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Final Report

Surveillance of the Thomas Jefferson National Accelerator Facility Radiation Protection Program

Mike Henderson
Mike Henderson, SME
Oak Ridge Office

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Date

Andy Bassett, SME
Oak Ridge Office

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1.0 INTRODUCTION

A surveillance of the Thomas Jefferson National Accelerator Facility (TJNAF) Radiation Protection Program was conducted on July 19–20, 2005, by Andy Bassett and Mike Henderson of the Department of Energy (DOE) Oak Ridge Office on behalf of the DOE Thomas Jefferson Site Office (TJSO). The surveillance focused on whether the program meets the requirements of Title 10, Code of Federal Regulations (CFR), Part 835, *Occupational Radiation Protection*, including As Low As Reasonably Achievable (ALARA) performance, training, workplace controls, internal audits, and sealed radioactive source control. TJSO provided the lines of inquiry for the surveillance, and Steve Neilson, TJSO, facilitated the surveillance. The team observed a demonstration of the Key Watcher Locker System for accountability of commonly used sealed sources and a demonstration of the safety improvements made to the polarized source photoelectron gun testing operation.

2.0 LIST OF ACRONYMS

ALARA	As Low As Reasonably Achievable
ARM	Assigned Radiation Monitor
CFR	Code of Federal Regulations
CY	Calendar Year
DOE	Department of Energy
mrem	millirem
JRRP	Jefferson Laboratory Radiation Review Panel
RCG	Radiological Control Group
RCT	Radiological Control Technician
RPP	Radiation Protection Program
RWP	Radiological Work Permit
TJNAF	Thomas Jefferson National Accelerator Facility
TJSO	Thomas Jefferson Site Office

3.0 DISCUSSION OF RESULTS

The team addressed each of the lines of inquiry provided by the TJSO during the surveillance, and the results of each criterion are discussed below.

1. Is the ALARA principle included in work control documents and work planning?

   The Jefferson Laboratory Radiation Review Panel (JRRP) serves as the ALARA committee. Radiological Work Permit (RWP) procedures have "trip levels" that require approval from the JRRP before the levels can be exceeded. The site's Administrative Alert Level of 250 millirem (mrem) is well within acceptable limits. As a practical matter, many ALARA principles were incorporated into the operation of the polarized source after the 1996 photocathode gun burnout issue, including a change in training, development of new procedures, and forbidding operators from being in the room during operations. The Radiological Control Group (RCG) also incorporates ALARA by using the relative short half lives of many activation products to its advantage. This criterion has been met.

2. Are regulatory and site dose limits being met?

   For 2003 and 2004, the high dose individual barely exceeded the 100 mrem minimum monitoring requirement. The site's boundary dose did not exceed 4 mrem for the same two years. This criterion has been met.

3. Are RCG personnel adequately trained and qualified?

   The supervisory-level members of the RCG are highly qualified. The in-house, practical training appears to be in-depth and relevant to the instrumentation and operations performed at TJNAF. Three Radiological Control Technicians (RCTs) are certified by the National Registry of Radiation Protection Technologists, and two others are scheduled to take the certification examination in August 2005. The team identified several documentation questions about the training for the RCTs that need to be resolved. In addition, there are three certified Health Physicists on staff, including the Radiological Control Manager. This criterion has been met.

4. Are Assigned Radiation Monitors (ARMs) familiar with the scope limitations, and are they properly trained on the equipment they use?

   The ARM interviewed was familiar with the scope limitations. He stated that (a) he cannot free-release material from the beam areas, (b) he must check with the RCG to determine whether workers may perform certain duties, (c) he must request assistance in postings beyond the 5 mrem level, and (d) he has no authority to write RWPs. The ARMs are initially trained for two days, have a biennial retraining requirement, and are trained to source-check their survey instrumentation weekly. This criterion has been met.

5. Are Radiation Protection Program goals being monitored and revised accordingly?

   The team reviewed the minutes of the quarterly meetings of the JRRP and the Calendar Year (CY) 2004 radiological safety briefing to the TJNAF Director. The briefing reflects a careful consideration of the dosimetry results and issues from the Radiological Control Manager. In addition, there are biennial peer reviews of the Radiation Protection Program by accelerator health physicists from across the country. These forums serve to heighten management awareness and increase management involvement in the radiological control processes and outcomes.

