Report of the Spallation Neutron Source (SNS)

Accelerator Safety Review Committee (ASRC)

SNS ASRC Triennial Assessment

June 25-27, 2013

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NOTE: This cover page was created and appended to the front of the original report by David Freeman on August 16, 2013 for the purpose of assigning an SNS Document Number to the attached report.

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Table of Contents

1.0 Introduction

Members of the SNS ASRC performed an assessment of key areas related to accelerator safety in order to ensure compliance with DOE Order 420.2C. The assessment may also help focus SNS management on specific improvements necessary for continued safe operations. SNS ASRC members provided a brief summary of their individual assessments in Appendix 1. Following presentations by SNS Management, SNS ASRC members performed the assessment by reviewing documents, interviewing responsible personnel, interviewing employees performing work and participating in tours of the accelerator facilities.

1.1 Scope

Please refer to Table 2 of Appendix 2 for the 12 specific assessment topics. A Charter for the SNS ASRC is in Appendix 3. Areas assessed during this specific Triennial Assessment focused on checking SNS procedures and programs against requirements in the DOE 420.2C Contractor Requirements Document (CRD) for accelerator safety.

1.2 Summary

Assessment findings are in Appendix 1 for each of assessment topic. Assessment findings are defined as evaluation of the collected evidence, which were observation, documentation and communication with staff and workers in the field. Results of topical evaluations were compared with the contractor requirements in DOE Order 420.2C, Safety of Accelerator Facilities, and with the details in ORNL SBMS, SNS procedures and SNS authorization documents.

Assessment findings provided the basis for the conclusion of this Triennial Assessment, which is compliance with the contractor requirements in DOE Order 420.2C, Safety of Accelerator Facilities.

There were 35 recommendations/considerations, which may provide SNS managers with bases to develop actions for improvement. Recommendations/considerations are suggestions based on the experience of the ASRC members. The SNS ASRC suggests these as a means of improving an activity or helping to fulfill the intent of a requirement in the CRD of DOE Order 420.2C.

2.0 Signature Page

On June 25-27, 2013, the Spallation Neutron Source requested the SNS ASRC to perform a Triennial Assessment of accelerator-safety program elements, as specified in DOE Order 420.2C, and other key areas related to accelerator safety. The ASRC evaluated presentations, documentation, procedures, training records, operating plans and hardware, and conducted personnel interviews.

SNS ASRC conducted this review to help maintain the Contractor Assurance System requirement in 4.a. of the Contractor Requirements Document in DOE Order 420.2C. SNS ASRC conducted this review in conformance with the SNS ASRC Charter (Revised April 2013, see Appendix 3).

Team Member Signatures below denote concurrence with findings and recommendations identified in this report.

Edward T Lessard

Edward Lessard, Chair

Kelly Mahoney

Sandra B Kennedy

Sandra Kennedy

Ian Evans

Charles Schaefer

William G Ruzicka

William Ruzicka

Mark Gulley

Appendix 1 – Individual Topical Reports

Topic 1: Accelerator Safety Envelope (ASE)

Assessment Findings:

The ASE has eight signatures. It is not clear who is accountable to ensure the ASE is accurate, resource supported and implemented. The signatures and the organizational roles on the ASE are not administratively up to date. Many signatures creates a concern for "lack of ownership" when a person's signature is within a forest of signatures. The ASRC advocates that the number of signatures be pared down to just those that have ownership of meeting the ASE requirements. Discussions revealed that the number of signatures would be reduced due to the recent reorganization. This led to a question of whether there was an issue with the ASE being out-of-date due to the signature page not reflecting the current organization. Discussion revealed that a USID was completed for the reorganization. This USI is included in the provided documentation (SNS 102030103-ES0039-R00, *USID for the 2011 SNS Reorganization*).

The power limits in Section 1 of the ASE are stated to be measurable limitations. The ASE does not identify the method of measurement. Discussion of the ASE Section 1 on Limitations to Operating Parameters brought out the issue that a measurable method of determining that these limits are not being exceeded is not in the ASE. It was discussed that these limits may not be exceeded due to physical limitations to the performance of the machine, but the ASRC does not advise that the 'physics limitations' argument be used. This can be difficult and expensive to defend. Instead, the ASRC advocates that the measurable, documented parameters to be used to document compliance with operating limits be included in Section 1. The parameter information need not come from a safety-credited device.

Section 4 of the ASE, Credited Administrative Controls, addresses ORNL SBMS Chemical Safety Program, Combustible Materials Control Program, Ignition Control Program, and Hoisting and Rigging Program. Institutional, standard-industrial-safety programs are not required to be addressed in an ASE. If the safety analysis shows a SNS specific control for a standard industrial hazard prevents the triggering of an event involving a non-standard industrial hazard, then only that specific control should be identified in the ASE. Broad inclusion of a conventional safety program in the ASE, with all its implied controls, is an indeterminate control. During the discussion about the overall organization of the ASE, both ASRC and SNS advocated taking credit for the existing ORNL-wide processes in the SAD safety bases. The discussion was that the control set discussed in the ASE should be just those systems that are SNS accelerator-specific. The ASE should not address existing lab-wide programs for standard industrial hazards and prescribed SBMS controls; that is, the ASE should address specific non-standard-hazard controls.

