FERMILAB Internal Readiness Review Report
Phased Review #1a – Common, Support, Linac, and MTA
November 29 – December 1, 2023

Review Team

- Don Gregory, on-site Chair (retired ORNL)
- John Woodford, on-site reviewer (ANL)
- Tyler Spears, virtual reviewer (LANL)
- Sam Hays, virtual reviewer (LBL)
- Dan Broemmelsiek, on-site reviewer (FNAL)
- Mike Geelhoed, on-site reviewer (FNAL)
- Rachel Madiar, DOE observer (Fermi Site Office)

Executive Summary

The review committee wishes to thank the FERMI management team for their hospitality, technical support, and professionalism during the review. The combination of on-site and remote reviewers worked well, primarily due to the seamless use of remote viewing/display. Considerable progress since the last Accelerator Readiness Review toward full compliance with DOE O 420.2D was evident in the reviewed materials. Each of the three primary documents which form the main basis of the review (Safety Analysis Document, Accelerator Safety Envelope, and Unreviewed Safety Issue program) are very close to being in full compliance with the Order. The committee makes specific recommendations below in two categories – some are judged by the committee to be "Pre-starts" (necessary to come into full compliance with the Order), and the remainder are recommendations (improvements that will in our opinion make operations more effective and efficient). Presentations made to the committee were well-designed, concise, and helpful. Questions from the committee were answered promptly and fully.

Fermi management states that they have an agreement with the DOE Site Office to the effect that an ASE violation has occurred when beam operations take place with the knowledge that the accelerator is operating outside the ASE safety envelope. If beam operations are terminated on discovery of a non-compliant condition, and are not restarted until the accelerator is brought into compliance with the ASE, then no ASE violation has occurred. This basis is assumed in several of the following pre-starts/comments. Fermi has also decided to make the Search and Secure process part of the credited RSIS instead of having Search and Secure as a separate credited control. This change will require several editorial and substantive changes in the SAD description, the Hazard Analysis, and the ASE. The committee has recommended that the Operation Authorization Document should not be a credited control. If Fermi accepts this recommendation there will be additional changes needed to the SAD description, Hazard Analysis, and ASE. Since no substantive changes have been made to the Linac and MTA accelerators since they were last operated, Fermi does not plan to have a commissioning phase, and has no Commissioning Plan for review.

Charge Questions

1. Have the Safety Assessment Document (SAD) Chapters and the Accelerator Safety Envelope (ASE) supporting Linac and MTA operations been updated to meet the requirements in DOE O 420.2D and address the recommendations from FSO, the ARR review team and the DOE Assist team?

   Conditional YES

   In general the SAD and ASE do meet the requirements of the Order but we present items that need resolution in the IRR report.
   Recommendations of previous review teams have been successfully addressed, but some of our recommendations overlap those of previous reviews.

2. Is the methodology for determining the Maximum Credible Incident (MCI) appropriate, and is it clear in our updated documentation?

   YES and CONDITIONAL YES

   The methodology for determining the MCI is appropriate, but some additional documentation is needed to provide a sufficient basis for determining credited controls. Additional discussion will be added to the SAD to reference that documentation.

3. Is our updated strategy to use the MCI analysis to determine Credited Controls, and Shielding Assessment analysis to determine Defense-in-Depth controls, appropriate and is it clear in our updated documentation?

   YES and NO

   The strategy to use the MCI to determine credited controls is appropriate and with the addition of a flow-down study to justify active element settings the process will be complete.
   The Shielding Assessment was not provided to the committee and defense-in-depth controls were not presented in detail. The committee considers these topics, appropriately, to be outside the review scope.

4. Have the performance elements for active engineered Credited Controls been appropriately incorporated into the SAD Section I?

   YES

5. Have the performance elements for active engineered Credited Controls applicable to Linac and MTA (RSIS and radiation monitors) been appropriately detailed into their respective SAD Chapters and flowed-down into the Fermilab Main Accelerator ASE?

   YES

6. Does the content of the updated Unreviewed Safety Issue (USI) Program meet the requirements in DOE O 420.2D CRD § 2.f.(1) through 2.f.(5)?

