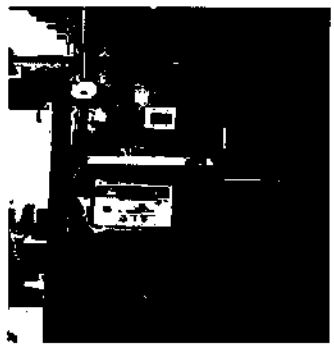

Figure 7. Test Lab

Personnel protective eyewear was found within the laser facility, and this was discussed with the LSS. As a general practice, laser protective eyewear is stored outside of the lasing facility

to reduce the potential for damage caused by exposure to routine laser light and aid laser users in donning protective equipment prior to entry into the laser lab. The prescription eyewear found was for an approved laser user, and additional eyewear was available in the control room.

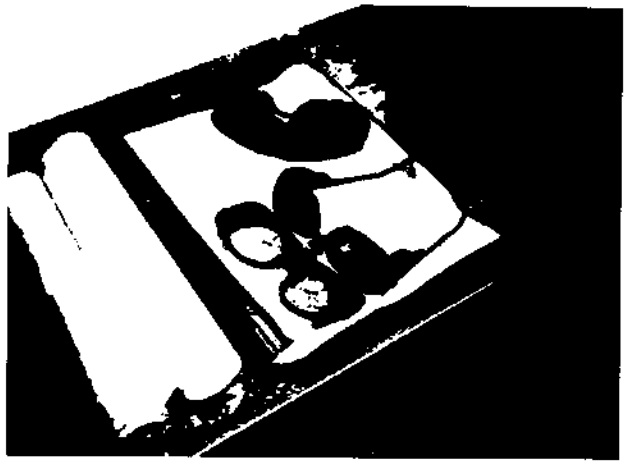

Figure 8. Laser Protective Eyewear

Non-beam hazards were identified in this facility and shared with Jefferson Laboratory personnel.

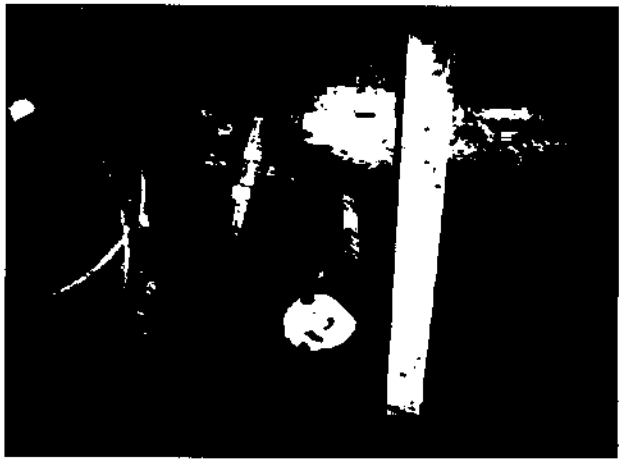

Figure 9. Test Lab Non-Beam Hazards

Access controls for both entrances were adequate based on the facilities location. However, Jefferson Laboratory must be diligent in conducting facility inspections to ensure exits are not obstructed to and from the laser facility due to the narrow routes.

Applied Research Center

A walkthrough was conducted of the Applied Research Center (ARC) to review a laser lab application that was under development and utilized by graduate student users. This laser lab

was found to be very clean, well organized, and equipment properly labeled. Postings outside the facility were appropriate, and protective laser eyewear was available and stored appropriately. During the inspection of the laser eyewear personal protective equipment, it was noted that one pair of laser protective eyewear had a cracked side shield. Another pair of laser protective eyewear presented an opening at the side shield due to the ear piece adjustment. While it was noted that it probably did not reduce the effectiveness of the eyewear's protection of the retina, in some instances it may reduce the effectiveness of protection of the cornea. Because this eyewear is a commercially available product and appears to be a design issue, discussions with ARC laser users were focused on awareness of the opening. Jefferson Laboratory could take the initiative and contact the vendor and discuss or share a lessons learned with the DOE laser community that there are differences between the laser safety eyewear designs that should be recognized.