   At the working level, applicable RWPs contain hold points for radiological work if the specified individual doses are exceeded. In addition, although seldom used, worker feedback is solicited in the form of suggested improvements and lessons learned as part of the RWP process. This criterion has been met.

6. Do the field personnel have a basic knowledge and familiarity with the health effects of radiation and identifying radiological signage?

   Personnel from graduate students through senior managers have taken the requisite TJNAF radiological training, and they have a firm grasp of radiation health effects and the important regulatory topics, including radiological postings. This criterion has been met.

7. Are RWPs in place to support task-specific work?

   The team reviewed all of the CY 2005 RWPs. General access RWPs cover activities conducted in areas having potential dose rates from TJNAF operations in excess of 0.05 mrem/hour but below that required for job-specific RWPs. The job-specific RWPs, which are required by procedure at whole body dose rates of greater than 25 mrem/hour and contact dose rates of greater than 250 mrem/hour (among other criteria), generally have hold points to limit worker doses to 50 mrem. The highest dose to an individual worker in CY 2004 was 104 mrem, which serves as proof that the system is working. This criterion has been met.

8. Is there a process to ensure that workers who are subject to an RWP are briefed on the RWP in advance of their work activity?

   Personnel must sign a briefing sheet to acknowledge that they have received a formal briefing by the Maintenance Supervisor and/or the RCT on all job-specific RWPs. The team identified one instance, RWP 05-J007, where two workers had not signed the briefing sheet, and this forms the basis for the finding included below. This criterion has been met.

9. Is there a system in place to facilitate feedback and continuous improvement from lessons learned?

   In conversations with RCG staff, a wide variety of continuous improvement mechanisms were discussed. Notable among these mechanisms are radiation safety deviation reports, notable event reports, internal audits, biennial peer reviews, JRRP quarterly meetings, "scheduled accelerator down" briefings, RCG meetings with Experiment Hall staff, ALARA projects, briefings for the Accelerator Division Associate Director and the TJNAF Director, solicitation of feedback on procedures, solicitation of lessons learned from RWPs, and a feedback mechanism through the radiation safety assessment document. The continuous improvement process for radiation protection at TJNAF is thriving due to these various processes. This criterion has been met.

10. Are documents and positive controls in place to control and track calibration source material and perform leak tests?

    The team reviewed the source inventory and the leak test records. No discrepancies were found. The use of the Key Watcher Locker System to automate control over frequently used sources is a noteworthy practice. The team observed that documentation provided during the system demonstration had the wrong time stamp, but all of the other important source information was properly captured in the online report printout. This criterion has been met.

11. Are controls in place to design and maintain radiological shielding?

    The team reviewed HPP-OSP-003, *Shielding Package Determination and Tracking*, and questioned staff members about the process to change shielding configurations in the field. There appears to be tight configuration control over the TJNAF shielding. The controls include a configuration control label on the shielding itself, photographs documenting the shielding, inspections, and procedures for removing the shielding. The RCG creates the shielding package and is responsible for ensuring that the operating parameters and assumptions are defined and that the calculations are performed. An RCG Physicist performs the necessary shielding calculations. This criterion has been met.

12. Are High Radiation areas locked and posted?

    No High Radiation areas were observed. However, other radiological areas are heavily posted. Conversations with members of the RCG support the contention that all High Radiation areas are posted and that other physical controls are in place at the 1 rem/hour level as required in 10 CFR 835.502(b). This criterion appears to be met.

13. Are internal audits conducted within a three-year cycle?

The team found piecemeal evidence that the functional elements of 10 CFR 835 are audited within a three-year cycle through a combination of external reviews and self-assessments. Some documentation to that effect was provided to the team, but there is no single, standalone document to support the fact. This criterion appears to be met.