   CONDITIONAL YES

   USI training must be developed and implemented for the USI program to fully comply with the requirements of DOE O 420.2D.

Recommendations from Previous Reviews

Fermi responded to all comments from the FSO, ARR, and Contractor Assist Visit reports. Responses were presented to the IRR team in a presentation, and the responses appear to be complete and responsive. Additional details of the comment responses and one recommendation follow.

The FSO provided 20 comments. Of these, one was a compliment on the revised ASE (and thus not requiring a response), and two were not applicable to the IRR 1a team review scope (one involved ODH, and the other involved machines for which the posited intensity for the MCI analysis was less than the maximum intensity of which the machine was capable). Of the remaining 17 comments, 9 were accepted as is by the IRR team. The IRR team did note that the MCI analyses depended on the physical shielding configuration as described in the existing facility shielding analyses, not on the method(s) used for the existing facility shielding analyses. The responses to the remaining 8 comments were largely adequate, but the IRR team had a few suggestions to address any concerns. These suggestions are provided in the responses to other charge questions. The IRR-1a suggestions were mainly focused on improving consistency in the ASE descriptions of credited controls, clarifying the USI process, and improving the description of the MCI analyses in the SAD. The IRR-1a team noted that there may be ASE violations that would justify immediate response terminating beam operations without taking the time to work through a USI screening before acting. Concerning FSO Comment #12, although both tables in the ASE have been given titles, Table 2 is not referenced in the body of the ASE.

The ARR Team provided 21 comments. Of these, one was not applicable to the IRR 1a team review scope (it involved ODH). Of the remaining 20 comments, 11 were accepted as is by the IRR team. As with the FSO comments, FNAL's responses to the remaining 9 comments were largely adequate, but the IRR team had suggestions to resolve further concerns. These suggestions are provided in the responses to other charge questions. Again as with the FSO comments, several of the IRR team suggestions deal with consistency and clarity in the ASE, and with the USI process.

Recommendation: The IRR team recommends that the difference between the quantitative methodology used for the MCI analyses and the semiquantitative methodology used for NASHs be described explicitly in the SAD.

The DOE/Contractor Assist Visit provided 33 comments. Of these, 12 did not require responses from FNAL. Of the remaining 21 comments, 16 were accepted as is by the IRR team. The IRR team evaluation of the last five questions generally paralleled comments on the FSO and ARR team responses. The IRR team notes that while many of the hazard descriptions in the SAD Appendix C include chapter references to the FESHM, not all of them do. Some of the hazard descriptions include references to the FESHM without a chapter reference (e.g., Appendix C, Fringe Fields hazard).

Safety Assessment Document (SAD) Description

The SAD structure has been updated to meet the CRD requirements in DOE O 420.2d. The methodology to determine Credited Controls using an MCI analysis is sound.

1. The navigation from the SAD description to the HA risk table appendix needs to be called out explicitly.
2. There is no mention of authorizing authority for Support Facilities operations, and since Support Facilities have no accelerator-produced hazards, they have no ASE. A completed hazard analysis with acceptable mitigated risks confirms that the Support Facilities are prepared for safe operation. We suggest that you explicitly state in the SAD description that authorization to operate those Support Facilities having a satisfactory hazard analysis is found in the Prime Contract.
3. Changes to the MCI for a particular segment may affect the MCI for downstream segments. We suggest adding a statement in the MTA SAD explicitly stating that a change to the Linac MCI will be evaluated for its effect on the MTA through the USI process.
4. In the Linac RSIS section, III-1.4.1.2.1, there is a sentence discussing personnel access to the Booster. Remove this sentence.
5. **[Pre-start]** An additional analysis document is under development detailing how the MCI requires particular trip settings on active credited controls (primarily Chipmunks) for both the Linac and MTA to enable safe operation. This document needs to be completed, approved, and implemented (i.e., appropriate Chipmunk settings specified in the applicable ASE) prior to beam operations. The review and approval process for this document will likely be different from the Shielding Assessment approvals regimen.
6. **[Pre-start]** We suggest that it needs to be made clear in the early paragraphs of the SAD that the entire FERMI site is an Accelerator Facility as defined in O 420.2D. One simple sentence would remove any doubt about the extent of O 420.D applicability.
7. **[Pre-start]** In Section III-1.1.7 of the Linac SAD, second paragraph, Flourinert is listed as an accelerator-specific hazard. Discussion during the review indicated that Flourinert has been re-evaluated and is now included in the FESHM. If that is the case, remove discussion of Flourinert as an accelerator specific hazard in the location cited above and in any other places it is called out in the SAD.
8. In the MTA SAD, Section III-2.2.1.6, Air Activation, there is a detailed discussion of air activation, ending with an estimated release to the environment. The unmitigated risk is listed as a "I". In the corresponding section of the Linac SAD (III-1.2.1.6), the Air Activation hazard is listed as "N/A". The discrepancy needs to be reconciled since the hazards are roughly equivalent in the two accelerator segments.
9. **[Pre-start]** Chipmunks to be used to protect workers from MTA hazards must be located, installed, and incorporated into the RSIS prior to beam operations.
10. An added figure in the Linac SAD showing the locations of credited Chipmunks would help the reader grasp the extent of Chipmunk coverage much quicker than the current list of locations. The same is true of the MTA once Chipmunk locations are determined. We suggest you consider adding such drawings.

