12 GeV Upgrade
Future Science at Jefferson Lab

Accelerator Readiness Review Plan

Revision 1

Tuesday, 22 October 2013 – Thursday, 24 October 2013

Phase 1B

Jefferson Lab

REVISION SUMMARY

REVISION	DATE	DESCRIPTION
1	10/18/2013	Plan revised to include Phase 1B.
0	08/16/2013	Initial plan developed for Phase 1A.

REVIEW

Associate Director, ESH&Q…….....	Mary Logue
Safety Configuration Management Board (SCMB)…….……..	Bob May - Chair Paul Collins Harry Fanning Kelly Mahoney Steve Suhring Vashek Vylet

Table of Contents

1.0 Executive Summary 1

2.0 Scope 1

3.0 The Accelerator Readiness Review Process 2

3.1 Selection of an ARR Team 2

3.2 Team Member, Affiliation, and Focus Area(s) 2

3.3 Prerequisite Documentation 3

3.4 Schedule 4

3.4.1 Phase 1 5

3.4.1.1 Phase1A 5

3.4.1.2 Phase1B 15

3.4.2 Phase 2 17

3.4.3 Phase 3 18

4.0 Accelerator Readiness Review Conduct 18

4.1 Methodology 18

4.1.1 Presentations 18

4.1.2 Field Evaluations 19

4.2 Recordkeeping 19

4.3 Reporting 19

5.0 Abbreviations, Acronyms, and Definitions 20

Appendix 1: Laboratory Director Communication to ARR Team 26

Appendix 2: Links to Pre-requisite Documentation 28

Appendix 3: Prerequisite Documentation 29

A3.1 Safety Assessment Document (SAD) 29

A3.2 Accelerator Safety Envelope (ASE) 31

A3.3 Unreviewed Safety Issues (USI) 32

A3.4 Contractor Assurance System (CAS) 34

A3.5 Safety Configuration Management (SCM) 36

A3.6 Commissioning Plan (CP) 38

Appendix 4: Key Accelerator Systems 40

Appendix 5: CRADs/LOIs for Key Accelerator Systems 41

A5.1 Accelerator Readiness Review (ARR) Process and Plan 41

A5.2 Work Planning and Control 44

A5.3 Lessons Learned Program 47

A5.4 Software QA 48

A5.5 Cyber Security 50

A5.6 Operations Training and Qualification Program 53

A5.7 Operations Procedures 55

A5.8 Industrial System Safety (ISS) 57

A5.9 General Radiological Protection Program 59

A5.10 Radiological Protection for 12 GeV Commissioning and Operation 61

A5.11 Emergency Management Program 63

A5.12 Credited Controls (CC) 66

Appendix 6: Other Supporting Materials 68

Appendix 7: Current and DRAFT Guidance Crosswalk on Accelerator Readiness Reviews 69

Appendix 8: Phase 1A CRAD/LOI Results 76

1.0 Executive Summary

This Accelerator Readiness Review (ARR) Plan was developed to facilitate the review to verify Jefferson Lab's readiness to safely re-commission and operate the upgraded Continuous Electron Beam Accelerator Facility (CEBAF) - Accelerator and Experimental End Stations. This plan guides the ARR process in such a way that it is conducted according to the requirements of Department of Energy (DOE) Order (O) 420.2C, Safety of Accelerator Facilities and that it is consistent with the August 2013 DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, Safety of Accelerator Facilities. This plan was developed according to Jefferson Lab's QACI-041 – "Accelerator Readiness Review Program" which states that a substantial upgrade or change to an existing facility is sufficient reason to conduct an ARR.

2.0 Scope

This plan considers the process by which verification of hardware, personnel, and procedures, associated with commissioning and routine operations, are determined to be ready to permit activities to be undertaken so the facility can move safely through a logical commissioning sequence until full operation is achieved. This is an overview and sampling process, not an extensive wall-to-wall assessment.

The actual ARR addresses accelerator specific hazards associated with the following topical areas:

- Ionizing and non-Ionizing Radiation
- Electrical Hazards
- Fire Hazards
- Pressure and Vacuum Hazards
- Cryogenics and Oxygen Deficiency Hazards
- Magnetic Fields
- Other Mechanical, Chemical, and Gaseous Hazards

This ARR Plan provides guidance, based on a graded approach, as to the extent of review associated with topical areas. Depending on the nature of a hazard and the extent to which its profile has changed, the scope of the ARR will vary. This will be evident in the extent of the review of the topical areas, the criterion for determining readiness, and the depth of inquiry used to evaluate a particular criterion. This review is Phase 1 as provided in Table 1 - Accelerator Readiness Review Schedule of Section 3.4.

3.0 The Accelerator Readiness Review Process

3.1 Selection of an ARR Team

Jefferson Lab has assembled a team of experts, drawn from in and outside the lab to conduct the ARR. The team consists of individuals chosen for their expertise in key aspects of accelerator organization, operation, experimental physics, and safety, and sufficiently removed from areas under review to avoid conflicts of interest. This supports a level of scrutiny that may not be readily achieved by external experts alone.

ARR Team members were recommended for approval by the Associate Director – Environment, Safety, Health, and Quality (ESH&Q) to the Laboratory Director. Approved team members were reviewed by the Safety Configuration Management Board (SCMB), an independent review board approved by the Laboratory Director. The SCMB is responsible for oversight of safety configuration management and the process by which the laboratory evaluates Unreviewed Safety Issues (USI).

3.2 Team Member, Affiliation, and Focus Area(s)

Approved team members include the following:

Member	Affiliation	Focus Area
Bob May	Jefferson Lab	*ARR Process Facilitator*
Roger Erikson (*Chair*)	Stanford Linear Accelerator Center	Commissioning Plan Review, Accelerator Conduct of Operations
Ian Evans	Stanford Linear Accelerator Center	Mechanical, Electrical, Electronics Systems Readiness
Jim Floyd	Lawrence Berkeley National Laboratory	Industrial Safety Programs, Safety Systems Readiness
Dennis Parzyck	Retired, Former Contractor/DOE	ARR Process, Final Safety Assessment Document, Accelerator Safety Envelope (ASE), Contractor Assurance System (CAS)
Karen White	Oak Ridge National Laboratory	Engineered Protection, Cyber Security, Software Quality Assurance (QA)
John Anderson	Fermi National	Safety Basis Documentation, Safety Systems, Accelerator Operations
Roger Carlini	Jefferson Lab	Internal Reviewer
Harry Fanning	Jefferson Lab	Internal Reviewer
George Neil	Jefferson Lab	Observer for ARR 1B
Dick Walker	Jefferson Lab	Observer for ARR 1B

The DOE Thomas Jefferson Site Office (TJSO) will observe and provide DOE oversight of this ARR at various times:

- Andre Bethea, TJSO
- Scott Davis, DOE Science Headquarters
- Patty Hunt, TJSO
- Dave Luke, TJSO
- Steve Neilson, TJSO

See Appendix 1 for the specific charge communication from the Laboratory Director to the ARR Team.

3.3 Prerequisite Documentation

The ARR depends on a certain level of organizational maturity and analyses to accurately characterize hazards associated with facility operations. To facilitate this analysis, the following documentation is provided to team members:

- **Safety Assessment Document (SAD)** – provides an analysis and is pertinent to understanding the risks of accelerator operation. The SAD performs the following functions:
  - Identifies hazards and associated on and off-site impacts to workers, the public, and the environment from facility operations both normal and credible events.
  - Contains sufficient descriptive information and analytical results of specific risks to ensure understanding of the hazards.
  - Provides detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) in place that eliminate, control, or mitigate hazards from operation.
  - Includes, or references, descriptions of facility function, location, management organization, components, and operation.

