

**Fermilab ES&H Section Consolidated Review and Assessment Document
(CRAD) and Lines of Inquiry (LOI) for the
400 MeV Test Area (MTA) Operational Restart for the
Irradiation Test Area (ITA)
Accelerator Readiness Review (ARR)**

1.0 Plenary Session Topics

- 1.1 Welcome, Introductions, Description of Accelerator Readiness Review (ARR)
Process and Plan
Maddie Schoell
- 1.2 Discussion of Change of Operations in support of MTA
Tom Kobilarcik/Evan Niner
- 1.3 Tour of MTA
Jason St. John

2.0 Discussion of Required Documentation for MTA Operational Restart for ITA

- 2.1 Safety Assessment Document (SAD)
Maddie Schoell/Matt Quinn
- 2.2 Accelerator Safety Envelope (ASE)
Maddie Schoell/Matt Quinn
- 2.3 Safety Configuration Management (SCM) Documentation
Sue McGimpsey
- 2.4 Commissioning/Operations Plan
Jason St. John/Evan Niner/Todd Sullivan

3.0 Accelerator Systems for MTA Operational Restart for ITA

- 3.1 Accelerator Component Readiness
Jason St. John
- 3.2 Training and Qualification Program for Accelerator Operations Personnel
Todd Sullivan
- 3.3 Accelerator Operations Procedures for MTA Operations for ITA
Evan Niner/Jason St. John/Todd Sullivan
- 3.4 Work Planning and Control Related to Accelerator Safety
Evan Niner/Sue McGimpsey
- 3.5 Credited Controls (CC)
Sue McGimpsey
- 3.6 Radiological Protection
Sue McGimpsey

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2.0 Discussion of Required Documentation for 400 MeV Test Area (MTA) Operational Restart for Irradiation Test Area (ITA)

2.1 Safety Assessment Document (SAD)

Objective:

Determine if the Fermilab SAD provides an adequate description of the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA) and an analysis of hazards associated with the relevant portions of 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 implemented. Determine whether the SAD provides an acceptable basis for the facility Accelerator Safety Envelope (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:

- a. 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.
- 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 of proposed operations.
- c. 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.
- d. 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 relevant SAD Chapter(s). Review the relevant SAD and reference information to determine if the SAD fulfills DOE O 420.2C requirements as expressed in Fermilab ES&H Manual (FESHM) Chapter 2010. 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.

Lines of Inquiry (LOIs): LOIs are provided for each topic to guide the discussion to assure comprehensive coverage of all topics. The reviewers may choose to use the LOIs in the form of a

checklist at their discretion. In the LOIs the term “interview” encompasses both informal discussions with relevant personnel and presentations.

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 Assessment Review Panel of Radiation Safety Subcommittee. - SAD Review 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 20.	
5. Determine adequacy of process to review and approve SAD.	- Type of review, review committee structure, and approval process.	
6. Assess adequacy of knowledge of SAD requirements by management/staff.	- Determine understanding of SAD requirements with those responsible for conducting those operations, Control Room Staffing, Beam Permits, Running Condition, Beam Delivery Authorization, and ORC Process.	
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 Fermilab Site Office (FSO)/Fermilab agreed-upon requirements for operations.

Criteria:

DOE O 420.2C requires that the ASE:

- a. Identifies controls and operating limits considered essential to safe operations as defined in the safety analysis referenced in the Fermilab SAD;
- b. 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 assess knowledge of controls, operational requirements, and ASE operating limits.

Performance Review: Interview selected staff/management involved in facility management and operations to determine understanding of accelerator controls, operational requirements, and ASE 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. Discussions with 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 ASE operating limits.	
3. Determine if ASE meets DOE O 420.2C requirements.	- Fermi National Accelerator Laboratory SAD, Appendix A, Accelerator Safety Envelope, as revised for the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA). Note: It is common during ARRs for the appropriate revised ASE to be at some stage of the approval process but not yet complete. If this is the situation, the review team may comment on the approval status.	
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, Control Room Staffing, Beam Permits, Running Condition, and Beam Delivery Authorization.	
6. Determine adequacy of ASE to support operations.	- Basis for decision.	

2.3 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.

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 ES&H Section Radiation Physics Operations and Engineering Staff 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 2.3: Safety Configuration Management
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Determine if the configuration(s) of Credited Controls are properly managed during accelerator operation and maintenance.	<ul style="list-style-type: none"> - Interlock system access controls - Interlock Change Request - Interlock System Bypass procedures - MCR Hot Item Book - JULIE Permit System - FESHM 7030 Excavation restrictions near radiological areas. - Moveable Shielding Inventory - Accelerator Startup Documents <ul style="list-style-type: none"> - Beam Permit - Running Condition - Start-up Sign-off Document 	
2. Determine if the accelerator controls system is protected against un-authorized access.	<ul style="list-style-type: none"> - MCR - Procedures and practices 	
3. Determine if the configuration management program is adequate to support operations.	<ul style="list-style-type: none"> - Basis for decision. 	

