Fermilab Advanced Superconducting Test Accelerator (ASTA) Injector Accelerator Readiness Review Plan
List of CRAD/LOI Documents

1.0 Plenary Session Topics

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J. Anderson Jr.

1.2 ASTA Injector Overview
E. Harms

1.3 SA, SAD, & ASE Review Processes and Current Document Status. Overview of FESHCom, SA and SAD Subcommittees
J. Anderson Jr.

1.4 Credited Controls
J. Anderson Jr.

1.5 Lessons Learned - Response to Recent Accelerator Events
E. Harms

2.0 Required Documentation

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2.2 Accelerator Safety Envelope (ASE)
2.3 Accelerator Safety and the Fermilab Contractor Assurance System (CAS)
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2.0 Required Documentation

2.1 Safety Assessment Document (SAD)

Objective:
Determine if the Fermilab SAD provides an adequate description of facility and an analysis of hazards associated with facility operation to ensure that operational hazards are understood, necessary controls are identified and in place, and the requirements for effective and safe operation are fully understood. Determine whether the SAD provides an acceptable basis for the facility ASE under planned operational conditions. Determine if the safety analysis process has been effectively used to identify the needed credited controls.

Criteria:

DOE O 420.2C requires that the SAD:

Identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operation and credible accidents.

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 of proposed operations.

Provide detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., procedures) put in place to eliminate, control, or mitigate hazards from operation.

Include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation.

Approach

Document Reviews: Review the safety analysis used to support development of the ASTA Injector SAD Chapter. Review the facility SAD and reference information to determine if the SAD fulfills DOE O 420.2C requirements. Determine the adequacy of the review process supporting SAD approval.

Staff/Management Interviews: Interview selected staff involved in SAD preparation and approval to review knowledge of accelerator operations and understanding of SAD requirements.

Performance Review: Interview selected staff/management involved in facility management and operations to assess awareness of SAD requirements.

Criterion 2.1: Safety Assessment Document
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Interview selected management /staff involved in SAD development.	- Determine knowledge of SAD requirements. – Shielding Review Subcommittee – SAD Review Subcommittee – Radiation Safety Subcommittee	
2. Determine adequacy of safety analysis performed to support SAD.	- Identify accelerator hazards, potential impacts, necessary controls, etc.	
3. Determine if SAD meets DOE O 420.2C requirements.	- Reference DOE G 420.2C information.	
4. Determine if SAD provides adequate technical basis for ASE.	- Fermi National Accelerator Laboratory Safety Assessment Document, Revision 10, January 6, 2015.	
5. Determine adequacy of process to review and approve SAD.	- Type of review, review committee structure, and approval process	
6. Interview selected management /staff to determine knowledge of SAD requirements.	- Interview those who must operate under SAD requirements	
7. Determine adequacy of SAD to support operations	- Basis for decision	

2.2 Accelerator Safety Envelope (ASE)

Objective:
Determine if the ASE provides a high-level safety document that defines the physical and administrative accelerator bounding conditions and controls to ensure safe operations. Determine if the ASE provides acceptable documentation of the FSO/Fermilab agreed-upon requirements for operations.

Criteria:
DOE O 420.2C requires that the ASE:

Identifies controls and operating limits considered essential to safe operations as defined in the safety analysis referenced in the Fermilab SAD;

Includes operational requirements based upon the safety analysis referenced in the SAD.

Approach
Document Reviews: Review the Fermilab SAD safety analysis to ensure that the ASE reflects the controls and limits necessary for safe operations. Review the ASE to determine if the ASE includes facility operational requirements.

Interviews: Interview selected staff/management involved in ASE preparation and approval to review knowledge of controls, operational requirements, and operating limits.

Performance Review: Interview selected staff/management involved in facility management and operations to determine understanding of accelerator controls, operational requirements, and operating limits. Determine if an adequate process exists for updating the ASE to reflect operational changes.