Laser protective eyewear was observed at each location. With the one exception noted, eyewear appeared to be in good condition. The majority of eyewear was stored outside the labs, allowing the user to don the eyewear prior to entry. Laboratory personnel were questioned, and everyone responded affirmatively that there is mandatory use of laser eyewear at the site.

General housekeeping appeared adequate for systems that were reviewed, with the exception of those instances described above.

3.0 CONCLUSION

Jefferson Laboratory has a functioning Laser Safety Program and personnel that are sensitive to laser safety issues. Personnel displayed positive attitudes toward laser safety, and only minor programmatic breakdowns were observed (i.e., training and qualifications) in the administration of the Laser Safety Program. Jefferson Laboratory can strengthen the Laser Safety Program by taking a more aggressive and formal approach in appointing the Laser Safety Officer and working with this position to develop and ensure best-in-class credentials, training, and experience.

4.0 FINDINGS AND PROFICIENCIES

4.1 Findings

FIND-P2-001	Laser user training records are not being maintained in a manner that permits the LSO to execute their responsibility of assuring safety education and training requirements are met for laser area personnel, in accordance with ANSI Standard Z136.1-2000, 1.3.2.9.
FIND-P3-001	The Jefferson Laboratory Laser Safety Officer appointment, documentation, and certification process should be improved to demonstrate formality and rigor commensurate with the position.
FIND-P3-002	ES&H Manual Chapter 6410 and its Appendices should be reviewed, revised, and updated to reflect current practices and requirements.
FIND-P3-003	Jefferson Laboratory should review and revise the Experiment Safety Approval Form to ensure system hazards are addressed.

FIND-P3-004 Jefferson Laboratory should ensure that every request for a corrective action plan from the DOE Site Office is entered into its tracking system, and corrective action plans should be developed with more detailed information in order to facilitate a better understanding of closure of action items.

FIND-P3-005 ANSI Standard Z136.1-1993 is the referenced standard for medical surveillance on the Laboratory's website and should be updated to reflect the 2000 standard.

FIND-P3-006 Jefferson Laboratory should establish a quality assurance program governing computer software configuration control, and ensure implementing procedures on a safety dependant software system, such as the FEL PLC's, are compliant.

4.2 Proficiencies

PRO-001 Installation of closed circuit television is beyond the ANSI standard for personnel protection for a laser application of this power and is a model for the rest of the Department.

Appendix A – Personnel Interviewed

- Laser Safety Officer
- Acting Associate Director for Jefferson Laboratory – Environment, Safety, Health and Quality Division
- ES&H Quality Assurance Manager
- FEL Laser System Supervisor
- Test Lab Laser System Supervisor
- ARC Laser System Supervisor
- ARC Graduate Student (laser user)

Appendix B – Documents Reviewed

- Laser Inventory
- SAF 1140, *Laser Safety Training Orientation*
- FEL ESAF #07-015, *Installation of Commercial PLD System (PVD Products, Inc.)*, Laser Lab 5, dated December 3, 2007
- FEL ESAF #07-013, *Boron Nitride Molecule Synthesis via CO2 Laser Vaporization*, Laser Lab 3A, dated October 15, 2007
- FEL ESAF #07-005, *Direct Laser Synthesis (Laser Nitriding)*, Laser Lab 2, dated February 21, 2007
- LSOP #A-04-008-LSOP, *IR Upgrade Optical Control Room - FEL*
- LSOP #A-06-009-LSOP, *Electron Gun Test Stand Test Lab*
- LSOP #PHY-08-001-LSOP, *Compton Polarimetry Optical Set-Up ARC 313*
- LSOP #FEL-07-008, *FEL Facility User Lab I*
- ES&H Manual 6410, *Laser Safety*
- ES&H Manual 2410, *Applicable Regulations and Contractual Commitments*
- ES&H Manual 3130, *FEL Experiment Review Process*
- SAF 114, *Laser Safety Class*, Training Materials
- Example of Course Completion Record of Laser Users
- Example of FEL-Specific Laser User Examination
- Example of Incidental Laser Workers Visual Acuity Record
- Example of Laser Eye Examination Record
- Example of Ophthalmologist Report of Laser Eye Examination

Appendix C – Activity Observations

- FEL Control Room, Optics Control Room
- FEL Labs 1, 3, and 5
- Test Lab, Injector Group Cave
- Applied Research Center Laser Lab, Room 313