2.4 Commissioning/Operations Plan

Objective: Verify that there is a documented Commissioning/Operations Plan consistent with the Accelerator Facility Safety Implementation Guide for DOE O 420.2C, Safety of Accelerator Facilities.

Criteria:

The Commissioning/Operations Plan presents sufficient detail to describe the resources (e.g., people, equipment, and procedures), Division/Section/Department organization, and procedures necessary for safe commissioning of the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA). The Commissioning/Operations Plan must have sufficient internal review and oversight and identify the required components to ensure safe commissioning.

Approach

Record Reviews: Review Commissioning/Operations Plan development process.

Interviews: Interview Fermilab ES&H Section Radiation Physics Operations and Engineering Staff, Accelerator Operations Department Head, Accelerator Operators, ITA Coordinators and evaluate their level of integration, how well they understand the commissioning/operations goals and their roles, responsibilities, accountabilities, and authorities.

Performance Demonstrations: Evaluate the individual equipment assembly and commissioning activities and records. Observe Control Room Procedures, staffing plans, and training.

Criterion 2.4: Commissioning/Operations Plan
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Commissioning/Operations Plan fully describes roles, responsibilities, accountabilities, and authorities (R2A2s) that establish the expectations and duties of managers, supervisors, and operators for carrying out commissioning and operations.	<ul style="list-style-type: none"> - Commissioning/Operations Plan - Review of Commissioning/Operations Plan 	
2. Commissioning/Operations Plan addresses staffing schedules, authority and reporting chain for operational, safety, and scheduling issues, procedures (normal and emergency), administrative controls, and personnel training (including records and qualification for commissioning at the stated intensity).	<ul style="list-style-type: none"> - Monday, Wednesday, and Friday operations scheduling meetings. - Run Coordinator Role - Electronic Log Books 	
3. Commissioning/Operations Plan identifies or properly references engineered safety systems that will be operable for the accelerator.	<ul style="list-style-type: none"> - Running Conditions 	
4. Evaluate Commissioning/Operations Plan progress to date.	<ul style="list-style-type: none"> - Component checkout procedures. - Status of equipment required for commissioning and operations. 	
5. Determine adequacy of training program to support	<ul style="list-style-type: none"> - Basis for decision. 	

commissioning & operations.		
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3.0 Accelerator Systems

3.1 Accelerator Component Readiness

Objective:

Determine that Fermilab has an effective process in place to verify accelerator component readiness for beam commissioning and operations. Verify that components needed for safe accelerator and experimental operations are installed and ready for commissioning and operating activities.

Criteria:

The accelerator components necessary for safe operations are installed and ready for commissioning and operational activities.

Approach:

Document Review: Review Fermilab procedures used for verifying subsystem readiness. Review selected component check lists used to track component readiness.

Staff/Management Interviews: Interview Fermilab staff overseeing installation activities. Interview selected Fermilab management/staff on their specific equipment installation activities.

Performance Review: Walk down accelerator beam lines and service buildings to verify accelerator readiness.

Criterion 3.1: Accelerator Component Readiness
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Fermilab procedures used for component commissioning.	- Review subsystem procedures to verify component readiness for commissioning and operations.	
2. Interview Fermilab staff regarding component installation and checkout.	- Interview Fermilab staff overseeing installation activities. - Review component installation records. System ORC Reviews.	
3. Walk down beamlines and service buildings to verify component readiness.	- Visit beamlines and service buildings to view current state of installation activities.	
4. Review plans to complete and missing or incomplete component installation and checkout.	- Review adequacy of processes in place to finish missing or incomplete component installation.	
5. Determine adequacy of component readiness to support commissioning and operations.	- Basis for decision	

3.2 Training and Qualification Program for Accelerator Operations Personnel

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. The breadth of inquiries on this topic may be tailored by the ARR review team to the scope of the module being assessed in the ARR.

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

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Fermilab site training program documentation and procedures relevant to the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA)	- Review the Operators training program. - Review tailored approach to individual responsibilities regarding SAD, ASE, USI and routine/emergency procedures.	
2. Interview selected Fermilab personnel regarding training.	- Training needed for use of MTA facilities	
3. Determine adequacy of training program to support operations.	- Basis for decision.	