- **Accelerator Safety Envelope (ASE)** – approved by the DOE, the ASE defines the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the SAD. Any activity expected to exceed the bounding conditions of the ASE requires DOE approval. Any activity violating the ASE is terminated immediately and be put in a safe and stable configuration.

- **Unreviewed Safety Issue (USI) Process** – describes the process by which to identify conditions or activities that would present a significant increase in the probability of exceeding the bounding conditions of the ASE. Activities could be either planned modifications or conditions that could result in a significant adverse impact.

- **Contractor Assurance System (CAS)** – maintains the internal assessment process.

- **Safety Configuration Management Program** – includes procedures for ensuring accelerator safety. Consists of the following programs:
  - Configuration Management Process – defines how consistency of a system or product's performance, requirement, and operation are maintained throughout its life.
  - Quality Assurance Plan for the 12 GeV Upgrade – describes the configuration management process for this upgrade.
  - Conduct of Engineering Manual – provides procedures and processes by which engineering designs are managed within the scope of requirements.

- **Commissioning Plan** – describes:
  - Roles, responsibilities, accountabilities, and authorities of managers, supervisors, and operators for carrying out the commissioning/operations. Staffing schedules, authority, and reporting chain for operational, safety, and scheduling issues.
  - Procedures (normal and emergency/contingency), administrative controls, and personnel training (including records and qualification for commissioning at the stated intensity).
  - Engineered safety systems that operate for the accelerator and accelerator-associated experimental facilities.
  - Operational characteristics of specific facilities, sub-systems, and modes of commissioning needed to support the safety case for progressively higher power commissioning.

See Appendix 2 for links to Prerequisite Documentation.

3.4 Schedule

Jefferson Lab received approval to conduct a phased ARR from the TJSO. The phases and schedule are outlined below in Table 1.

Table 1 - Accelerator Readiness Review Schedule

Phase	Activity	Schedule
1	Commission Accelerator	4QFY13
2	Commission Hall A, D	2QFY14
3	Operate Accelerator to Hall A, D	3QFY14
4	Commission/Operate Hall B	TBD
5	Commission/Operate Hall C	TBD

3.4.1 Phase 1

Table 2 lists the critical operational parameters for ARR Phase 1, including commissioning activities subsequent to TJSO approval. Phase 1 will be conducted in two steps: 1A and 1B.

Table 2 - Operating Parameters for ARR Phase 1 and Commissioning

ARR Phase	Beam Termination	Beam Mode	Beam Energy (GeV)	Earliest Run Period	Planned Run Period
ARR Phase 1	Beam to Injector inline dump	CW	0.02 < E < 0.13	Acc I	Acc I
	Accelerator to (N)R dumplette, N=1..2	Tune-Mode*	0.50*N < E < 1.15*N	Acc I	Acc I
Post ARR Phase 1					
Commissioning	(N)R dumplette, N=3..10	Tune-Mode*	0.50*N < E < 1.15*N	Acc I	Acc II
	D-line dumplette	Tune-Mode*	5.50 < E < 12.5	Acc I	Acc II

*Tune-Mode beam is ensured by hardware and administrative methods.
Hardware Methods:
1) beam current monitor in injector set to trip at 20 uA CW
Administrative Methods:
1) button for CW disabled in software for operators
2) software controls for duty factor less than 2% beam authorization form limiting beam to "tune mode" only

3.4.1.1 Phase 1A

Phase 1A will focus on the areas in the schedules and assignment matrices outlined on the following pages. Team members involved in the review of Phase 1A are listed in the table found in Section 3.2 Team Member, Affiliation, and Focus Area(s).

Phase 1 – Monday AM, August 19, 2013

Session	Session Title	Reviewer								Observer	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Monday AM	**(CEBAF Center L102/104) In-brief and Joint Sessions**										
0800-0815	**In-brief**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
0815-0900	Joint Session 1: ARR Plan and Process for the Review	X	X	X	X	X	X	X	X	X	X
0900-0930	Joint Session 2: Facility Safety Basis (SAD, ASE, USI)	X	X	X	X	X	X	X	X	X	X
0930-1015	Joint Session 3: Lessons Learned (Internal and External)	X	X	X	X	X	X	X	X	X	X
Break											
1030-1145	Joint Session 4: Commissioning Plan Overview and Results of Director's Review	X	X	X	X	X	X	X	X	X	X
Working Lunch	**CEBAF Center L102/104**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Phase 1 – Monday PM, August 19, 2013

Session	Session Title	Reviewer								Observer	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Monday PM	**Technical Sessions 1-3**										
Technical Session 1 (CEBAF Center L102/104)											
1315-1400	**1A** Accelerator Conduct of Operations (Operations Directives)	X	X					X		X	
1400-1445	**1B** Commissioning Integration (Operations Directives Supplement)	X	X					X		X	
Break											
1500-1545	**1C** (Machine Control Center (MCC) Control Room) Operator Training, In-situ Discussion and Process Observation	X	X					X		X	
1545-1630	**1D** (MCC Control Room) Control Room Staffing, In-situ Discussion, Schedule Review, and Process Observation	X	X					X		X	
Technical Session 2											
1315-1445	**2A** (CEBAF Center F224/225) Accelerator Controls – Cyber Security					X	X		X		
Break											
1500-1600	**2B** (CEBAF Center F224/225) In-situ Discussion and Process Observation					X	X		X		
Technical Session 3											
1315-1400	**3A/3B** (CEBAF Center L210A) CAS			X	X						X
1400-1445	**3B** (CEBAF Center L210A) QA			X	X						X
Break											
1500-1545	**3C** (CEBAF Center L210A) Configuration Management			X	X						X
1545-1630	**3D** (CEBAF Center L210A) SCMB Process Discussion/Review			X	X						X
1630-1730	**(CEBAF Center L102/104) ARR Team Executive Session**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Phase 1 – Tuesday AM, August 20, 2013

Session	Session Title	Reviewer								Observer	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Tuesday AM	**Technical Sessions 4-6**										
0800-0815	**(CEBAF Center L102/104) In-brief**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Technical Session 4											
0815-1000	**4A** (MCC Control Room) Accelerator Conduct of Operations (continued)	X	X								X
Break											
1000-1145	**4B** (MCC Control Room) Accelerator Controls Accelerator Controls Software demo, Sweeps demo, Access Controls and ARM Surveys demo	X	X								X
Technical Session 5											
0815-1000	**5A** (CEBAF Center F224/225) Industrial Safety I, Radiation Control Program, Shielding, Prompt Rad. Policy			X			X	X		X	
Break											
1000-1145	**5B** (Bldg. 52, Acceleratory Tunnel) Radiation Control Program Infrastructure, Waste Mgt, Shielding Configuration Mgt			X			X	X		X	
Technical Session 6											
0815-1000	**6A** (CEBAF Center L210A) Accelerator Controls – Software QA Program				X	X			X		
Break											
1000-1145	**6B** (CEBAF Center L210A) Accelerator Controls Software QA (demonstrate change controls, problem resolution process), Lead Reviewer Discretion				X	X			X		
Working Lunch	**CEBAF Center L102/104**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Phase 1 – Tuesday PM, August 20, 2013