ASRC requested SNS provide documented evidence of certification of Credited Engineered Controls in the ASE. The most recent certification procedure for the TPS (ASE Section 3.1) was produced quickly. The certification procedure was correctly signed off at each step and parameter values filled in at each step. ASRC initially requested all of the certification procedures back to 2007 for TPS and SNS stated that procedures going back more than a couple of years take time to retrieve from an online document control system. More recent certification procedures are maintained as hardcopies as well as online. This was an acceptable response.

Recommendations:

1. Consider amending the ASE to make it administratively up to date. Consider limiting signatures to persons assigned authority, responsibility and accountability for the ASE. Consider amending the ASE to allow administrative changes on the signature page to be made without DOE approval.

2. Consider amending the ASE to identify the methods to measure beam power.

3. Consider amending the ASE to remove crediting of ORNL SBMS lab-wide standard-industrial-safety programs from Section 4.

Non-compliances with DOE O 420.2C:

None.

Topic 2: Spallation Neutron Source Final Safety Assessment Document for Neutron Facilities (FSAD-NF); Spallation Neutron Source Final Safety Assessment Document for Proton Facilities (FSAD-PF)

Assessment Findings (FSAD-NF):

The FSAD for Neutron Facilities underwent Revision 3 in September 2011. Along with this revision, a USI was conducted (SNS 102030102-ES0060-R00, *USID for 2011 Update to Final Safety Assessment Document for Neutron Facilities*). This revision to the FSAD indicates continuing progress in refining the scope of the safety analysis to ensure only essential credited controls were included. This revision also demonstrates that SNS personnel are taking advantage of operational experience to update and refine preoperational calculations and estimates.

In accordance with DOE O 420.2C, a SAD represents the technical basis for the ASE, is maintained current and must:

a. identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operations and credible accidents;
b. contain sufficient descriptive information and analytical results pertaining to specific hazards and risks identified during the safety analysis process to provide an understanding of risks presented by the proposed operations;
c. provide detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) taken to eliminate, control, or mitigate hazards from operation; and
d. include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation.

The SNS FSAD-NF accomplishes these requirements with one caveat. That is, the description of the management organization is out of date due to the 2011 SNS organizational re-organization. However, the change in organization is covered in a USID, which is included in the provided documentation (SNS 102030103-ES0039-R00, *USID for the 2011 SNS Reorganization*).

Assessment Findings (FSAD-NF):

The SAD reflects accurately the existing facilities. The USI process is used appropriately to keep the SAD up to date. However, the SAD for Accelerator Facilities describes Credited Controls that involve broad safety programs for standard industrial hazards. Based on discussions with staff, occurrences are not reviewed for impact on the safety bases in the SAD, and workers are not routinely trained on the safety bases in the SAD relevant to their work.

Recommendations:

4. Consider updating the organizational description in the SADs as soon as feasible.

5. Consider changing the SADs to remove broad references to conventional safety programs. Consider only describing the safety bases for specific controls that trigger an

event involving a non-standard industrial hazard (e.g., the safety bases for and the specific restrictions on crane lifts over the target facility).

6. Consider reviewing occurrences involving Credited Controls for impact on the safety bases in the SADs (e.g., evaluate occurrences via the USI process if they could involve Credited Controls in the ASE).

7. Consider training specific workers in the safety bases in the SADs that are relevant to their work. For example, riggers could be trained at some frequency on the safety bases involving lifts over the target facility, and workers in the Linac could be trained on the safety bases involving ODH if they are working at heights when work is also performed on the super-conducting RF.

Non-compliances with DOE O 420.2C:

None.

Topic 3: Unreviewed Safety Issue (USI) Process

Assessment Findings:

Members of the ASRC met with David Freeman to review the SNS USI process as documented in OPM 2.B-10. The process requires SNS to have USI preparers, reviewers and approvers. Nineteen (19) USI evaluations have been documented since the last ASRC review in April 2010. All were for planned facility or system modifications; none was for discovered conditions. Only one of these was positive requiring DOE approval.

Three (3) recent USI evaluations were reviewed to determine conformance to the OPM requirements. These were (1) the 2011 SNS reorganization; (2) irradiation of Pu-242 samples; and (3) Emergency Ventilation System operability with only 1 of 2 fans available. All three USI evaluations were determined to be quite thorough, compliant with the OPM requirements and clearly state whether an issue represents a USI requiring DOE approval.

USI screenings and evaluations are prompted by the work control process for Credited Engineered Controls (CECs). OPM 3.A-8.1a, CEC Permanent Change Request Form, requires the Safety Documentation Manager to provide a USID number or to mark the block "N/A" signifying that no USI evaluation is required. The experimental safety review process uses a checklist to help identify hazards associated with new types of experiments but does not provide a comparable prompt for USI screenings.

SNS has a contract for a backup USI preparer/evaluator. It is with a former SNS employee who is familiar with SNS systems, hazards and the USI process. Having only one staff member who is qualified to prepare USI evaluations represents a risk to SNS' operations. Another DOE accelerator recently lost both of its qualified USI preparers/evaluators within the same month.

Because of a recent DOE surveillance, SNS is planning to formalize USI training and deliver it to several groups including Group Leaders and Systems Engineers. This training will broaden the pool of staff that is formally qualified to prepare and/or review USI evaluations for systems for which they are responsible.