Hazard Analysis

Hazard Analysis comments are broken down into reviewing the Hazard Identification table and the Hazard Evaluation tables. This detailed review included Section II-1 Rail Head, Section III-1 Linac, and Section III-2 MTA. The Hazard Analysis for the other Support Facilities should be reviewed considering the comments made for the Rail Head facility – the facility hazards and mitigations are similar enough that it was not an effective use of limited review time to list detailed comments for all of the facilities.

Overall recommendation: In Section III-1 Linac and Section III-2 MTA for common hazards that are identified as applicable in the area, the risk matrix tables listed in the chapters often refer the reader to section I chapter 4. This Chapter in turns refer the reader to Appendix C for common hazards. It was stated that the risk tables for the support areas should match Appendix C. It would be beneficial to use this same process for Rail Head and other support facilities risk tables, wherever applicable. This will remove duplication and potential inconsistencies.

Section II Chapter 1, Rail Head and Rail Head Risk Tables:

1. Baseline risk is mentioned in each of the sections for the hazards discussed in Section II-1. It is not clear if you are referring only to the worker, co-located worker, or public. Some risk tables for the worker and the collocated worker are different. We suggest that for clarity you should include the worker, collocated worker, and MOI (if applicable) baseline risks in each of the sections of the Safety Analysis for the chapter.
2. In Table 2.4 Toxic Materials - Onsite Facility Worker. Based on the risk Matrix of L: A and C: M would mean that this is a Risk II. Currently is says it is Risk I. Fix the inconsistency.
3. Section II-1.2.2.1 Lead, the baseline risk is stated as a II. However, when looking at the associated tables, Risk I is listed for the worker and risk III for a co-located worker. Fix the inconsistency.
4. The SAD Section I-4.2.1, Lead, states that this is a Lab wide hazard risk matrix table, and we should refer to Table C.2 in Appendix C. However, you restate the table in list of risk tables for the rail yard. We recommend that you follow the same process as with Section III-1 and Section III-2. Refer in the risk matrix tables to Section 1 chapter 4, which in turn sends you to Appendix C. This will help avoid inconsistencies and duplicating work.
5. In risk Table 2.4 Beryllium, the facility worker matches the Appendix C table. However, for the collocated worker, the tables are different. Fix the inconsistency or refer to section 1 chapter 4 as you did in section III-1 and Section III-2.
6. There is an asterisk next to the Hazard Beryllium for Appendix C table, but there is no discussion/footnote on what that means. Remove the asterisk or add text that describes the what the asterisk means.
7. In Table 2.5 Toxic material, Onsite collocated worker, Beryllium, the risk is listed as “J”. With L: A and C: H the risk would be I. Risk I is different from the baseline mentioned in Section II-1.1.2.2.2 Beryllium, where it says the risk is II. Also, the Appendix C table brings Beryllium risk levels down to a risk III when mitigated, where Table 2.5 has beryllium mitigated to risk IV. Fix the inconsistencies.
8. Table 2.7 Flammable and Combustible Material has a small formatting issue where there is an extra box overlapping the table. Delete the overlapping table.