Criterion 2.2: Accelerator Safety Envelope
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Interview selected management/staff involved in ASE preparation.	- Review ASE preparation process. - Determine if process exists to modify ASE to reflect operational changes.	
2. Determine if ASE addresses required controls and operating limits.	- Review accelerator controls, operational requirements, and operating limits.	
3. Determine if ASE meets DOE O 420.2C requirements.	- Fermi National Accelerator Laboratory SAD, Appendix A, Accelerator Safety Envelope, Revision 10, January 6, 2015. Pending FSO Approval.	
4. Determine adequacy of process to review and approve ASE.	- Type of review, committee structure, and approval process.	
5. Interview selected management/operational staff.	- Interview those who must operate under ASE requirements.	
6. Determine adequacy of ASE to support operations.	- Basis for decision	

2.3 Accelerator Safety and the Fermilab Contractor Assurance System (CAS)

Objective:
Verify that concerning topics directly related to accelerator safety, Fermilab has implemented an effective CAS program consistent with DOE O 420.2C. Verify that the CAS program effectively combines DOE and laboratory operational and safety oversight activities into a system that promotes safe and effective accelerator operation.

Criteria:
Fermilab's CAS provides a comprehensive internal assessment process to ensure that operational and safety programs to protect workers, public, and the environment are effectively implemented. The accelerator operations and safety programs, particularly the credited controls identified in the ASE, are effectively implemented, managed, and continuously improved.

Approach:
Document Review: Review the operational and safety program plans, approval letters, procedures, assessments, and other related documents.

Staff/Management Interviews: Interview selected operations, safety, and ESH&Q personnel to assess their management and/or understanding of CAS processes (e.g., procedures, communications, independent verification) in the performance of their duties.

Performance Review: Review staff/management performance of selected CAS processes (e.g. procedures, communications, independent verification, etc.) related to Accelerator Safety to determine program effectiveness.

Criterion 2.3: Accelerator Safety and the Fermilab Contractor Assurance System (CAS)
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Determine if CAS provides a comprehensive internal assessment process.	– FESHM, FRCM, QA – FESHCom Subcommittees related to accelerator safety – Interview selected operations and safety staff/ management to assess CAS understanding.	
2. Determine if the CAS Program uses external assessment: employs peer reviews and assessments that include accelerator subject matter experts from other accelerator facilities.	– ARR, October 2013 – OHSAS 18001 registration – ISO 14001 registration – Triennial Assessments o Triennial Rad Protection Program Review – DOE SC Accelerator Safety Order Implementation Assessment	
3. Determine CAS program adequacy to support operations.	- Basis for decision	

2.4 Safety Configuration Management (SCM)

Objective: Verify that there is a configuration management program that is related to accelerator safety. Verify that the configuration management of Credited Controls and supporting documented processes, procedures, and records are consistent with the Accelerator Facility Safety Implementation Guide for DOE O 420.2C, Safety of Accelerator Facilities August 1, 2014**.**

Criteria:
Determine that there is a documented configuration management processes applied to safety related administrative and engineered Credited Controls, the management of safety-related procedures and training, and management of records. Configuration management is applied on a graded approach to defense-in-depth controls.

Approach
Record Reviews: Review installation drawings, test procedures, interlock change request documents, interlock approval documents, and records for Credited Controls. Review records and procedures associated with the maintenance, operations, and function of Credited Controls.

Interviews: Interview Fermilab Accelerator Division Interlock Group Staff and ESH&Q Section Interlock Liaison regarding the application of configuration management requirements for Credited Controls.

Performance Demonstrations: Observe the configuration of Credited Controls and compare to test procedures and system drawings.

Criterion 2.4: Safety Configuration Management
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Determine if the configuration of Credited Controls are properly managed during accelerator operation and maintenance.	- Interlock system access controls - Interlock Change Request - Interlock log book - Interlock System Bypass procedures - MCR Hot Item Book - JULIE Permit System - FESHM 7030 Excavation restrictions near radiological areas - Beam Permits, Run Conditions, and Startup	
2. Determine if the accelerator controls system is protected against un-authorized access.	- MCR and ASTA console controls - Procedures and practices	
3. Determine if configuration management is applied to defense-in-depth controls on a graded approach.	- ASTA Run Conditions - Bypass log - Shift turnover	
4. Determine if the configuration management program is adequate to support operations.	- Basis for decision	

3.0 Accelerator Systems

3.1 Accelerator Operator ASTA Training and Qualification Program

Objective:
Determine that Fermilab implements an effective training program consistent with DOE O 420.2C requirements. Determine that the Fermilab training program effectively combines both contractor and DOE operational and safety requirements into a single comprehensive site training program that promotes safe and effective operation.