Recommendations:

8. In addition to Systems Engineers and Group Leaders, SNS should consider providing USI training to select operations staff.

9. SNS should consider developing a 2nd staff member to serve as a qualified backup to the Safety Documentation Manager who can conduct USI screens and evaluations in support of work planning.

Non-compliances with DOE O 420.2C:

None

Topic 4: Accelerator Readiness Review (ARR) Program

Assessment Findings:

SNS conducted ARRs under Order 420.2B in 2006 for start of 100 kW Commissioning and 2007 for full 2 MW (1.4 MW Operations Envelope) operations. Since 2006, there are no new facilities requiring an ARR. There are preliminary project plans to build an Integrated Test Stand, a duplicate of the front end through the RFQ, which will operate at 2.4 MeV and 1-1.5 x the present peak current, but very low average current. The project planners are conservatively planning that this will not be an exempt facility and will fall under the Order 420.2C requirements, including an ARR at the appropriate level.

The review team was able to follow the flow-down of the ARR requirements from the Order 420.2C CRD through the ORNL SBMS into the SNS organization. Often, an ARR is invoked as a DOE construction project contract-deliverable. However, small support facilities like the Integrated Test Stand may not be a major DOE line-item project and thus require another vehicle to ensure the ARR process is in place before starting operations. The SNS may use the existing ASRC/POA assessment process with the appropriate level of review for this purpose.

Recommendations:

10. Consider developing a policy or procedure to define the requirements for an ARR in the absence of major construction project deliverables. This may also be a place to give further guidance on the appropriate graded approach to an ARR for facilities with significantly reduced risk profile when compared to a major construction project.

Non-compliances with DOE O 420.2C:

None

Observed Good Practice:

The on-line Accelerator Safety requirements SBMS links allows one to follow quickly the ARR flow-down to SNS processes.

Topic 5: Roles, Responsibilities, Authorities and Accountabilities (R2A2s)

Assessment Findings:

SNS-OPM 2.B-2, SNS Internal Assessment Process for Accelerator Safety Program Elements (2013) implements the Contractor Requirements Document (CRD) portion of DOE Order 420.2C Safety of Accelerator Facilities. Program elements to be assessed include clearly defined roles and responsibilities for safety related accelerator activities, including those for training and procedures.

Crystal Schrof generated a memo in November 2011 related to updating documentation to reflect the new SNS organizational structure. In this memo, she authorized deferral of documentation updates (to correct organizational changes) until the normal review/update cycle, which is every three years.

SNS-OPM 1.A-1 Authorization (Rev. 1, 2009) still refers to the old Neutron Scattering Science Division and Neutron Facilities Development Division but authorizations for operations are clearly defined.

All persons who manipulate the systems that control the SNS equipment must have authorization to operate the systems. Operations personnel may be authorized to operate the systems only after appropriate training. For each person, training requirements and training status is tracked by the "SNS Training and Qualification Plan" (SNS-OPM 4.B-2).

Systems Specialists may operate their specific systems with the concurrence of the Control Room (CR) Shift Supervisor. CR Accelerator Specialist trainees or the CR Shift Supervisor trainees shall operate the system only in the presence of and under the supervision of authorized CR Accelerator Specialists or CR Shift Supervisors, respectively.

SNS-OPM 4.B-2 SNS Training and Qualification Plan (Rev. 00, 2002) is no longer current and/or correct (references SAP and GoTrain instead of LRN). A comprehensive corrective action is being worked to transition SNS training to the ORNL LRN system.

SNS procedures consistently define responsibilities.

Research Accelerator Division Group Leaders were asked to generate updated position descriptions, using the ORNL R2A2s as a guide, for the next performance appraisal cycle. One of the desired outcomes is to clarify authorizations.

Recommendations:

See Conduct of Operations topic.

Non-compliances with DOE O 420.2C:

None.

Topic 6: Inventory Listing of Accelerator Facilities

Assessment Findings:

NRPD-ROD-1012-1, Nuclear and Radiological Protection Division Record of Decision, was reviewed. Three accelerators at ORNL subject to DOE Order 420.2C were identified and are required to fulfill the requirements of the Order. They were the Holifield Radioactive Ion Beam Facility, the Oak Ridge Electron Linear Accelerator and the Spallation Neutron Source. The Multicharge Ion Research Facility was determined not to fall within the coverage of the Order, and the Deuterium-Tritium neutron generators assessed were judged exempt from the Order. Discussions with the DOE Representative for SNS indicated the inventory kept by the contractor would also serve as the inventory for the DOE.

Recommendations:

11. Consider methods to ensure the DOE Representative for SNS is provided official copies and updates of the ORNL NRPD inventory.

Non-compliances with DOE O 420.2C:

None.

Topic 7: SNS Credited Engineered Safety Systems

Assessment Findings:

Review of the credited engineering controls included drill-down of configuration changes and interviews with the Data Services Department Manager, Protection Systems Team Leader, and PPS/TPS staff. The credited engineering controls include the Personnel Protection System (PPS), Instrument Protection System (IPS), Target Service Bay Differential Pressure Monitoring System, and the Target Protection System (TPS). Each of these systems includes access controls, interlocks, and warning devices designed to mitigate radiological hazards. The active CECs also include oxygen deficiency monitoring, tunnel ventilation system, target-bay fire suppression systems, and target bay access controls.