Session	Session Title	Reviewer								Observer	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Tuesday PM	**Technical Sessions 7-9**										
Technical Session 7											
1315-1430	**7A** (CEBAF Center L102/104) Commissioning Plan Implementation, Hot Checkout, Applied Lessons Learned	X	X					X		X	
Break											
1430-1645	**7B** (Accelerator Service Bldg.) Review HCO, Observe Checklist Entry(ies) and Associated Maintenance Activity(ies) for Correct Process, Use of ABIL and Verification of Logs	X	X					X		X	
Technical Session 8											
1315-1430	**8A** (CEBAF Center F224/225) Industrial Safety II, Radiation Control Upgrade Support – Evaluation of 12 GeV Impact on CEBAF Infrastructure and Ops			X	X						X
Break											
1430-1645	**8B** (Accelerator Tunnel, Hall D Tagger Ramp) Review Changes to Ops, Procedures, Walk Down Changes to Shielding and Controls - Tagger Ramp, Shield Wall, Rad Monitors, Service Buildings			X	X						X
Technical Session 9											
1315-1430	**9A** (CEBAF Center L210A) Software QA/Cyber Security Safety Systems					X	X		X		
Break											
1430-1645	**9B** (Bldg. 89, Accelerator Service Bldg.) Observe PSS PLC Test Stand, Network Interface, PSS Node Installation, Recordkeeping for Configuration Controlled Software					X	X		X		
1645-1745	**(CEBAF Center L102/104) ARR Team Executive Session**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Phase 1 – Wednesday AM, August 21, 2013

Session	Session Title	Reviewer								Observers	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Wednesday AM	**Technical Sessions 10-12**										
0800-0815	**(CEBAF Center L102/104) In-brief**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**
Technical Session 10											
0815-1000	**10A** (CEBAF Center L102/104) Industrial Safety III, DC Power, Installation/Vacuum (Ins/Vac), RF, Magnets		X	X							X
Break											
1000-1145	**10B** (Accelerator Service Bldgs, Accelerator, Tunnel, Central Helium Liquefier) Arc 1 Box Supply, LTT demo, Accel., Tunnel ODH and Ins/Vac		X	X							X
Technical Session 11											
0815-1000	**11A** (CEBAF Center F224/225) Accelerator Safety Envelope I – Review of ASE and Implementation	X					X			X	
Break											
1000-1145	**11B** (Accelerator. Tunnel) In-situ Discussions on Operations Procedures, Certifications, Access Controls, Demo/Inspections	X					X			X	
Technical Session 12											
0815-1000	**12A** (CEBAF Center L210A) Emergency Management (Lab-wide and Accelerator Programs and Processes)				X			X	X		
Break											
1000-1145	**12B** (CEBAF Center L210A) Tabletop Exercise or Breakout Session on YR Magnet Response, Planned Drills and Activities				X			X	X		
Working Lunch	**CEBAF Center L102/104**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**

Phase 1 – Wednesday PM, August 21, 2013

Session	Session Title	Reviewer								Observers	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Wednesday PM	**Technical Sessions 13-15**										
Technical Session 13											
1315-1430	**13A** (CEBAF Center L102/104) Accelerator Safety Envelope II	X			X						X
Break											
1430-1645	**13B** (Accelerator Tunnel, End Station D) Observe Credited Control Installation, Function	X			X						X
Technical Session 14											
1315-1430	**14A** (CEBAF Center F224/225) Industrial Safety IV, CRYO/ODH, Lasers			X			X	X			
Break											
1430-1645	**14B** (Accelerator Service Bldgs., Accelerator, Tunnel) Observe new C100 RF Zone and Magnet Installations, Injector/Laser Table			X			X	X			
Technical Session 15											
1315-1430	**15A** (CEBAF Center L210A) Work Controls, Maintenance and Repair during Commissioning and Ops		X						X	X	
Break											
1430-1645	**15B** (Accelerator Service Bldgs., Accelerator, Tunnel) Discussion and In-situ Observation of Work, Use of ATLis for Work Planning and Control, Follow-Up on HCO Tool		X						X	X	
1645-1745	**(CEBAF Center L102/104) ARR Team Executive Session**	**X**	**X**	**X**	**X**			**X**	**X**	**X**	**X**

Phase 1 – Thursday, August 22, 2013

Session	Session Title	Reviewer								Observers	
		Erickson	Evans	Floyd	Parzyck	White	Anderson	Carlini	Fanning	Neil	Walker
Thursday AM											
0800-1200	(CEBAF Center F224/225) Un-programmed Technical Session for follow-up										
0800-1200	(CEBAF Center L210A) Un-programmed Technical Session for follow-up										
0800-1200	**Draft Report**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Working Lunch	**(CEBAF Center L102/104)**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Thursday PM											
1300-1430	(CEBAF Center L102/104) Draft Report	X	X	X	X	X	X	X	X	X	X
1300-1430	Out-brief Dry Run	X	X	X	X	X	X	X	X	X	X
1430-1500	**Out-brief**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

List of Talks and Responsible Jefferson Lab Staff

Session Title and Contents	Responsible Jefferson Lab Staff (producing/delivering talks and leading in-field reviews and discussions)
Joint Sessions	
Joint Session 1: ARR Plan and Process for the Review	Talk: May
Joint Session 2: Facility Safety Basis (FSAD, ASE, USI)	Talk: May
Joint Session 3: Lessons Learned (Internal and External)	Talk: Freyberger; May
Joint Session 4: Commissioning Plan Overview and Results of Director's Review	Talk: Freyberger; Spata
Technical Session 1	
Technical Session 1A: Accelerator Conduct of Operations (Ops Directives)	Talk: Freyberger
Technical Session 1B: Commissioning Integration (Ops Directives Supplement)	Talk: Freyberger
Technical Session 1C: Operator Training, in-situ discussion and process observation	Walk: Vasilauskis; Okay
Technical Session 1D: Control Room Staffing, in-situ discussion, schedule review, process observation	Walk: Baggett; Spata; Vasilauskis; Freyberger
Technical Session 2	
Technical Session 2A: Accelerator Controls – Cyber Security	Talk: Bickley; Cuffe
Technical Session 2B: In-situ Discussion and Process Observation	Walk: Bickley; Cuffe
Technical Session 3	
Technical Session 3A: CAS	Talk: Smith
Technical Session 3B: QA	Talk: Smith
Technical Session 3C: Configuration Management	Talk: Smith; Michalski
Technical Session 3D: SCMB Process Discussion/Review	Walk: May; Collins; Suhring
Technical Session 4	
Technical Session 4A: Accelerator Conduct of Operations (continued)	Walk: Freyberger; Spata
Technical Session 4B: Accelerator Controls Software Demo, Sweeps Demo, Access Controls and ARM Surveys Demo	Walk: Vasilauskis; Suhring
Technical Session 5	
Technical Session 5A: Industrial Safety I, Radiation Control Program, Shielding, Prompt Rad. Policy	Talk: Vylet; Welch; Degtiarenko
Technical Session 5B: RadCon Program Infrastructure, Waste Mgt. Shielding Configuration Mgt.	Walk: Vylet; Welch; Hamlette
Technical Session 6	
Technical Session 6A: Accelerator Controls – Software QA Program	Talk: Bickley
Technical Session 6B: Accelerator Controls Software QA (demonstrate change controls, problem resolution process), Lead Reviewer Discretion	Walk: Bickley; Kjeldsen