9. In Section II-1.2.3.2 Flammable materials, it states that the baseline risk is II. Looking at Table 2.7 Flammable and Combustible Material and The Risk table from Appendix C, the baseline risk is I for the worker. Fix the inconsistency.
10. In Section II-1.2.4.2 High Voltage Exposure, it states that the hazard is not applicable. However, you mark it as applicable in the Hazard Identification table and even have a risk matrix for it in the chapter. Fix the inconsistency.
11. In Table 2.10, Electrical Energy, Onsite-1 Facility Worker, the mitigated Consequence is labeled as "I". Given the 2 mitigative bins from the listed controls, this should be "L". Fix the error.
12. Section II-1.2.5.2 Hot Work, has a discussion ending with a baseline risk of II. However, Hot work is not marked as a hazard in the Hazard Identification table and does not list a risk matrix table in the chapter. Fix the inconsistency.
13. Section II-1.2.6.1, Power tools, states the baseline is risk II, however the tables in the chapter show risk III. The Risk tables in the chapter are different from the tables in Appendix C. Fix the inconsistencies.
14. Section II-1.2.7.2, Compressed Gasses, has the baseline risk as II. In the chapter risk matrix tables and the Appendix C tables it shows it has a risk of I. Fix the inconsistency.
15. In Section I-4.1.7.2, Compressed Gases, it states that an acceptable level of IV was obtained for the mitigated hazard. Is this only for facility worker or does this include co-located worker? The collocated worker is mitigated to a risk of III. This is similar for Material Handling hazard. Include text that states the baseline risk is for the facility worker or include the facility worker, collocated worker baseline, and MOI (if applicable) so there is no confusion.
16. Table 2.25, Other Hazards. Noise lists the Consequence level as "I". To match Appendix C, it should be "L". Fix the inconsistency.
17. The table for Facility Worker regarding the Noise Hazard between the chapter risk matrix list and Appendix C do not match. Fix the inconsistency.
18. Section II-1.2.9.4, Ergonomics, states that the hazard is not applicable to the area. However, it is marked as a hazard in the Hazard Identification list and has an associated risk matrix table in the chapter. Fix the inconsistency.
19. When comparing the Rail Head chapter risk matrix table to Appendix C. for Ergonomics, it is N/A for collocated worker in Appendix C. However, in the chapter we have an Ergonomics table that is not N/A and has a risk bin for the collocated worker. Fix the inconsistency.
20. The Section II-1.2.10, Access & Egress, discussion mentions a risk baseline of II. The following subsection Life Safety Egress does not mention any risk baseline. When looking at the Hazard identification table, the Life Safety Egress is not check marked. There is no risk table in the rail head risk matrix chapter for Life Safety Egress. In the Appendix C there is a Life Safety Egress Risk Table, with the baseline for the Facility worker as risk I and risk II for the collocated worker. Based on the Hazard identification table, there is no Access & Egress Hazard that is applicable. Delete the baseline risk or fix the inconsistencies.

Section III Chapter 1 Linac

21. In the Accelerator Prompt Ionizing Radiation Hazard risk table, credit is taken for the Search and Secure action. According to discussions during the review, Search and Secure is being incorporated into the RSIS credited control. Add the information on the Seach and Secure into the RSIS entries on the risk table, and adjust the binning accordingly.