Appendix D – Status of Corrective Actions from Previous Assessment (September 2005)

Observation (OBS)	Description	Status
OBS-1	The LSS should formally authorize laser users upon completion of required training.	LSS is authorizing; however, irregularities found between systems.
OBS-2	The Lab should consider additional standardization (using best management practices of each LSS) for laser-specific training and LSOPs, in general, to help preclude problems in the future.	Root cause not addressed – similar observation identified during this assessment.
OBS-3	Review of completed start-up procedures found that checkboxes requiring a final laser safety check were not checked. The procedure contains human factor issues that need to be addressed. *(Upon further review it was found that the safety checks had been performed but were not documented via the procedure.)*	ESAF forms are completed; however, questions in Section 6 should be further developed.
OBS-4	The Lab should develop its own guidance for laser key control.	No keys were observed in the master switch during this assessments.
OBS-5	Formal LSO certification has not been completed. *(The LSO has been performing "LSO-like" duties for approximately 12 years, including instruction of initial laser safety orientation, and is competent in the position.)*	Former LSO certification was completed. Current LSO certification, appointment, and qualifications need to be formalized.
OBS-6	The Lab should have an "official" Laser Safety Committee that meets more frequently.	No Laser Safety Committee has been established.
OBS-7	Procurement controls are warranted for laser system acquisitions, as to facilitate the LSO's advanced approval, and receipt inspection of these devices.	Procurement controls are in place.

Appendix E – Laser Training Record Summary

WORKER/ USER	SAF-114E (eye exam)	SAF-114O (orientation)	SAF-115 X (Lab specific)
Worker 1	No records on file per Training Coordinator, but records were found in Management Information System (MIS) (3/04 and 7/06)	No records on file per Training Coordinator, but record found in MIS (3/04)	No records on file per Training Coordinator but print-out provided by LSO for FEL shows active training for Laser Lab's 1&4 (7/06)
Worker 2	No records on file per Training Coordinator; no record on file in MIS; but telecon with Medical Services confirmed completion (2/07)	No records on file per Training Coordinator; no record found in MIS; but hardcopy record provided by former LSO (2/07)	No records on file per Training Coordinator
Worker 3	Training Coordinator furnished summary record, Certified Eye Exam (10/05)	Training Coordinator furnished summary record, completed (4/95)	Training Coordinator furnished summary record, current for Drive Laser (4/05) and Gun Test Stand (1/08), but expired for SAF 115O (exp. 4/07) FEL locally managed electronic training records DO NOT show up-to-date access training, but he has still been able to access all laser labs, including 3a, in which he has worked within the past year
Worker 4	No evidence contained within Training Coordinator furnished record summary No record on file in MIS, but telecon with Medical Services confirmed completion (2/00)	Training Coordinator furnished summary record, completed (2/00)	Training Coordinator furnished summary record, current for FEL Laser Lab 6 (8/06)

WORKER/ USER	SAF-114E (eye exam)	SAF-114O (orientation)	SAF-115 X (Lab specific)
Worker 5	No evidence within Training Coordinator furnished record summary, but telecon with Medical Services confirmed completion (7/06)	Training Coordinator furnished summary record, completed (8/99)	Training Coordinator furnished summary record, current for FEL Laser Lab 5 (11/07)
Worker 6	Training Coordinator furnished summary record, Certified Eye Exam (7/06)	Training Coordinator furnished summary record, completed (7/06)	Training Coordinator furnished summary record, current for FEL Lab 1 (4/07), Lab 3 (2/07), Lab 6 (2/07), and ITS Laser Lab (2/08)
Worker 7	No evidence within Training Coordinator furnished record summary, but call to Medical Services confirmed current (11/06)	No evidence within Training Coordinator furnished record summary, but MIS search confirmed current (7/00)	No evidence within Training Coordinator furnished record summary, but training records provided by LSO confirmed current for FEL Laser Lab 2 (2/07)
Worker 8	No records on file per Training Coordinator, but MIS search confirmed complete (11/06)	No records on file per Training Coordinator and no records in MIS FEL locally managed records suggest completion in November 2006	No records on file per Training Coordinator, but LSO furnished records, confirmed current for FEL Laser Lab 3 (11/06)