Session Title and Contents	Responsible Jefferson Lab Staff (producing/delivering talks and leading in-field reviews and discussions)
Technical Session 7	
Technical Session 7A: Commissioning Plan Implementation, Hot Checkout, Applied Lessons Learned	Talk: Lauze; Baggett; (Michaud; Vasilauskis; Slominski, R. in attendance)
Technical Session 7B: Review HCO, Observe Checklist Entry(ies) and Associated Maintenance Activity(ies) for Correct Process, Use of ABIL and Verification of Logs	Walk: Michaud; Baggett; Lauze; Suhring; Carpenter; Slominski, R.
Technical Session 8	
Technical Session 8A: Industrial Safety II, RadCon Upgrade Support – Evaluation of 12 GeV Impact on CEBAF Infrastructure and Ops	Talk: Vylet; Degtiarenko; joint
Technical Session 8B: Review Changes to Ops, Procedures, Walk Down Changes to Shielding and Controls - Tagger Ramp, Shield Wall, Rad Monitors, Service Buildings	Walk: Vylet; Welch; Hamlette
Technical Session 9	
Technical Session 9A: Software QA/Cyber Security Safety Systems	Talk: Mahoney; (Bickley; Cuffe in attendance)
Technical Session 9B: Observe PSS PLC Test Stand, Network Interface, PSS Node Installation, Recordkeeping for Configuration Controlled Software	Walk: Mahoney
Technical Session 10	
Technical Session 10A: Industrial Safety III, DC Power, Installation/Vacuum (Ins/Vac), RF, Magnets	Talk: Kimber; (0815-0845) Hiatt; Nelson; (0845-0930) Bevins; (0930-1000)
Technical Session 10B: Arc 1 Box Supply, LTT demo, Accel., Tunnel ODH and Ins/Vac	Walk: Hiatt; Nelson; (1000-1030) Kujawa; Kimber; (1030-1100) Bevins; (1100-1145)
Technical Session 11	
Technical Session 11A: Accelerator Safety Envelope I – Review of ASE and Implementation	Talk: May; (0815-0900) Mahoney; (0900-1000)
Technical Session 11B: In-situ Discussions on Operations Procedures, Certifications, Access Controls, Demo/Inspections	Walk: Mahoney; Aiken
Technical Session 12	
Technical Session 12A: Emergency Management (Lab-wide and Accelerator Programs and Processes)	Talk: Menefee; (0815-0900) Vasilauskis; (0815-0900)
Technical Session 12B: Tabletop Exercise or Breakout Session on YR Magnet Response, Planned Drills and Activities	Walk: Menefee; Vasilauskis
Technical Session 13	
Technical Session 13A: Accelerator Safety Envelope II	Talk: May; (0815-0900) Mahoney; (0900-1000)
Technical Session 13B: Observe Credited Control Installation, Function	Walk: May; Mahoney

Session Title and Contents	Responsible Jefferson Lab Staff (producing/delivering talks and leading in-field reviews and discussions)
Technical Session 14	
Technical Session 14A: Industrial Safety IV, CRYO/ODH, Lasers	Talk: Hansknecht; Arenius; Owen
Technical Session 14B: Observe new C100 RF Zone and Magnet Installations, Injector/Laser Table	Walk: Hansknecht; Arenius; Owen
Technical Session 15	
Technical Session 15A: Work Controls, Maintenance and Repair during Commissioning and Ops	Talk: Suhring; (Michaud; Baggett; Lauze in attendance)
Technical Session 15B: Discussion and In-situ Observation of Work, Use of ATLis for Work Planning and Control, Follow-Up on HCO Tool	Walk: Michaud; Suhring

Completion of Phase 1A determines Phase 1B review activities. Information on future ARR Phases is included in Sections 3.4.2 and 3.4.3 to inform the review team.

3.4.1.2 Phase 1B

Phase 1B focuses on activities to resolve recommendations from Phase 1A. Operational safety of accelerator equipment not ready for review during Phase 1A and maturity of Control Room conduct of operations (training and procedures) is included.

Approved team members for Phase 1B include the following:

Member	Affiliation	Focus Area
Bob May	Jefferson Lab	*ARR Process Facilitator*
Roger Erikson (*Chair*)	Stanford Linear Accelerator Center	Commissioning Plan Review, Accelerator Conduct of Operations
Ian Evans	Stanford Linear Accelerator Center	Mechanical, Electrical, Electronics Systems Readiness
Jim Floyd	Lawrence Berkeley National Laboratory	Industrial Safety Programs, Safety Systems Readiness
Dennis Parzyck	Retired, Former Contractor/DOE	Safety Systems Readiness, Accelerator Conduct of Operations
Harry Fanning	Jefferson Lab	Internal Reviewer
Paul Collins	Jefferson Lab	Observer for ARR 1B

Phase 1B will focus on the areas in the schedules outlined on the following page.

Phase 1B – Tuesday, October 22, 2013

SESSION	CEBAF Center (L102/104)
0800-0830	**Executive Session (Committee Only) – Bob May et al.**
0830-0900	ARR In-Brief (Lab Leadership) - Bob May
0900-1030	CEBAF Status and ARR Phase 1A Findings - Arne Freyberger
Break – CEBAF Center	
1045-1105	Hot Check Out (HCO) Status - Ken Baggett
1105-1125	Training and Procedure Status - Paul Vasilauskis
1125-1200	RadCon Measurement Plans - Dr. Vaclav Vylet
Working Lunch - CEBAF Center	
1320-1330	Tour Prep and Transition to CEBAF Site (Committee and Escorts)
1330-1545	Tunnel Tour
Break / Discussion – Machine Control Center (MCC)	
1615-1700	Service Building Tour
1700-1705	Transition MCC to CEBAF Center (Committee and Escorts)
1705-1800	Executive Session (Committee)
1800-1830	Homework Requests (All)
Dinner - CEBAF Center	

Phase 1B – Wednesday, October 23, 2013

SESSION	CEBAF Center (L102/104)
0745-0800	Transition CEBAF Center to MCC (Committee and Escorts)
0800-0815	MCC Morning Meeting
0815-0900	Hot Check Out (HCO) at MCC/Service Buildings - Ken Baggett et al.
0900-0945	Control Room Staffing and Procedures
0945-1045	Spot Inspections/Tours at Request of Committee
1045-1100	Transition MCC to CEBAF (Committee and Escorts)
1100-1200	Homework Answers and Summary - CEBAF Center
Working Lunch - CEBAF Center	
1315-1330	Transition from CEBAF Center to MCC
1330-1415	Attend Weekly Scheduling Meeting (All) - MCC
1415-1430	Transition from MCC to CEBAF Center
1500-1800	Executive Session - CEBAF Center
Dinner – On Your Own	

Phase 1B – Thursday, October 24, 2013

SESSION	CEBAF Center (L102/104)
0800-1030	Closed Session – Report Writing Committee
1030-1200	Close Out Session (All)

3.4.2 Phase 2

Table 3 below outlines the critical operational parameters for ARR Phase 2 and for commissioning activities subsequent to TJSO approval.