Each of these systems has well established policies and procedures for requirements, design, and configuration control. The documents reviewed are up to date and reflect the current machine configuration. The Team Leaders were knowledgeable about their role in managing credited controls in the context of the accelerator safety order, FSADs, and ASE.

New or modified designs follow a traveler and acceptance criteria list (ACL) process that includes a checklist and independent verification that each step is complete. The list includes both hardware and software QA steps. The ACL also includes completion of a separate checklist for safety-instrumented systems from the PLC equipment manufacturer. All documentation related to a configuration change is saved as an attachment in the work request system. This includes USI reviews of design or equipment changes.

SNS management has a succession planning process that includes professional development for safety systems personnel. Personnel interviewed by the ARSC team were knowledgeable in their area of expertise; they receive training on new systems and on new equipment as it is introduced. At the moment, the safety system specific training is not formally tracked.

PPS systems and equipment are well marked and under configuration control. The team observed an RF power supply that did not have labels identifying the internal equipment as under PPS configuration control. The SNS staff relies on work planning meetings to communicate tasks that may affect equipment interlocked through a safety system. At this time, the work-control computer application does not automatically notify the PPS team when there is work on a credited control.

The PPS team follows a strict but potentially outdated model for cyber security. The ASRC team discussed the model and potential areas for improvement with the Data Services Department Manager and the PPS Team Leader.

Chipmunks

SNS has an inventory of 50 Chipmunks of which 47 are in active use. This could be a concern as the facility ages and/or the Chipmunk failure rate rises. The ORNL Calibration Group calibrates the Chipmunks, and the PPS Team owns/maintains them. Following re-calibration and

installation, each Chipmunk is subjected to a series of performance checks, which include voltage and timing measurements, removal of source counts, and evaluating time between pulses. Additionally, the Chipmunks are response checked using a special form sealed source. The response checks evaluate the 5 and 20 mR/hr alarm and interlock set points. System performance checks are covered in OPM 2.H-18.7.

Interlocking Chipmunks function through the PPS by disabling the Ion Source High Voltage and RF for the RFQ. The 20 mR/hr interlock is based on not creating a Radiation Area; that is, the interlock occurs when the condition of 20 mR/hr has existed for 15 minutes. CCR staff is able to view archived Chipmunk dose rate data to determine the dose rate that caused the Chipmunk to interlock the beam.

Chipmunk calibration due dates are tracked through the SNS DataStream work order system.

In 2010, SNS recognized that the Chipmunk "Digitizer" circuit contains components that are no longer supported. SNS contracted with a vendor to redesign the circuit using up-to-date components and to minimize susceptibility to humidity. SNS specified in the procurement documents the performance requirements for this diagnostic circuit. A consultant was hired to evaluate the reliability of the "new" Chipmunk electronics design to ensure it was no less reliable than the original Chipmunks. Before deploying the new Chipmunks, it was discovered that the newly designed circuit does not work at -20 degrees C, which is a standard acceptance test. This is holding up approval of the new Chipmunks.

Recommendations:

12. Protection System Team Leaders should consider taking credit for the investment in personnel development by recording training in the training management system.
13. The Protection Team and other QA stakeholders should consider periodically performing a management assessment and observation of PPS/TPPS/IPS/TPS procedures such as certification.
14. The Protection Team Leaders should consider incorporating periodic audits of protection system configuration, labeling, and work controls into their respective PM programs.
15. Consider identifying equipment that performs PPS interlock functions in the work control database. Work requests involving devices performing PPS functions should notify PPS team to ensure requestors consider the impact on credited safety functions.
16. SNS should consider enlarging its pool of available Chipmunk spares.
17. SNS should raise the priority of finishing acceptance testing of the new Chipmunks and place them into operation.
18. SNS Data Services Department should consider re-evaluating cyber security practices for protection systems using the recommended practices of ICS-CERT, equipment manufacturers and other standards bodies.

Non-compliances with DOE O 420.2C:

None.

Topic 8: User Safety (Including Sample Handling, Training, Experiment Work Planning and Feedback Process)

Assessment Findings:

Although there have been several User related incidents (unauthorized electrical work, removal of radiological postings, non-conformance with JHA and radiological controls), effort continues to be applied in fact finding of these (and less serious events) to understand points of failure and develop lessons learned. Depending on the level critique, lessons learned are disseminated at bi-weekly operations meetings, morning tailgate meetings and into the more formal ORNL systems. In discussions, it is clear that instrument staff, both scientific and support, are conscientious about ESH and are recognizing and reporting safety issues and concerns to the appropriate staff in a timely manner. This is supported by having an ESH staff member resident in the Experimental Hall, who is engaged, available and highly visible to Users and staff alike.

With the present organizational structure, access to technical resources within the Research Accelerator Division (RAD) has become easier, affording greater and more effective support of Users and Instruments. The Scientific Associates (SA's) now report to Team Leads, which is a positive outcome for both the SA's and the staff they support, allowing for cross training and an avenue to question and provide input into a program, rather than just at the individual instrument level.