22. DOE-HDBK-1163-2020 states “Each control is credited for a single ‘bin drop’ either in likelihood or consequence; not both.” In Table 5.1, Prompt Ionizing Radiation, the RSIS is listed as both P/M. In the MTA Risk Table for Prompt Ionizing Radiation the RSIS is listed as P for preventative. Change the RSIS system to either be just preventive or just mitigative.
23. In Table 5.1, Prompt Ionizing Radiation, the Consequence is mitigated from H to N, indicating credit for three controls. The current controls are M-Shielding, M-RSIS, P-Operation Authorization Document, P-Staffing, P-Accelerator Operating Parameters. Update the new mitigated consequence to L:BEU, C:M, R:IV, which is still acceptable.
24. These was a discussion during the review indicating Fermi believes that the binning Methodology is only applicable to Non-Accelerator Hazards. However, section III-1.9 Risk Matrices seems to state/read otherwise. State clearly in Section III-1.19 Risk Matrices, if the controls for non-accelerator specific hazards do not follow explicitly the methodology followed in DOE-HDBK-1163-2020.
25. If the one-control per bin methodology from DOE-HDBK-1163-2020 is not applicable to the accelerator, you can argue that with the MCI acceptable dose requiring the mitigated dose to the worker is less than 5 rem (N level consequences) the controls that implement this requirement (shielding and the chipmunks/RSIS), are enough to bring the Consequence levels down from H to N. Essentially, you would be taking more than one bin credit for each control. This leaves P-Operation Authorization Document, P-Staffing, P-Accelerator Operating Parameters controls to reduce the Frequency/likelihood to still be BEU. This discussion would need to be clearly stated in section III-1.2.1.1 so that people can follow the logic of the risk tables.
26. In Table 5.1 Radiological Onsite Facility Worker, Prompt Ionizing Radiation, exposure to ionizing radiation from klystrons is at a risk level II unmitigated and reduced to a risk level IV without any credited controls. Per the methodology from DOE-HDBK-1163-2020, any binning done to an accelerator hazard would be considered a credited control. The current controls listed are P – Proper operation of klystron, M – Shielding, & M – ESH gallery radiation surveys. The Baseline Qualitative Risk is L:A, C:M, R:II. You can credit M-shielding since it is already a credited control. This would set the mitigated risk bins to be L:A, C:L, R:III. A Risk 3 is acceptable per the methodology of DOE-HDBK-1163-2020.
27. Since non-accelerator specific hazards are managed by other DOE approved programs and/or processes or through FESHM, controls listed in Table 5.1 Radiological (such as ALARA Plan or Postings) are not easily traced back to the applicable DOE approved programs and/or processes. We recommend that when you describe the hazard in the chapter, you should mention the controls and the applicable program that this control is associated with. This way, someone can follow backwards if the control is from a DOE approved program or FESHM. For example, the control listed in Table 5.1 Radiological – Residual Activation is “ALARA Plan”. It is not clear whether this is part of FRCM or FESHM. A suggestion is to clearly state the DOE-credited program in Section III-1.2.1.2 Residual Activation.
28. The possibility of removing “Operation Authorization Document” as a credited control was discussed. If this control is removed, the “exposure to prompt ionizing radiation” mitigation from the risk table will need to be updated.
29. In table 5.1 Radiological, Contamination. The listed control “M – Proper PPE specified in RWP” is different from what was listed in the presentation on the LINAC overview. M- Material survey and release process was used on the presentation instead. If the MTA Overview

Presentation was incorrect, no change is needed in the tables. Otherwise, update the hazard table to match the MTA Overview.

30. Table 5.3 Radiological – MOI offsite. The Hazard is listed as not applying to the public. We suggest you add a short justification on why the risk does not apply to MOI to either the description section of the hazard or the Risk table itself. For example, the hazard cannot reach the public or the risk to the public is low or negligible and is not carried forward, per the DOE-HDBK-1163-2020, page C-2.