Criteria:

DOE O 420.2C requires that the site training program provide:

a. a description of the site-wide programs in controlled documents that summarizes the overall features of the programs;
b. training and qualification for all individuals who work in and around the accelerator facility to include site safety programs, site hazards, and emergency procedures;
c. specific training and qualification for operations, maintenance, support personnel, and experimenters to include job-specific procedures and controls; and
d. ongoing monitoring of personnel training program to assess overall effectiveness and support continuous improvement.

Approach:
Document Review: Review the site-wide training documentation. Review selected training procedures related to the Fermilab site-wide program. Review selected personnel training and qualification documentation to assess program effectiveness.

Staff/Management Interviews: Interview the Fermilab training manager on features of the Fermilab training program. Interview selected administrative and technical personnel regarding their experience with the training and qualification program.

Performance Review: Attend selected training modules provided for administrative, operations or experimental staff. Interview selected personnel during training-specific job assignments to assess training effectiveness.

Criterion 3.1: Accelerator Operations Training and Qualification Program
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Fermilab site training program documentation and procedures.	- Review tailored approach to individual responsibilities regarding SAD, ASE, USI and routine/emergency procedures.	
2. Interview AD Operations Department training manager regarding program.	- Discuss the Operations Department training program - Review Operations Department ASTA specific training.	
3. Interview selected Fermilab personnel regarding training.	- Laboratory training programs for accelerator specific and industrial safety. - Individual Training Needs Assessment (ITNA) process.	
4. Observe selected job assignments and compare with job-specific training.	- Key logger database verifies training prior to issuing an enclosure entry key. - Key logger rules assigned by the AD SSO and AD Operations RSO.	
5. Determine adequacy of training program to support operations.	- Basis for decision	

3.2 Accelerator Operations Procedures for ASTA

Objective:
Determine that Fermilab has an effective accelerator operational procedures program consistent with DOE and contractor requirements. Determine that
the Fermilab operational procedures program addresses the accelerator operations with safety significance. Determine that Fermilab procedures are controlled complete with processes for regular updates and revisions. Determine that procedural updates and revisions are effectively communicated consistent with the Fermilab configuration management program.

Criteria:
The operational procedures program for operations of safety significance should:

a. provide specific directions to ensure safe operations during routine, non-routine and emergency situations;
b. provide sufficient detail commensurate with the level of hazard and complexity of operation;
c. reflect available operational experience written in a format readily usable to operational staff;
d. incorporate lessons learned from past operations in order to improve the procedure and identify potential need for other procedures; and
e. require procedures to be controlled documents with specific attention to those procedures that reflect ASE requirements.

Approach:
Document Review: Review Fermilab procedures program documentation. Review selected operational procedures with safety significance.

Staff/Management Interviews: Interview Fermilab staff on the Laboratory, Divisional, and Departmental procedures program. Interview selected Fermilab management/staff on their use of specific procedures and the mechanisms to contribute to the program.

Performance Review: Attend selected operations/maintenance activities performed under specific operational procedures. Interview the operations/maintenance staff regarding their opportunity to modify, update or revise procedures.

Criterion 3.2: Accelerator Operations Procedures
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Fermilab procedure program documentation.	- Review process to develop, document, control, update, and revise Fermilab operational procedures.	
2. Interview Fermilab staff regarding procedures program.	- Discuss process for procedures management including managing updates/revisions particularly those supporting ASE requirements.	
3. Interview selected management/staff on their role in the Fermilab operational procedure program.	- Discuss with management process of ensuring that procedure creation, updates and revisions are effectively communicated. Discuss with staff process of identifying new procedures and ability to provide feedback on those procedures.	
4. Review selected operating procedures controlling approval for startup, beam authorization, and safety significant controls.	- Discuss use and adequacy of the specific procedure(s) as well as mechanisms to provide feedback on the procedure content, any updates, or procedure revisions. - Beam Permit, Run Conditions, and Accelerator Startup procedure. - Response to potential violations of the accelerator safety envelope procedure.	
5. Review AD Operations Department emergency response documentation and procedures.	- Review tailored approach to individual responsibilities regarding routine/emergency procedures.	
6. Interview Fermilab AD Operations Department staff on emergency response procedures.	- Interview the Operations Department and ASTA staff on Emergency Response procedures. - Walk through an emergency response procedure.	
7. Interview selected Fermilab emergency response personnel.	- Interview selected emergency response personnel on response preplanning and Operations Department and ASTA group response.	
8. Determine adequacy of procedure program to support operations.	- Basis for decision	

3.3 Work Controls Program Related to Accelerator Safety

Objective:
Determine that Fermilab has an effective work controls program consistent with both DOE and contractor requirements. Determine that Fermilab work controls are managed as part of a controlled system complete with processes for regular update and revision. Determine that work controls, updates and revisions are effectively communicated as part of the Fermilab configuration management program.