Much effort has been spent in developing institutional programs that help Users and the SNS facility become more efficient, examples are:

- User check in process day before beam time to allow equipment to be appropriately reviewed (and brought up to standard) as necessary
- End of Run survey that is technical in nature, providing feedback on User support services
- Operational Experiment Feasibility review provides avenues beyond the scientific staff to voice an opinion on what is practical and feasible to do. This falls into the realm of "continuous improvement" and pays great dividends when planning experiments and saving resources
- Quick Start Guides for equipment or processes that provide a User with the right information to understand hazards, controls and how the equipment/process works
- Global Sample Management planning that is coupled with ITEMS (Inventory, Tracking, Equipment, Material and Sample) tracking that covers all instruments

Through interviews and discussions, it is clear that the model developed for User support is being implemented and effectively supports the SNS mission. The Science Support (and Instrument Support) groups have momentum and a clear vision of where they need to be and what they need to do to help support Users and the science program.

An Information System Stakeholders committee is in place to evaluate needs and priorities for programming and software development.

Experiment Work Planning and Control is provided through the institutional proposal process IPTS (Integrated Proposal Tracking System). Each proposal is reviewed for ESH considerations, with identified concerns resolved with PI's before beam time starts. Controls are established when needed and identified in the Experiment Safety Summary Sheet that is developed for each experiment. These sheets are signed by ESH, Instrument support staff and the User approving risks and precautions, and Safety and Health Controls.

The SNS User Training Program is well developed with six basic User training modules, covering site and facility access, User Radiological Training (theory and practice), Target Building Awareness and Instrument Specific Training. Some of these are web based and can be completed (preferable) before coming to SNS, while others are interactive and employ the use of Hall Coordinators and Instrument Staff. The latter gives a User real time practical experience and a face to call if they need help. Training records are captured electronically and provide the necessary inputs for access control.

Recommendations:

19. Continue on the path of program development that helps users maximize their scientific time at SNS and on programs that help SNS staff effectively and efficiently use their time and their interaction with Users.

20. From a scientific support perspective, SNS has forged ahead with innovative programs that support laboratory use and create a simple environment for Users to work in, making compliance and safety easy to reach. The team should consider how they should disseminate this model to other National Labs.

Non-compliances with DOE O 420.2C:

None.

Topic 9: Configuration Control

Assessment Findings:

SNS-OPM 9.A-1, Configuration Management Policy (Rev. 01, October 2009), specifies that responsibility for configuration control resides with the System Engineer.

The Configuration Management Policy specifies that the design of new SNS systems, structures, components, and software (SSCS) and establishment of its reference design configuration shall be carried out in accordance with SNS-OPM 9.A-02 SNS Design Development Procedure (Rev. 02, May 2011).

The Configuration Management Policy specifies that changes to existing SSCSs shall be carried out in accordance with the OPM 09.A-03 SNS Design Change Procedure (now titled the SNS System, Structure, Component, and Software Change Procedure), which is a component of the configuration management policy.

Roles and responsibilities are identified in the SNS Design Development Procedure, the SNS SSCS Change Procedure and in the SNS Work Control Procedure. These roles and responsibilities include System Engineer, Lead Engineer and Operation Engineer. Additionally, configuration control changes may be reviewed by a Configuration Control Committee, which would include Facility Managers and other affected staff.

Configuration Control Committees were not found on the Neutron Sciences staff website under committees.

Configuration changes associated with credited controls are rigorously reviewed and approved, including completion of an Unreviewed Safety Issue evaluation.

Recommendations:

21. Ensure the roles and responsibilities for configuration control referenced above are current.

22. Ensure the Configuration Control Committee(s) charter(s) are current and available.

23. Consider establishing a configuration control change eLog (for changes not associated with credited controls) to ensure preservation and availability of information.

Non-compliances with DOE O 420.2C:

None.

Topic 10: Shielding Configuration Control and Change Management

Assessment Findings:

Facility bulk shielding is not a credited control in the ASE but SNS does have a policy and program for maintaining configuration control of radiological shielding that is documented in OPM 2.H-7.7, *Removal or Modification of Radiation Shielding and Beam Line Components*, and Attachment 2.H-7.7a, *SNS Shielding Under Configuration Control*. Task-specific shielding used for ALARA is not under the scope of these OPMs but is controlled through the Radiological Protection Program. The SNS RSO has the responsibility to approve all shielding modifications including its temporary removal and replacement.

During the committee's field walkthrough, radiation shielding was observed to be labeled "Configuration Controlled Shielding – Contact Radiation Safety Officer Before Disturbing".

The SNS RSO produced a list of shielding that either has been moved or has had a Radiation Safety Hold tag applied during the current maintenance period. As part of the Management Self Assessment (MSA) process for authorizing beam operations, the RSO is required to verify that all shielding is installed/re-installed but the process does not require the use of a formal checklist. Pictures of stacked block shielding (e.g., Klystron penetration block shielding) are available but are not used to help facilitate and verify configuration control requirements.

The ASE Section 2, Shielding, is ambiguous and not addressed in the FSADs. The requirement to address shielding in the ASE was eliminated in the ASO version C.

Recommendations:

24. The next revision of the ASE should remove criteria from 420.2B no longer present in revision 420.2C. Examples are ASE Section 2: Shielding

25. The SNS RSO and other QA stakeholders should consider periodically performing an audit of shielding configuration (including RS Hold tags) against the master configured shielding list as well as the list of temporary shielding modifications.