Section III-2 MTA

31. In Table 2.1 Radiological prompt ionizing radiation, Interlocked Beam Loss Detectors and Search and Secure are now part of the RSIS. This leaves the Scenario with P-RSIS, P-Operation Authorization Document (if this credited control continues to be credited), P-MCR staffing, M-Shielding as credited controls. This brings the mitigated bins to be L:BEU, C:M, R:IV. Update the MTA risk table for prompt ionizing radiation to reflect the new alignment of controls.
32. According to the discussion, only prompt ionizing radiation and ODH require credited controls. Various other hazards listed, such as residual activation, have controls highlighted in red in the risk tables. Remove red highlight on controls from every hazard that is not considered an Accelerator Hazard.
33. The ODH hazard has a baseline risk of IV for the MTA compared to the Appendix C hazard table Risk of I. It would be useful to include information regarding the ODH hazards from the MTA Overview Presentation slide 17 to section III-2.2.5.3 since this discussion justifies why the MTA ODH risk is lower than the Appendix C baseline risk.
34. In the presentation for the MTA overview, it mentions M-Radiological signage and M-Radiological Shielding were listed as controls for the Ground and Surface water activation. However, neither of the risk tables mention these controls. Similarly, do the controls "M-Machine Protection System" and "M-Pond Monitoring System" need to be taken out, since they were not listed in the MTA overview presentation. If the MTA Overview Presentation is incorrect, no change is needed. Otherwise, update hazard table to match the MTA Overview.
35. In Section III-2.2.1.8 Soil Interactions it states, "The consequences from potential exposure to this hazard is considered to be of negligible consequence, and since this material is inaccessible to workers, co-located workers and public due to where it may find within the facility, ~~no preventive or mitigative measures are required,~~ the risk is of a minimal concern~~, and not subject to additional evaluation~~." [cross-outs added] This wording implies there is no Hazard table listing with controls, but though there is one. We suggest removing the crossed-out words shown in the comment above.
36. The Air Activation Hazard risk table has 2 controls that are repeated. Both Engineered Air Flow and Run conditions are stated twice. Combine/delete the duplicate controls from the hazard table.
37. In the MTA Overview presentation, Radiological Signage was included as a Mitigative control for Air Activation Hazard. Assuming the presentation is correct, this mitigation should be added to the table in order make sure that the consequence level has enough binning to bring it down from H to N.
38. The Radioactive Waste hazard risk table listed in the chapter is slightly different from the MTA Overview Presentation table. The controls M-Distance to Stored Material & P-Key Control Program are not listed in the MTA Overview table. The MTA Overview had M-Material Survey

and Release Process listed but they are not included in the MTA chapter risk table. Reconcile the two statements.

39. Section III-2.2.1.10 Contamination states, “The baseline qualitative risk was determined to be a risk level of IV (minimal concern). The consequences from potential exposure to this hazard is considered to be of negligible consequence, and since this material is inaccessible to workers, co-located workers and public due to where it may found within the facility, no preventive or mitigative measures are required, the risk is of a minimal concern, and not subject to additional evaluation.” This text is inconsistent with the associated risk table in the chapter. The Baseline is risk I and the Consequence is H. Fix the inconsistency.
40. There is a duplicate hazard in the MTA chapter risk Table 2.4 to 2.6 for Pseudocumene. Delete the duplicate hazard.
41. Section III-2.2.5.1 Bakeout and Hot Work are marked in the Hazard Identification as applicable Hazards but do not have any associated risk table in the chapter. Add the hazards to the risk table to keep this consistent with the other hazards, even if they just refer to Section I-4.
42. Section III-2.2.11 Environmental is missing the subsections for Hazard to Air, Hazard to Water, Hazard to Soil. Add each of the subsections with the appropriate descriptions/text similar to the corresponding Linac Section III-1.2.11.
43. Section III-2.2.11 Environmental states, “The MTA presents environmental hazards in the form of a list of checked off hazards shown in Table 2.” However, Table 2 is for the MTA Longitudinal Shielding Thicknesses. If you are referring to Hazard Identification Table, where Environmental Hazards are not listed, then the text should be deleted. Correct the statement or remove it.
44. Section III-2.2.2 Toxic material is states, “The MTA presents toxic material hazards identified in Table 2.” However, Table 2 is for the MTA Longitudinal Shielding Thicknesses. Fix the Table number or take other appropriate action.
45. It was discussed that the Search and Secure was fundamentally part of the RSIS and the two controls will be combined. Section III-2.4.3.1 Search and Secure will need to be combined with the RSIS, or the discussion about Search and Secure will need to note that it is part of the RSIS.