Table 3 - Operating Parameters for ARR Phase 2 and Commissioning

ARR Phase	Beam Termination	Beam Mode	Beam Energy (GeV)	Earliest Run Period	Planned Run Period
ARR Phase 2	BSY Dump	CW	1 < E < 11.5	Acc II	Acc II
	Accelerator to Hall-A,B,C Dumplettes	Tune-Mode*	1 < E < 11.5	Acc II	Acc II
	Accelerator to Hall-A High Power Dump	Tune-Mode*	1 < E < 11.5	Acc II	Acc II
	Accelerator to A & D EndStation Tagger Dump	Tune-Mode*	5.5 < E < 12.5	Acc II	Acc III
Post ARR Phase 2					
Commissioning	Multiple beams (RF Separation)	Tune-mode*	Any	Acc II	Acc III

*Tune-Mode beam is ensured by hardware and administrative methods.
Hardware Methods:
1) beam current monitor in injector set to trip at 20 uA CW
Administrative Methods:
1) button for CW disabled in software for operators
2) software controls for duty factor less than 2%
3) beam authorization form limiting beam to "tune mode" only

Phase 2 will be conducted in one-step and will focus on the following areas in the assignment matrices represented below:

Place Holder for Phase 2 - Assignment Matrix, January 2014.

3.4.3 Phase 3

Table 4 below lists the critical operational parameters for ARR Phase 2 and for commissioning activities subsequent to DOE Site Office approval.

Table 4 - Operating Parameters for ARR Phase 3 Commissioning and Operations

ARR Phase	Beam Termination	Beam Mode	Beam Energy (GeV)	Earliest Run Period	Planned Run Period
ARR Phase III	Hall-A High Power Dump	CW	1 < E< 11.5	Acc II	Acc III
	Accelerator to Tagger Dump	CW	5.5 < E < 12.5	Acc III	Acc III
	Accelerator Multiple Beams	CW	Any	Acc III	Acc III
Post ARR Phase 3					
Operation	Operations within the approved Accelerator Safety Envelope				

Phase 3 will be conducted in one-step and will focus on the following areas in the assignment matrices represented below:

Place Holder for Phase 3 - Assignment Matrix, June 2014.

4.0 Accelerator Readiness Review Conduct

4.1 Methodology

The general method for evaluating systems (including supporting documentation, procedures, and training) is to verify that specific Criterion for Readiness (CRAD) have been met by following supporting Lines of Inquiry (LOI). CRADs and LOIs in Appendix 3 are associated with pre-requisite documentation; Appendix 4 provides a summary of major systems that the lab requires as part of the ARR; and Appendix 5 provides information the lab considers valuable to the ARR Team. The systems in Appendix 5 and their associated processes will be selected by the ARR Team using a graded approach on the basis of presentations, field observations, or personnel interviews. Jefferson Lab will have the resources available to include additional elements into the CRADs and supporting LOIs on the basis of input from the ARR Team.

4.1.1 Presentations

Systems/subject matter experts (SME) will present an overview of accelerator facilities and subsystems. Each SME will describe the function and hazards of a designated system. When a system interfaces with one or more credited controls identified in the ASE, the credited control(s) and the nature of the interface will be described.

The SMEs will also present or refer to evidence that equipment was installed and functionally tested, properly documented, and resources and procedures are in place, in order to ensure that the system can be maintained and operated as intended.

4.1.2 Field Evaluations

Team members will conduct field evaluations to inspect a sampling of installed credited controls along with the evidence that they are indeed fully operational, documented, and that training has been developed and implemented, or is on schedule. A graded approach will be used to select the systems and processes.

4.2 Recordkeeping

A computer documentation system is provided to support the ARR Team. It is located at https://misportal.jlab.org/arpt. The system is linked to the results of pre-Hot Checkout reviews where SMEs certify readiness of their system(s) and link evidence to support this claim. The ARR team can access the system, inspect the certification and documentation, and verify or question the SME(s). The tool is supported by the Quality Assurance/Continuous Improvement (QA/CI) Department in Environment, Safety, Health, and Quality (ESH&Q) Division and the Management Information System (MIS) Department.

4.3 Reporting

The ARR Team will provide a report to the Laboratory Director determining whether the lab is ready to commission the accelerator and will include findings, deficiencies, or recommended activities prerequisite to commissioning. The report will address the presented CRADs, associated LOIs, and document the ARR Team's activities.

5.0 Abbreviations, Acronyms, and Definitions

Abbreviation	Definition	Page
ARR	Accelerator Readiness Review	Cover
ASE	Accelerator Safety Envelope	2
CAS	Contractor Assurance System	2
CEBAF	Continuous Electron Beam Accelerator Facility	1
CRAD	Criterion for Readiness	17
DOE	Department of Energy	1
ESH&Q	Environment, Safety, Health and Quality	18
HCO	Hot Checkout	11
ICP	Integrated Commissioning Plan	70
LOI	Lines of Inquiry	17
MCC	Machine Control Center	6
MIS	Management information System	18
O	Order	1
QA	Quality Assurance	2
QA/CI	Quality Assurance/Continuous Improvement	18
SAD	Safety Assessment Document	3
SCMB	Safety Configuration Management Board	2
SME	System/Subject Matter Expert	17
TJSO	Thomas Jefferson DOE Site Office	2
USI	Unreviewed Safety Issue	2

Other Useful Terms:

6MSD – Six-month shutdown, May 2011–Nov 2011. This planned shutdown, which interrupted the 6 GeV physics program, provided a window to begin installation and preparation for the 12 GeV program.

ABIL (Accelerator Bypassed-Interlock Log) – A web-based log that lists bypassed interlocks presently installed in accelerator systems. ABIL also includes the policy and process that defines how interlocks must be bypassed.

AOD (Accelerator Operations Directives) – A document that provides directives for those who operate and maintain the CEBAF accelerator and the associated beam-delivery systems. Required control room staffing levels and critical event response protocols are included.

Accelerator Operations Directives (AOD) Supplement for 12 GeV Commissioning – A document that supplements the existing AOD by providing 12 GeV commissioning-specific details.

ARR (Accelerator Readiness Review) – A required, structured review process to verify that hardware, personnel, and procedures associated with commissioning or routine operations are ready to permit the activity to be undertaken safely (DOE Order 420.2C). At the completion of the ARR process, the Laboratory Director will authorize beam operations, and the DOE site office will concur via a formal letter to the Director of Accelerator Operations.

ASE (Accelerator Safety Envelope) – An overarching safety document, published in accordance with the DOE Accelerator Safety Order that provides bounding conditions and limitations within which the CEBAF accelerator must be operated to assure the safety of workers, the environment, and the public.

ASO (Accelerator Safety Order) – DOE document DOE-420.2c, which addresses accelerator safety.

ATLis (Accelerator Task List) – A web-based work planning tool used to submit, review, approve, and schedule CEBAF maintenance tasks.

ATLis Work Map – A web-based visual tool that depicts work going on around the accelerator site on a day-by-day basis. Descriptive text and icons overlaying a map of the accelerator help identify busy areas and encourage coordination of overlapping tasks.

Beam Authorization Form – Must be completed and entered into the CEBAF electronic logbook by the Director of Accelerator Operations before running beam in an accelerator segment.

Beam Test Plans – Beam Test Plans are generally single-use procedures written by system experts to test specific accelerator operating parameters and to gather test data during beam operations. Test plans are written, submitted, and approved using an on-line form that is a part of the web-based ATLis work planning system. During 12 GeV commissioning, Beam Test Plans will be used to supplement the Commissioning Plan and standard operating procedures.