Conclusion

The TJNAF RCG personnel are professional, accommodating, and dependable. The Physics Division has nothing but praise for the efforts of the RCG, and this sentiment was echoed by others. There is very little collective dose at TJNAF, but this fact has not led to complacency. The low doses are a tribute to the diligence of the TJNAF workers and the small RCG, which consists of the Radiological Control Manager, a Radiological Engineer, a Physicist, and five RCTs. The RCTs have diverse responsibilities within the group, and coverage on critical areas such as dosimetry, shielding tracking, RWP dose tracking, field instrumentation, and environmental monitoring are only one person deep. With the few exceptions noted below, the areas covered by this surveillance were successfully met.

4.0 ISSUES, OBSERVATIONS, AND NOTEWORTHY PRACTICES

4.1 Issues

ISS-1 Two people did not sign the briefing sheet on RWP 05-J007. One was the Radiological Control Manager, who did not sign because he had prepared the RWP and his signature was not specifically required by procedure at that time, but the second was unexplained.

4.2 Observations

OBS-1 TJNAF has a good Radiation Protection Program, and its RCG personnel are effective and dedicated. The program could be further strengthened by a few additions to the documentation. Based on empirical air monitoring data, TJNAF does not perform internal dosimetry. It is suggested that TJNAF collect all of this data into a technical basis dosimetry document that supports the need not to perform internal dosimetry.

OBS-2 Currently within DOE, there is heavy emphasis on meeting self-assessment and audit requirements. As strong as its Radiation Protection Program is, TJNAF would have difficulty demonstrating in a timely manner that it is meeting these audit and self-assessment expectations. The TJNAF program is too good to let a simple lack of documentation detract from the good job the RCG is doing in protecting the TJNAF employees.

4.3 Noteworthy Practices

NP-1 Use of the Key Watcher Locker System for sealed source accountability and control for frequently used sources is a noteworthy practice. This system may be of use elsewhere in the DOE complex.

NP-2 ALARA principles are actively applied at TJNAF with substantial results.

Appendix A – Personnel Interviewed

- Scientist, Accelerator Division
- Scientist, Physics Division
- University of Virginia Graduate Assistant
- Physics Division Deputy
- Accelerator Division Crew Chief (also an ARM)
- Polarized Source Group Leader
- Environment, Health, and Safety Reporting Manager
- Accelerator Division Safety Officer
- Radiological Control Manager
- Radiological Engineer
- Supervisory RCT

Appendix B – Documents Reviewed

- *TJNAF Radiation Protection Program (RPP)*
- *Jefferson Lab Radiation Control Manual*, Revision 3, January 2004
- *Jefferson Lab EH&S Manual*, Chapter 6310, "Ionizing Radiation Protection," revised December 9, 2003
- *Jefferson Lab EH&S Manual*, Chapter 6311, "Prompt Radiation Control," revised December 9, 2003
- *Jefferson Lab EH&S Manual*, Chapter 2240, "EH&S Committees," "Jefferson Lab Radiation Review Panel (JRRP)"
- *Review of the Radiation Control Program at the Thomas Jefferson National Accelerator Facility*, September 18, 2002
- *Radiation Control Peer Review, August 30–September 1, 2004* (presentation)
- *Review of the Radiation Control Program at the Thomas Jefferson National Accelerator Facility*, November 1, 2004
- HPP-OSP-001, *Radiological Work Permit Issuing and Tracking*, February 18, 2005
- HPP-OSP-003, *Shielding Package Determination and Tracking*, November 13, 2003
- HPP-ADM-013, *Sealed Source and Radioactive Compressed Gas Control and Inventory*, May 12, 2004
- HPP-SUR-003, *Radiological Survey Requirements Including Radioactive Material Control*, May 19, 2005
- Sample shielding calculations
- Radioactive source inventory and leak test records
- Training records for a typical radiation worker and an RCT
- Fiscal Year 2004 radiological performance goals and the most recent report to the TJNAF Director on same
- ARM radiological survey of Hall-A
- Occupational exposure records for TNJAF workers
- Minutes of the JRRP Meetings on April 25, 2005, and January 24, 2005
- Results of the Dosimetry Audit conducted on August 6, 2003
- *Jefferson Lab External Dosimetry Internal Audit 2005*
- Results of the training audit of a Radiation Worker II class conducted on August 5, 2003
- Results of a sealed source inventory audit conducted on August 28, 2003