Accelerator Safety Envelope

1. **[Pre-start]** Per Order 420.2D, CRD, 2.b.(2) a DOE approved ASE must be in place prior to commissioning and routine operations. The reviewed ASE is not yet submitted to or approved by the FEMRI DOE Site Office. Approval of the ASE will be required prior to beam operations.
2. **[Pre-start]** Clarify statements concerning what constitutes an ASE violation. In Section 4, the ASE clearly states that an ASE violation occurs when beam is delivered to a segment of the accelerator and a *known* credited control loss, or loss of credited control function, exists. This definition is accurately reproduced in the USI Evaluation form. In other parts of the ASE, there are statements that imply ASE violations may exist, regardless of whether it is known that a credited control is absent or has a loss of function. Examples:
   a) Section 3 – in the "Required Surveillance" specification, it is stated that "surveillances are to be carried out at the minimum specified interval. Beam Operation to the affected area without the required surveillance being performed within the minimum specified interval is an ASE violation."
   b) Section 3 – In the "Credited Control" specification, it states that, "Beam operations to the affected area without required elements in place is an ASE violation."
   c) Section 4 – "Beam operations of the segment of the Fermilab Main Accelerator beyond the ASE Intensity Limit is a violation of the ASE."
3. **[Pre-start]** For all "Staffing" credited controls, clarify:
   a) what "on shift" means (e.g., does this mean the person is on-site and, if so, can they be anywhere on-site?).
   b) whether the current requirements may be satisfied by one person, or if it requires two separate people.
4. **[Pre-start]** Call out the Search and Secure of Exclusion Area(s) within the "Description of Credited Control" section of the Linac and MTA Radiation Safety Interlock System Credited Control Section. Currently, the actual control only says the RSIS must "prevent entry." [Sample wording: "A Search and Secure procedure must be carried out inside the Exclusion Area(s) prior to beam operations to ensure that all personnel are excluded. The Radiation Safety Interlock System (RSIS) must both ensure all personnel are cleared from exclusion areas prior to beam authorization and prevent entry into Exclusion Areas during beam operations."]
5. **[Pre-start]** In the "Response" section for each accelerator segment's credited controls, further define what actions are necessary for specific circumstances, especially when an ASE violation occurs. The current wording in all "Response" statements may be interpreted to mean that all USIs that warrant an evaluation must have affected beamline operations shut down and restart requires AD Associate Lab Director and DOE Field Element Manager Approval. [Sample wording using the Linac: "Beam operation to the Linac will be terminated immediately once a USI Screening determines that a discovered condition warrants USI Evaluation. If an ASE violation is determined to have occurred, then beam operation to the Linac/MTA will not resume until approval is received from the AD Associate Lab Director and the DOE Field Element Manager. If beam operation was immediately terminated and the discovered condition corrected with no further beam operation, then beam operation will resume once approval is authorized by the *[e.g.] Area Manager(?).*"]

6. **[Pre-start]** In the MTA "Shielding" credited control, the 17.2 effective feet of dirt listed is credited but is not present at all locations. The credited e.f.d. shielding should not exceed the minimum thickness evaluated when determining the need for active controls (Chipmunks).
7. **[Pre-start]** Further define "down time" and "maintenance" periods to clarify that these are periods where beam is not being delivered (found in Sections 3 and 5).
8. **[Pre-start]** Make the MCI references consistent regarding the 5 rem, 500 mrem, and 100 mrem evaluation. Sections where there seems to be a difference:
    a) The "Accelerator Safety Envelope Intensity" definition only lists a 500 mrem evaluation.
    b) Section 3 – ASE Intensity Determination only mentions the 5 rem or 500 mrem (not the 100 mrem).
    c) Section 7 – Linac - "Active Engineered- Radiation Safety Interlock System (RSIS)" the 5 rem, 500 mrem, and 100 mrem conditions do not match the location or potentially exposed individual information found in Table 1 (found in Section 3 of the ASE).
    d) Section 7 – MTA - "Active Engineered- Radiation Safety Interlock System (RSIS)" the 5 rem, 500 mrem, and 100 mrem conditions do not match the location or potentially exposed individual information found in Table 1 (found in Section 3 of the ASE).
9. Consider removing the "Operation Authorization Document" as an ASE credited control. If the document is not an essential safety process that is absolutely necessary for the safe operation of the machine, it should become a defense in depth control that is not in the ASE. If the Authorization Document is necessary to ensure the functionality of other credited controls, then only the required parts of the document should be credited to reduce the opportunity for an unnecessary ASE violation. Removal of this document as a credited control will require rewording in (among other places) ASE introductory sections.
10. Consider removing the statements from the RSIS Credited Controls that require the RSIS be specified in the Linac/MTA's Operation Authorization Document. This is either covered by the separate credited control for the Operation Authorization Document, or if removed entirely from the ASE, not necessary.
11. Consider removing unnecessary sections of the ASE that may be better referenced from the SAD or USI Process document. For example,
    a) Section 5 "Configuration Management for Credited Controls" may be a reference to configuration management procedures that describe the necessary defense-in-depth controls.
    b) Section 6, "USI Safety issue (USI) Process," may be removed and the USI process referenced elsewhere in the SAD.
    c) Unused definitions in the definition section (ARR, Commissioning, etc.)
12. For all Interlocked Radiation Monitors listed as a credited control, clarify that the limits are an upper limit. For example, place a "≤" symbol before each value or (preferably) state that the trigger level may be set lower for ALARA purposes or to ensure compliance with 10CFR835.
13. Consider moving the extensive discussion section in the ASE introduction to the SAD. This would simplify the ASE to simply a list of credited controls and the associated actions. As written, DOE approval is required to modify or update the discussion part of the ASE.
14. In Section 4 of the ASE (ASE Violation Determination and Actions), Determination section, the wording implies that credit may be taken for defense-in-depth controls to mitigate an ASE violation. The discussion about taking ASE credit for defense-in-depth controls should be removed.