Criteria:

The Fermilab work control program should include:

a. Pre-approved work plans for proposed work particularly those systems with safety significance;
b. review of proposed work and management approval before starting work or the return of equipment to service;
c. work assignments only for qualified and authorized personnel;
d. management validation of work for completeness and functionality;
e. document control of the program, periodic updates and revisions as necessary; and
f. effective communication of information on controlled work scope.

Approach:
Document Review: Review the Fermilab work control program. Review selected work control procedures on those accelerator systems associated with engineered controls.

Staff/Management Interviews: Interview Fermilab management/staff with responsibility for the work control program. Interview selected Fermilab operations and maintenance on their experience with the Fermilab work control program.

Performance Review: Attend selected operations/maintenance activities performed under specific work controls. Interview operations/maintenance staff regarding the process to update or revise procedures. Assess process for communicating work status, completion and any modifications to work controls.

Criterion 3.3: Work Controls Program Related to Accelerator Safety
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Fermilab work control program documentation.	- Review the FESHM chapters addressing work controls as they pertain to accelerator safety. FESHM 2060, 7010, 7020 - FESHCom Subcommittees IIP & S3 assigned to update work control documents.	
2. Interview selected management/staff on their role in the work control program.	- Discuss Accelerator Shutdown Electronic Work List database, HA Database, Work Permit Database, Electrical Hazard Analysis Work List database. - Discuss how ASTA maintenance activities are conducted in conjunction with accelerator operations.	
3. Observe selected job assignments with job-specific work controls.	- Discuss use and adequacy of selected work controls and mechanisms to provide feedback, updates, or revisions.	
4. Determine adequacy of work controls to support operations.	- Basis for decision	

3.4 Credited Controls (CC)

Objective:
Verify that the Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for the respective operations phase or operations, are effectively in place (installed, operational, managed, etc.). Verify that defense-in-depth controls are managed in a similar manner but using a graded approach. Verify that the configuration of Credited Controls, their system interfaces, and the supporting processes, procedures, and records are managed consistent with the Accelerator Facility Safety Implementation Guide for DOE O 420.2C, Safety of Accelerator Facilities, August 1, 2014.

Criteria:
Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for ASTA Injector operations are effectively in place (installed, operational, managed, etc.). The configuration of the Credited Controls and any related procedures, processes, training, records, etc. are managed. Configuration Management is applied to Credited Controls and defense-in-depth controls on a graded approach.

Approach:
Record Reviews: Review installation records, test procedures, operations records for Credited Controls where applicable. Review records and procedures associated with the maintenance, operations, and function of Credited Controls.

Interviews: Interview Fermilab AD Interlock Group, AD Radiation Protection Group, and AD Operations Department staff regarding the installation, maintenance, and operation of configuration management of Credited Controls.

Performance Demonstrations: Physically observe Credited Controls installed in the workplace. Where possible, observe the function/actuation (or the result of actuation) of Credited Controls.

Criteria 3.4: Credited Controls (CC)
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Verify that Credited Passive, Active, and Administrative Controls in the ASE are installed and operational.	– Observation of Credited Controls installed for ASTA Injector operations – Observation of function/actuation of selected Credited Controls – Review Interlock System test records	
2. Verify that Credited Passive, Active, and Administrative Controls in the ASE are properly managed.	– Observe Accelerator Operators and ASTA staff interaction with Safety System (actuate and verify) – Discuss how off-normal conditions are managed – Review Interlock System test records – Discuss operations interaction with the RSO and Interlock Group	
3. Verify that defense-in-depth controls also have Configuration Management applied on a graded approach.	- Review Run Conditions to identify safety significant systems	
4. Determine adequacy of Credited Controls to support operations.	- Basis for decision	