BELS (Beam Envelope Limit System) – BELS is designed to ensure that CEBAF does not exceed its operations and safety envelopes for combined beam power. The system measures beam current and energy at each destination, combining the results and alerting operators well in advance of any shutdown action needed to avoid exceeding the envelopes. BELS has the ability to shut off beam itself, if necessary.

BSY Dump – A beam dump in the beam switchyard area of the accelerator (located just upstream of Halls A, B, and C). Beam must pass through the upstream portion of the Hall C line to reach the BSY Dump.

B-Team (Beam Transport Team) – The group responsible for meeting 12 GeV beam transport and beam specification goals. During beam commissioning, this group will provide an accelerator scientist on all shifts to participate in moving the program forward.

C100 – The newest cryomodule design; 7-cell cavities designed to provide 100 MV/m of acceleration. Ten C100s are added for 12 GeV.

C20 – The earliest style of cryomodule; 5-cell cavities designed to provide 20 MV/m of acceleration.

C50 – Reworked and upgraded 5-cell-design cryomodules; designed to provide 50 MV/m of acceleration.

CAB (Commissioning Advisory Board) – A 12 GeV commissioning high-level oversight body that conducts periodic reviews of the 12 GeV commissioning program and makes appropriate recommendations to the Commissioning Planning Team (CPT).

CAM (Cost Account Manager) – Manages costs for a specific accelerator system, area, or project.

CAS (Contractor Assurance System) – DOE-required internal system to manage Jefferson Lab performance consistent with contract requirements.

CASA (Center for Advanced Studies of Accelerators) – An organization of scientists and technical personnel with the broader goal of pursuing a program of theoretical and experimental research in accelerator and beam physics. A subset of this group comprises the B-Team, with responsibility for meeting 12 GeV beam transport and beam specification goals.

CED (CEBAF Element Database) – A database that defines all operational elements of the accelerator, both in the tunnel and in the service buildings.

CHL (Central Helium Liquefier) – Helium refrigerator located inside the accelerator ring; provides cooling for super-conducting components.

CMP (Configuration Management Program) – Establishes consistency among design requirements, physical configuration, and documentation (including analysis, drawings, and procedures) for the activity, and maintains this consistency throughout the life of the facility or activity, particularly as changes are being made.

CPT (Commissioning Planning Team) – Develops, coordinates, and ensures the execution of the commissioning plan and provides close, day-to-day oversight of the accelerator program.

Credited Controls – Credited controls mitigate the hazards identified in the FSAD as posing unacceptable risks and assure the safety of workers, the public and the environment. Credited controls are listed in the ASE.

C-Type dipoles – Large dipole magnets used in the arcs during the 6 GeV era, taking their name from the shape of the steel in the magnets. For 12 GeV, steel was added to these magnets, making them H-type dipoles.

CW Mode Beam – Continuous-wave beam, 100% duty factor.

Focus meetings – Typically held after the 0800 accelerator meeting to pull experts and stakeholders together to focus on a specific problem.

FML (Facilities Management and Logistics) – Jefferson Lab organization responsible for performing or specifying performance of all Jefferson Lab facility maintenance, construction, security, property, and facility services.

FSAD (Final Safety Assessment Document) – This document provides a qualified safety assessment of the hazards specific to CEBAF and defines the measures used to mitigate those hazards to safe levels. The FSAD does not address common industrial hazards.

Gun HV – High voltage supplied to the electron gun in the injector.

H-Type dipoles – Large dipole magnets used in the arcs for the 12 GeV era, taking their name from the shape of the steel in the magnets. Steel was added to the 6 GeV C-type magnets, making them H-type dipoles with greater bending strength.

HCO (Hot Checkout) – The period immediately before beam operations when required systems are systematically checked without beam. The Restoration Coordinator (RECO) coordinates HCO activities.

ISMS (Integrated Safety Management System) – ISMS is a safety management system established to systematically integrate safety into management and work practices at all levels of the organization.

LCW (Low Conductivity Water) – Specially purified water is used to hold accelerator components at a consistent temperature.

LLRF – Low-level RF controls for cryomodule control systems.

LSD (Long Shutdown) – The primary 16-month 12 GeV installation period, May 2012–Sept. 2013.

MAC Training – MAC (machine access control) Training is a subset of the standard Crew Chief/Operator training that must be taken by accelerator scientists or technical personnel who, when beam is present in the accelerator, need to make control system changes that will affect beam transport.

Moodle – A web-based, open source learning management system used by MCC Operations to deliver Operator, Crew Chief, and MAC training.

MPS (Machine Protection System) – Software/hardware that protects equipment from damage by beam operations. Includes the BLM (beam loss monitoring), BCA (beam current accounting), and FSD (fast shutdown) systems.

PD (Program Deputy) – Staff appointed by the Director of Accelerator Operations to serve for a two-week period, during which they are responsible for the hands-on direction of the accelerator program, including publishing a PD Shift Plan for all shifts, maintaining the shift-by-shift operating schedule, and running the 0800 Daily Summary Meeting.

PSS (Personnel Safety System) – Software/hardware system of access control, interlocks, and warning devices dedicated to personnel protection from hazards associated with CEBAF accelerator operation.

R100 – An early seven-cell-design cryomodule, designed to provide 100 MV/m of acceleration. The single cryomodule of this design is located in the injector. The R100 design was superseded by the next-generation C100 cryomodule.

RECO (Restoration Coordinator) – Coordinates hot checkout, the period immediately before beam operations when required systems are systematically checked without beam.

SAD Calendar – A web-based calendar used to schedule activities during scheduled accelerator downs. During the LSD, the SAD calendar is used by the Operability Group to plan day-to-day maintenance and installation activities.

Songsheets – Accelerator drawings maintained by the Mechanical Engineering Division that show the beamline and all major beamline components.

SRL (Skill Requirements List) – A web-based tool used lab-wide to define required training for each employee.

TJSO (Thomas Jefferson Site Officer) – Primary DOE representative at Jefferson Lab Site Office.

Tune Mode Beam – Low power, low duty factor (1.5%) beam with a 250 μs, 60 Hz pulse structure used to tune the accelerator during commissioning. All insertable dumps are capable of safely absorbing this power level.

USI (Unreviewed Safety Issue) – An accelerator safety issue that presents a significant safety risk and was not previously identified, analyzed, and already mitigated as documented in the FSAD.

Viewer Limited Mode Beam – A very low duty factor beam mode that is automatically enabled when an insertable device (e.g., a beam viewer) is inserted into the beam path.

YR magnet – Septa magnets used in the accelerator spreaders and recombiners.

Appendix 1: Laboratory Director Communication to ARR Team

Jefferson Lab
Thomas Jefferson National Accelerator Facility
Exploring the Nature of Matter

May 29, 2013

Dear Team Member,

Thank you for agreeing to assist Jefferson Lab as a member of the Accelerator Readiness Review (ARR) Team. The members of the ARR Team will determine if the CEBAF Accelerator Facility, subsequent to the 12 GeV energy upgrade, is prepared to undertake commissioning activities and to operate consistent with the requirements of DOE O420.2C, Safety of Accelerator Facilities. Consequently, the ARR Team will verify that the personnel, documentation, and equipment are adequate to support proposed CEBAF Accelerator activities in a safe and efficient manner. The review will be based on the ARR Plan for 12 GeV Commissioning and Operations. This plan, along with other key documents, will be provided to you in advance.