26. SNS should consider using a checklist based on (25) above, as both an aid and a record when verifying shielding configuration before machine operations.

27. Consider using the existing database tools to create and maintain the list of configured shielding, applicable information from (25) above, and creation of checklists described in (26), above.

28. Consider expanding the information on configured shielding list to associate shielding configuration items required for each facility-operating mode (e.g. Ion Source, Front End Only, Linac Tune-up, and Full Power).

29. SNS should consider formalizing the use of pictures of stacked block shielding to help ensure shielding that is temporarily removed meets configuration requirements when reinstalled.

Non-compliances with DOE O 420.2C:

None.

Topic 11: Conduct of Operations (Procedures, Procedure Revision Process, Authorization Process for Restart Following Outage, Training and Qualifications)

Assessment Findings:

Contractually, DOE requires ORNL's Research Accelerator Division to implement DOE Order 422.1. The ORNL Contract DE-AC05-00OR22725, Implementation Plan for DOE O 422.1, Conduct of Operations, specifically commits the SNS to implement the Order. The SNS Implementation Matrix for O 422.1 addresses topics such as procedures, procedure revision process, authorization process for restart following outage, and training and qualifications. However, the ASRC identified procedures that are behind in their three-year review. For example, the SNS Job Hazard Analysis Procedure is dated 2007 and all approvers are no longer assigned to those positions authorized to approve. The SNS Training and Qualification Plan is dated 2002 and still references SAP and GoTrain programs. There is a corrective action being worked on this deficiency. SNS management acknowledged this as being an identified area for improvement and is in the process of placing a Revision History into the procedures to clarify what the document's history is. Two SNS Lock-Out Tag-Out (LOTO) procedures (SNS 104070400-PR0007-R05 and SNS 104070400-PROO08-ROI) may not reflect the latest OSHA requirements for LOTO for hazardous energy sources or the 2012 NFPA 70E Standard for Electrical Safety in the Workplace, as they predate changes to these external safety requirements. Two different LOTO tags were observed to be in use by SNS personnel but many workers, when questioned by members of the ASRC, did not know why. The requirements for RS Hold tags and locks as they relate to LOTO for hazardous energy sources may not be equivalent with OSHA requirements for LOTO for hazardous energy sources. For example, the complexity of an RS Hold sequence that requires a specific written procedure is not clearly defined in a governing SNS procedure or policy.

Discussions with one SNS employee indicated ORNL SBMS illustrates two different LOTO tags, one for complex LOTO, and one for single point LOTO to be used with hazardous energy sources. Discussions indicated SNS plans to eliminate SNS specific procedures from their LOTO program and reference SBMS. The Cryo Group supervisor provided a complex LOTO procedure for control of hazardous energy, and discussed the training. Both aspects, procedure and training for this specific LOTO sequence, appear to be compliant with current OSHA requirements for LOTO for hazardous energy sources. Discussion regarding a job involving a single point LOTO that also required a group LOTO to enter the accelerator enclosure illustrated to ASRC that they were safe, but the ASRC is unsure if the work package also meets the definition of complex LOTO in NFPA 70E (2012).

On the subject of training and qualification, SNS is in the process of moving its training from an SNS-specific program (GoTrain) to the standard ORNL training program (LRN). Not surprisingly, with this transition comes a certain amount of interim training issues. SNS has local training programs for specific roles, such as Accelerator Operator and Target Operator. These job-specific training programs are also in the process of being migrated from being tracked at the group level to LRN. Different groups within SNS are at different stages in the migration of training and qualification.

Recommendations:

30. A short document that provides a table with a crosswalk between the ASE and the SNS procedures that meet the ASE requirements could be helpful.

31. Ensure SNS procedures are reviewed and updated as necessary at least once every three years as required by SNS-OPM 1.A-1 and SNS-OPM 1.A-2. Identify and prioritize procedures that may be behind in their three-year review.

32. SNS-OPM 4.B-2 SNS Training and Qualification Plan (Rev. 00, 2002) is no longer current and/or correct (references SAP and GoTrain instead of LRN). A corrective action is being worked for this deficiency and should include a prioritized implementation of training within the new system.

33. Consider maintaining SNS specific LOTO procedures up to date in order to comply with the Conduct of Operations Order, as opposed to relying on an SBMS Subject Area as the procedure. Note: DOE O422.1 implies that documents like these LOTO procedures are contractual requirements if they are identified as "attributes" to support a requirement in the DOE O422.1 Conduct of Operations Matrix.

34. Consider having the SNS accelerator enclosure group LOTO practice reviewed by an NFPA 70E expert (e.g., to determine its role in complex LOTO procedures).

Non-compliances with DOE O 420.2C:

None.

Topic 12: Instrument Readiness Review Process (Including Authorization Process for Beamline Operation)

Assessment Findings:

ASRC members interviewed Phil Ferguson, Kevin Jones, and Don Gregory pursuant to the Instrument Readiness Review Process at the SNS Facility. Ferguson has been recently appointed to Chair the Instrument System Safety Committee (ISSC) following the exit from SNS of the past ISSC Chair, Melissa Harvey. Following discussions with Ferguson, Jones, and Gregory, ASRC members in a separate discussion, talked to two Instrument Scientists who had recently taken their Instruments through the IRR Process. These were Christoph Wildgruber of the BL16B-Instrument VISION, and Leighton Coates of the BL11B-Instrument MaNDi. VISION and MaNDi went through the IRR Process in 2012.