3.3 Accelerator Operations Procedures for restart of MeV Test Area (MTA) for Irradiation Test Area (ITA)

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/Sectional, 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 3.3: Accelerator Operations Procedures for restart of MeV Test Area (MTA) for Irradiation Test Area (ITA)

Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Review selected operating procedures controlling approval for startup, beam authorization, and safety significant controls for the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA)	<ul style="list-style-type: none"> - 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, Running Conditions, and Accelerator Startup procedure. - Response to Excursions above the Accelerator Operating Limits. - Response to potential violations of the accelerator safety envelope procedure. - Search and Secure Procedures - Enclosure LOTO Procedures 	
2. Review procedures for installing and operating new equipment for the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA)	<ul style="list-style-type: none"> - Review applicable Operational Readiness Clearance (ORCs) performed for various aspects of the restart of MeV Test Area (MTA) for Irradiation Test Area (ITA) - Review applicable USIDs. 	
3. If applicable, review relationship between MCR and remote control rooms.	<ul style="list-style-type: none"> - Discuss with MeV Test Area (MTA) management the intended relationship between remote operators and the MCR. - Interview the MCR Operation Department and the MTA personnel to ensure understanding of relationship and R2A2s. 	
4. Determine adequacy of procedure program to support operations.	<ul style="list-style-type: none"> - Basis for decision. 	

3.4 Work Planning and Controls 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. The breadth of inquiries on this topic may be tailored by the ARR review team to the scope of the module being assessed in the ARR.

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 3.4: Work Planning and 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 for MTA. - FESHM Chapters 2060.	
2. Review process for experimental reviews and approvals.	- Review procedures for review and approval of proposed experiments. - Review procedures for approved procedures (i.e., installation, running, uninstalling, storing equipment, etc.)	
3. Determine adequacy of work controls to support operations.	- Basis for decision	

3.5 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.

Criteria:

Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for the MeV Test Area (MTA) 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 ES&H RPE Interlock Group, ES&H RPO Department, 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 3.5: 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.	<ul style="list-style-type: none"> - Observation of Credited Controls installed for the MeV Test Area (MTA). - Observation of function/actuation of selected Credited Controls - Review Interlock System test records as applicable. 	
2. Verify that Credited Passive, Active, and Administrative Controls in the ASE are properly managed.	<ul style="list-style-type: none"> - 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.	<ul style="list-style-type: none"> - Review Run Conditions to identify safety significant systems. 	
4. Determine adequacy of Credited Controls to support operations.	<ul style="list-style-type: none"> - Basis for decision. 	

3.6 Radiological Protection for MeV Test Area (MTA)

Objective:

Determine that Fermilab Radiological Protection Program has fully evaluated and addressed the impact of accelerator operations with the reconfiguration of the MeV Test Area.

Criteria:

The Fermilab radiological protection program:

- a. Evaluated the necessary shielding needed for the facility modifications;
- b. Evaluated operational and environmental impact associated with the facility modifications;
- c. Identified and incorporated or facilitated the necessary changes in structures, infrastructure, processes, and procedures to reflect the facility modifications;
- d. Identified and planned necessary tests, measurements, and activities to verify calculated and modeled radiation shielding and installed shielding effectiveness; and
- e. Worked with operations to effectively integrate shielding studies.

Approach:

Document Review: Review Fermilab documents that serve as the evaluation and technical basis for MTA operations. Review procedures and processes that address these operations.

Staff/Management Interviews: Interview the Shielding Assessment Review Panel Chair and selected staff regarding evaluation of operational and environmental impact for the facility modifications. Interview selected accelerator operations management/staff on their interface with Radiation Safety personnel with emphasis on effective communication of changes associated with the facility modifications.

Performance Review: Participate in table top discussions with Radiation Safety staff and Operations staff to review changes to radiological protection practices associated with the facility modifications. Conduct selected facility/building walk-throughs and observe implementation of shielding assessment generated changes to the facilities.

Criteria 3.6: Radiological Protection for MeV Test Area (MTA) Operations
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. Determine if relevant radiation shielding assessments for the facility modifications have been fully reviewed and assessed.	<ul style="list-style-type: none"> - Fermilab SAD, ASE - Technical Basis for Shielding Design - Applicable Shielding Assessment 	
2. Determine if the operational and environmental impacts associated with the facility modifications have been evaluated.	<ul style="list-style-type: none"> - Applicable Shielding Assessment 	
3. Determine if the facility modifications and program changes have been effectively communicated and implemented.	<ul style="list-style-type: none"> - Beam Permits - Running Conditions - Interviews of Operations Department Staff 	
4. Determine if there a plan to test assumptions regarding effectiveness of shielding.	<ul style="list-style-type: none"> - Interviews with assigned RSO and Operations Department staff - Shielding verification plans 	
5. Determine adequacy of radiation protection program to support operations.	<ul style="list-style-type: none"> - Basis for decision 	