The ARR will take place in several phases; the first phase is scheduled in late August, 2013. This first phase will evaluate two things: 1) the labs overall approach to the ARR process and any prerequisite documents and activities, and 2) as mentioned above, readiness to commission the newly upgraded CEBAF Accelerator based on a review of documentation, key programs and processes, a focused review of key systems and activities, and an overview and sampling of the full scope of the proposed commissioning activities. The ARR Team Charge for Phase 1 is attached to this letter.

I look forward to any insights and recommendations regarding the lab's readiness to commission and operate its upgraded accelerator facility. Bob May will facilitate the ARR process, provide you with advance copies of documents, and ensure you have access to the tools and information you need. Thank you in advance for your help.

Sincerely,

Hugh Montgomery

Cc: Joe Arango
Bob McKeown
Mike Dallas
Claus Rode
Allison Lung
Leigh Harwood
Andrew Hutton
Fulvia Pilat
Arne Freyberger
Rolf Ent
Patrizia Rossi
Rusty Sprouse
Mary Logue
Paul Collins

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Jefferson Lab
Thomas Jefferson National Accelerator Facility
Exploring the Nature of Matter

DRAFT Charge, ARR Phase 1

The members of the Accelerator Readiness Review (ARR) Team will determine if the CEBAF Accelerator, subsequent to the 12 GeV energy upgrade, is prepared to safely undertake commissioning consistent with the requirements of DOE O420.2C, Safety of Accelerator Facilities. The ARR Team will verify that the personnel, documentation, and equipment are adequate to support the scope of proposed commissioning activities. The ARR Team will base the determination on the ARR Plan for Accelerator Commissioning, a review of key documentation and programs, focused review of systems and activities, interviews of staff, and an overview and sampling of the full scope of the proposed commissioning activities.

Key documentation will be provided to the ARR Team in advance: the ARR Plan for Accelerator Commissioning, a complete and up-to-date Safety Assessment Document (SAD), an approved Accelerator Safety Envelope (ASE), procedures for evaluating and resolving Un-reviewed Safety Issues (USI), a functional description of the laboratory's Contractor Assurance System (CAS) and the Configuration Management process, and the Beam Commissioning Plan.

Based on criteria in the ARR Plan for Accelerator Commissioning, the ARR Team will determine if the necessary accelerator safety program elements, consistent with the accelerator order and current draft guidance, are incorporated as part of the commissioning process:

1. Commissioning and routine operational procedures necessary for the safe operation of the activity have been developed, reviewed, and approved, and an appropriate process for the development, review, and approval of new and revised procedures is in place.
2. Procedures to deal with abnormal and emergency situations have been prepared, reviewed, and approved for use.
3. Records important for pre-operational, operational, and post-operational activities are adequately managed and controlled.
4. Equipment and systems having safety significance meet criteria established in the SAD and are fully operational and are managed as part of the laboratory's configuration management process.
5. Training and qualification programs necessary for safe accelerator operations are in place in compliance with the ASO and JLab Integrated Safety Management (ISM) program.
6. Staffing requirements specified in the ASE are met.

The ARR team will develop a report to document their review of these elements. The report will be based on the scope above and review criteria established in the ARR Plan for Accelerator Commissioning. In the report, the Team shall make a recommendation to the Jefferson Lab Director as to whether the lab is ready to commission the accelerator and include any findings, deficiencies, or recommended activities prerequisite to commissioning.

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Appendix 2: Links to Pre-requisite Documentation

Document	Jefferson Lab Document Title	Location
Safety Assessment Document	Thomas Jefferson National Accelerator Facility Final Safety Assessment Document Revision 7, August 27, 2012	https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-21395/FSAD%20REV%207%20%28110512%29.pdf
Accelerator Safety Envelope	Thomas Jefferson National Accelerator Facility Accelerator Safety Envelope Revision 7, November 1, 2012	https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-62667/ASE%20REV7%20%28Dated%20110112%29.pdf
Unreviewed Safety Issues	Identifying USI Procedure	M:\scmb\0Logistics\Identifying USI Procedure.rtf
	SCMB USI Screening	M:\scmb\0Logistics\ SCMB USI Screening.docx
Contractor Assurance System	Jefferson Science Associates, LLC, Contractor Assurance System Description for the Thomas Jefferson National Accelerator Facility, September 2012	https://misportal.jlab.org/InsightWebProject/docushareDownload/Approved_CAS_Program_Description.pdf?handleIndex=41240&fileName=Approved_CAS_Program_Description.pdf
Safety Configuration Management	Configuration Management Governance Procedure, QA44	https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-49425/Config%20Mgmt%20%28Smith%2012-14-11%29%20posted%20version%201-5-2012.docx
	Supplemental QAP for 12 GeV CEBAF Upgrade	https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-23922
	Conduct of Engineering Manual ENG-AD-01-001 Revision A	M:\scmb\0Logistics\ ENG-AD-01-001 - Conduct of Engineering Manual - rev A.docx
Commissioning Plan	Under development	

Appendix 3: Prerequisite Documentation

Each pre-requisite document undergoes a review based on specific LOIs. The status of each LOI and supporting evidence is identified. If the document meets all of the LOIs and is supported by sufficient evidence, the document is considered verified and ready for commissioning activities.

- Safety Assessment Document (SAD)
- Accelerator Safety Envelope (ASE)
- Unreviewed Safety Issues (USI)
- Contractor Assurance System (CAS)
- Safety Configuration Management (SCM)
- Commissioning Plan (CP)

A3.1 Safety Assessment Document (SAD)

Objective:

Validate that there is a current, approved SAD that supports safe and effective 12 GeV accelerator commissioning and operations. Validate that the requirements in the SAD are fully understood. Validate that there is an effective process to maintain the accuracy of the information contained in the SAD.

Criteria:

There is an approved SAD which serves as an accurate technical basis for accelerator commissioning and operations and supports the requirements in the accelerator safety envelope. The FSAD is understood, implemented, and maintained current.

Approach:

Document Reviews: Review the facility FSAD and approvals.

Staff/Management Interviews: Interview selected staff involved in FSAD preparation and approvals. Discuss FSAD update/development process, involvement of staff and DOE Site Office personnel, and the internal review process. Review general knowledge of accelerator operations staff regarding understanding of FSAD requirements.

Performance Review: Interview selected staff/management involved in facility management and accelerator operations to assess awareness of FSAD requirements and implementation needs.

Performance Demonstrations: Select one or more hazards from the FSAD Hazard Table and, during the course of the ARR, observe that the mitigations specified in the FSAD Hazard Table are implemented as described.

Safety Assessment Document
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. There is an approved FSAD for 12 GeV operations that meets DOE O 420.2C requirements.	**Status:** Thomas Jefferson National Accelerator Facility Accelerator Safety Envelope Revision 7 developed in cooperation with TJSO. Published August 27, 2012 **Evidence:** https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-21395/FSAD%20REV%207%20%28110512%29.pdf – Interview selected management/staff involved in FSAD development	
2. The FSAD is maintained current by a process that routinely compares FSAD content to accelerator operations requirements.	**Status:** **Evidence:** – SCMB Charter, procedures, and records – Select one or more hazards from the FSAD Hazard Table and, during the course of the ARR, observe that the mitigations specified in the FSAD Hazard Table are implemented as described	
3. There is a process to evaluate unanticipated/discovered conditions against known hazards and determine if an update is necessary.	**Status:** **Evidence:** - SCMB Charter, procedures, and records	
4. Operations staff are sufficiently familiar with the FSAD to recognize and implement requirements.	**Status:** **Evidence:** – Interview selected management/staff to determine knowledge of FSAD requirements (include those who must operate under FSAD requirements)	
5. Determine adequacy of FSAD to support commissioning.	Basis for decision	

A3.2 Accelerator Safety Envelope (ASE)

Objective:

Verify that there is a documented accelerator safety envelope (ASE) that meets DOE Order 420.2C requirements.