The Procedure for IRRs for SNS Neutron Beamline Instruments (SNS-NSCD-SC-PR-0001-R01) was reviewed and is well written and comprehensive. It is user friendly, in that it gives a road map to the Instrument Team, as to what the ISSC will require for a successful completion of the IRR Process. Specifically, Section 5 of the Procedure lists the minimum required documentation and the minimum components of the Instrument Plan.

The ISS Committee appears to have an adequate membership, with the members having the necessary experience and knowledge of their respective specialties. That being, the Committee taps into individuals, which represent Health Physics, general safety, fire safety, shielding, PSS interlocks, neutronics etc.

The Instrument Team meets a handful of times with subsections of the ISSC to discuss Instrument Team deliverables and the general IRR process.

Proper ISSC and Instrument documentation control appears to be in place.

The ISSC process includes physical inspection of the instrument and review of Instrument staff qualification. As necessary, a punch list of items may be given to the Instrument Team for completion prior to ISSC recommendation to proceed with Commissioning, User Operation etc.

The IRR process is properly divided into four categories, Commissioning, User Operation, Modifications, and Limited Scope reviews.

The Instrument Scientists interviewed thought the IRR process was fair, organized, and was value added. They thought the process was not overly painful.

The ASRC reviewers were impressed with Section 3.0 Steps 3.1 and 3.5. These steps state that the Instrument Team shall deliver to the ISSC all required documentation 10 business days prior to the review. In addition, the IRR Committee Chair shall promptly compile an Action Items listing within 7 days.

Recommendations:

35. The ASRC reviewers noted that some other DOE neutron and light sources have similar Instrument / Beamline initial commissioning review processes. They also noted that some of these facilities also require an Instrument / Beamline safety and Instrument procedure review to be performed periodically. Specifically, Argonne's APS and decommissioned IPNS utilize this practice. This periodic review is a formal process with short presentations given to the Review Team of instrument practices, proper documented paperwork, and current Instrument staff assigned responsibilities. A Periodic Review Team need not have the same membership as the ISSC and would have a bias towards ongoing operations. That being, neutronics, shielding configuration and seismic issues etc., probably need not be revisited. We suggest the SNS consider this suggestion as an opportunity for improvement.

Non-compliances with DOE O 420.2C:

None.

Appendix 2 – ASRC Plan of Action

SNS ASRC Triennial Assessment

Plan of Action for June 25 – 27, 2013

(updated 6/24/2013)

Objectives: to assess accelerator safety program elements specified in the Contractor Requirements Document (CRD) portion of DOE Order 420.2C *Safety of Accelerator Facilities* and to assess other key areas related to accelerator safety, to ensure compliance with DOE Order 420.2C, and to focus SNS management attention on improvements necessary for continued safe operations. At a minimum, the following accelerator safety program elements should assessed for compliance with 420.2C requirements:

1. ASE
2. SAD
3. USI Process
4. ARR Program
5. Roles and Responsibilities
6. Inventory listing of accelerator facilities

Scope: The scope of the assessment is to be focused on accelerator specific safety requirements as promulgated in DOE Order 420.2C.

Methodology: ASRC members (see Table 1) will perform the assessment through a combination of document reviews, staff interviews, facility walk-downs and task observations as appropriate. The specific assessment topics and individual responsibilities of the ASRC members are defined in Table 2. ASRC members will provide a brief summary of their assessments for inclusion into the final assessment report.

Conduct of Assessments: Assessments evaluate conformance to established requirements. The ASRC members examine objective evidence that demonstrates activities, procedures, instructions, and records are being properly executed and documented.

Assessment criteria are derived from the DOE Order 420.2C *Safety of Accelerator Facilities* including facility specific policies and procedures used to implement requirements from DOE Order 420.2C.

During the assessment, verify that documentation called out by SNS procedures is accurate and complete. All concerns should be brought to the attention of the person responsible for the area for possible resolution or correction prior to the completion of the assessment. No corrective action is required for any deficiency satisfactorily resolved prior to the completion of the assessment. However, a record of the finding must be included in the assessment report, and acknowledged as having been resolved.

Documentation: Topical assessment reports shall include Findings, Recommendations, and Noncompliances, which are defined as follows:

Findings - Results of the evaluation of the collected assessment evidence compared with the agreed assessment criteria. Assessment findings provide the basis for the report. While all

findings of nonconformity must be documented, findings of conformity may also be documented.

Recommendations (opportunities for improvement) - A suggested means of improving an activity or fulfilling the intent of a requirement.

If a noncompliance as defined below is observed, then it must be documented in the assessment:

- Noncompliance - An activity, attribute, or document, which fails to comply with established requirements, and may lead to a condition having an adverse effect on environment, health and safety, operations or Credited Controls.
    - Major noncompliance - A lack of an element, procedure, or a non-fulfilled requirement that puts the process/system at jeopardy, and could lead to significant impact on environment, health and safety, operations or Credited Controls.
    - Minor noncompliance - An observed lapse in a program, process, procedure, or requirement, usually single incidents that do not have a significant impact on environment, health and safety, operations or Credited Controls.