15. In Section 4 of the ASE (ASE Violation Determination and Actions), Determination section, and in the ODH system description, the wording implies that the ODH classification of an area can be redefined after an apparent ODH ASE violation has occurred. Consider whether such a classification change constitutes a change to the ASE and requires reauthorization by DOE. Clarify the language in those two locations.
16. Consider whether any procedures or other documentation that directly implement or facilitate credited controls would require a USI screening prior to significant revisions. Note that special status in any qualifying procedures or documentation.

Unreviewed Safety Issue Program

The program overview follows the required elements of the DOE O 420.2D §2.f. The document clearly articulates the differences between Proposed Activities and Discovered Conditions. The program is clearly broken down into the three main steps and is clearly labeled within the flowchart.

The Definitions of the program are clearly understood and cover the appropriate aspects of the program.

The USI Process of Screening, Evaluation and Determination are clearly defined within the Program document. As standalone activities these steps are coherent and clear. The flow of the overall USI process is likely to improve as the training program is developed.

1. **[Pre-start]** The Roles and Responsibilities associated with the Program identified a role of Screener. This role was identified as having received training that has not been established. A training program must be developed, approved, and implemented before the USI program will be fully compliant with O 420.2D.
2. **[Pre-start]** The USI program must be approved by DOE prior to approval for beam operations.
3. For discovered conditions the committee suggests that it should be made clear in the training and Section 3.1 that beam operations should be stopped while the screening form is filled out.
4. In the opening paragraph, 2nd sentence, the committee noted potential confusion on which accelerators the USI Program is implemented for. If Fermi has any accelerators currently or potentially operating that have not been approved under DOE Order 420.2D then removal of the word “all” would remove the potential confusion. If all future accelerator operations will be under O 420.2D authorization, no change is suggested.
5. The Screening and Evaluation Forms are not completely clear. For a Proposed Activity, committee members did not agree on how to proceed through the form and end in the same conclusions. In particular the Evaluation form poses logical decisions too challenging given their complexity and multiple layered questions. Within the same questionnaire there is an inherited logical “and” for the answer while the questions proposed are stated with “or”. The committee suggests considering using separate forms for proposed activities and discovered conditions.
6. Records retention was included in the program but it did not include the length of retention (it was termed “appropriate”) for these records. We recommend that the retention period be specified. [Possible wording: “Completed USI forms will be retained for the life of the facility, and USIs will be considered when revising the SAD.”]
7. The language suggests USI report numbers are either for proposed activities or discovered conditions, but it is not clear who issues USI numbers, their format, or at what stage a number is issued. We recommend that the point at which a number is issued, by whom, and the number format be specified in the USI program document.
8. Consider reviewing the USI program flowchart(s) to incorporate classic flowchart symbols.