Noteworthy Practices - An assessment result that constitutes a condition or practice which exceeds expectations or common practice worthy of bringing to the attention of management.

Schedule: The onsite SNS ASRC Triennial Assessment will be conducted June 25 through 27, 2013. A closeout meeting with SNS management will be held on Thursday, June 27, 2013 at a mutually agreed upon time.

A report addressed to Kevin Jones, SNS Operations Manager, with findings and recommendations will be prepared at the completion of the on-site reviews and finalized by July 10, 2013.

ASRC Members: Members of the SNS ASRC are listed in Table 1.

ASRC Work Plan: A breakdown of the scope of each on-site team member's work is provided in Table 2.

Table 1. ASRC Membership, Affiliation and Contact Information

Name	Affiliation (Association)	Phone Number	Email Address
1. Ian Evans	SLAC	650-926-2628 650-630-9047 (cell)	evans@slac.stanford.edu
2. Charles Schaefer	BNL	631-344-4728 631-484-9386 (cell)	schaefer@bnl.gov
3. Sandra Kennedy	ORNL	865-576-0240 865-556-1175 (cell)	kennedysb@ornl.gov
4. Ed Lessard - Chairman	BNL	631-344-4250 631-525-6811 (cell)	lessard@bnl.gov
5. Kelly Mahoney	JLAB	757-269-7024	mahoney@jlab.org
6. Ruzicka, Bill	ANL	630-252-6834	wruzicka@anl.gov
7. Mark Gulley	LANL	505-665-5579 505-665-0932	gulley@lanl.gov

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Table 2 ASRC Member Assignments

Assessment Topics	Lessard	Ruzicka	Evans	Mahoney	Schaefer	Kennedy	Gulley
I. Required Topics from Order 420.2C							
1. ASE – Assess compliance with 420.2C Requirements	L						X
2. SAD – Assess compliance with 420.2C Requirements	LA		X				LN
3. USI Process – Assess compliance with 420.2C Requirements		X			L		
4. ARR Program – Assess Compliance with 420.2C				L	X		
5. Clearly Defined Roles and Responsibilities – Assess Compliance with 420.2C						L	X
6. Inventory listing of accelerator facilities - Compliance with 420.2C Requirements	L						
II. Other Topics for Review							
7. SNS Credited Engineered Safety Systems (includes PPS and ODH Systems) and processes to ensure maintained current and operable in accordance with FSAD				L	X		
8. User Safety (includes training, sample handling, experiment work planning and feedback process)		X	L			X	
9. Configuration Control and Work Control of Credited Engineered Controls				X		L	
10. Shielding Configuration Control and change management (e.g. unstacking/restacking of shielding)				X	L		
11. Conduct of Operations (procedures, procedure revision process, authorization process for restart following outage, training and qualifications).	X					X	L
12. Instrument Readiness Review Process (including authorization process for beamline operations)		L	X				

L = Lead reviewer responsible for write up
X = Associate reviewer

Page 4 of 4

Appendix 3 – ASRC Charter

Charter for the SNS Accelerator Safety Review Committee

(Revised April 2013)

Mission

The mission of the SNS Accelerator Safety Review Committee (ASRC) is to support the overall integrated safety management process by providing an independent review of accelerator safety for ongoing and proposed activities authorized under DOE Order 420.2C *Safety of Accelerator Facilities* (or its successors). The Committee functions in an advisory capacity reporting to the SNS Operations Manager.

Roles and Responsibilities

1. Perform SNS Internal Assessments as requested by the SNS Operations Manager in accordance with the approved SNS Procedure(s).
2. Perform Accelerator Readiness Reviews (ARRs) as requested by the SNS Operations Manager in accordance with the requirements of DOE Order 420.2C (or its successors) and the SBMS Procedure *Accelerator Readiness Reviews*.
3. Perform ad-hoc reviews based on need as determined by the SNS Operations Manager.
4. Prepare timely written reports documenting findings and recommendations resulting from reviews.
5. Review and assess adequacy of SNS management response to findings and recommendations.
6. Review proposed changes, modifications, and new activities with potentially significant safety implications as requested by the SNS Operations Manager.

Structure and Methods of Operation

1. The ASRC Chair is appointed by and reports to the SNS Operations Manager.
2. The ASRC Chair and SNS Operations Manager jointly determine the scope and conditions for each readiness review or assessment.
3. Members of the ASRC are chosen by the SNS Operations Manager with concurrence of the ASRC Chair.
    a. Members of the ASRC should be selected to provide the range of education and experience necessary to perform comprehensive assessment or readiness review.
    b. The ASRC may include ORNL staff and/or external individuals. Individuals should be operationally independent of the topical area(s) they assess.

4. Assessments and readiness reviews of limited scope may be performed by a subcommittee of the ASRC.
5. The ASRC shall provide a written report to the SNS Operations Manager documenting the results of their reviews which are to be retained by SNS management as an auditable record.
6. SNS management response to ASRC recommendations including rationale for altering or rejecting recommendations shall be documented and retained by SNS management as an auditable record.

APPROVED: _____ May 3, 2013
Kevin Jones — Date
SNS Operations Manager

_____ May 3, 2013
Edward T. Lessard — Date
SNS ASRC Chair