Criteria:

There shall be properly documented, approved, and effective ASE that will govern accelerator facility commissioning and operations.

Approach:

Record Reviews: Review extant ASE and other supporting documents to verify ASE is complete and has been reviewed and approved by TJSO.

Interviews: Interview TJSO and Jefferson Lab staff to participate in the processes that support the development and approval of the ASE.

Performance Demonstrations: Process discussion/review with selected SCMB Members: propose for SCMB, chartered responsibilities regarding Accelerator Safety Envelope compliance, evaluation of ASE effectiveness, suitability of FSAD technical basis, and possible revisions or addenda to the SAD.

Accelerator Safety Envelope (ASE)
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. A documented ASE must define the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the SAD.	**Status:** Complete Thomas Jefferson National Accelerator Facility Accelerator Safety Envelope Revision 7, Approved by TJSO November 1, 2012 **Evidence:** https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-62667/ASE%20REV7%20%28Dated%20110112%29.pdf	
2. The ASE is submitted to DOE for approval.	See 3.3.1 above	
3. An activity expected to exceed the bounding conditions of the ASE requires DOE approval.	See 3.3.1 above	

LOI	Status/Evidence	ARR Reviewer Notes
4. Any activity violating the ASE must be terminated immediately and be put in a safe and stable configuration (DOE notification is required).	See 3.3.1 above	
5. Any activity that was shut down by DOE must not recommence until DOE approves the activity.	See 3.3.1 above	
6. The ASE must be periodically reviewed to ensure it is maintained current and changes/updates must be supported by safety analysis in the form of a revision or addendum to the SAD.	– Discuss chartered responsibilities for ASE with selected SCMB members – Review recent safety concern	
7. ASE supports accelerator commissioning and operation.	Basis for decision	Sign off

A3.3 Unreviewed Safety Issues (USI)

Objective:

Determine if USI process provides for evaluation of operations and activities with the potential to significantly impact safety of operations. Determine if the USI process establishes a framework to identify modifications to documentation, operations, systems, components, or the addition of new activities that could significantly impact safe operations.

Criteria:

The purpose of the USI process is to:

a. Inform and ensure contractor/ DOE management awareness of proposed changes or new findings that could impact the safety of operations.
b. Provide a structured approach for decision making regarding operations following proposed changes or discovery of as-found conditions.
c. Identify possible changes to the safety analysis supporting the FSAD or the ASE that would follow identification of a USI.

Approach:

Record Reviews: Review Accelerator Operations Directives and Safety Configuration Management Board (SCMB) procedures associated with identifying and evaluating potential USI conditions. Review the process for communicating USI-related

information to contractor/DOE management. Review SCMB records regarding previous USI determinations.

Interviews: Interview selected staff/management regarding their understanding of the USI process and the mechanisms used to communicate USI-related information.

Performance Review: Identify those selected facility activities (e.g. record reviews, walkthroughs, etc.) designed to identify and report potential USI conditions.

Performance Demonstrations: Conduct Table-top discussion with SCMB staff related to a recent safety concern or identified USI.

Unreviewed Safety Issues
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. A documented USI process exists and is based on DOE O 420.2C requirements.	**Status:** Complete **Evidence:** SCMB Charter https://wwwold.jlab.org/ehs/scmb.html – USI Procedure – Interview those involved in USI process development and management – Review history and status of USI process as well as lessons learned – Consider role of USI in relation to safety analysis/FSAD/ASE	
2. Determine if adequate processes exist to identify intended changes or discovered safety issues which may pose unreviewed hazards.	**Status:** **Evidence:** Accelerator Operations Directives http://opsntsrv.acc.jlab.org/ops_docs/online_document_files/ACC_online_files/accel_ops_directives.pdf	
3. Review interface of USI process with facility configuration management program.	**Status:** **Evidence:** Conduct of Engineering Manual https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-21395/FSAD%20REV%207%20%28110512%29.pdf – Conduct Table-top discussion with SCMB staff related to a recent safety concern or identified USI	
4. Determine adequacy of USI process to support commissioning.	Basis for decision	Signoff

A3.4 Contractor Assurance System (CAS)

Objective:

Verify that Jefferson Lab implements 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 single comprehensive site performance management system that promotes safe and effective operation.

Criteria:

Jefferson Lab'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 operational and safety program plans, approval letters, procedures, assessments, and other related facility 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.) to determine program effectiveness. Observe data in corrective action tracking system.

Performance Demonstrations: N/A

Contractor Assurance System (CAS)
Lines of Inquiry, Status and Evidence for Each Criterion

LOI	Status/Evidence	ARR Reviewer Notes
1. CAS provides a comprehensive internal assessment process.	**Status:** **Evidence:** Program Description https://misportal.jlab.org/InsightWebProject/docushareDownload/Approved_CAS_Program_Description.pdf?handleIndex=41240&fileName=Approved_CAS_Program_Description.pdf FY 2013 Integrated Assessment Schedule https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-66232/FY13%20Assessment%20Schedule%20091012%20FINAL.pdf – Interview selected operations and safety staff/ management to assess CAS understanding – Review previous Jefferson Lab CAS program assessments and outcomes.	
2. CAS Program uses external assessment: employs peer reviews and assessments that include accelerator subject matter experts from other accelerator facilities.	**Status:** **Evidence:** – ARR, August 2013 – OHSAS18001 registration	
3. CAS Program integrates ASO requirements and includes a periodic assessment of DOE O 420.2C CRD requirements.	**Status:** **Evidence:** 2010 Accelerator Internal Safety Review https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-29440/MSA%202010-06.pdf – Documents reviewed – Review CATS for findings related to the Accelerator, and review work observations for 12 GeV construction activities. Pick one or two and use them during the walkthrough/visit to the Accelerator to show evidence of tracking and closure of Accelerator-related issues – Assessment Review Report #14827 OFIs or findings from any recent reviews/audits properly dispositioned?	

LOI	Status/Evidence	ARR Reviewer Notes
4. CAS Program supports the Accelerator Readiness Review process.	**Status:** **Evidence:** – ARR conducted under the auspices of ESH&Q with QA/CI support – MOA-2012-136 CATS # MOA 2012-136 – CAS MSA and CRAD/LOIs FY12 Combined.pdf – ARR Program Description – Review staff/ management performance of selected CAS activities	
5. Determine CAS adequacy to support commissioning.	Basis for decision	Sign off

A3.5 Safety Configuration Management (SCM)

Objective:

Verify that there is a Facility Configuration Management Program that is related to accelerator safety. Verify that the configuration management of Credited Controls, system interfaces, and supporting documented processes, procedures, and records are consistent with the DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, SAFETY OF ACCELERATOR FACILITIES (August 2012)**.**

Criteria:

There is a documented configuration management process 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, and commissioning records for Credited Controls. Review records and procedures associated with the maintenance, operations, and function of Credited Controls.

Interviews: Interview Jefferson Lab Engineering Division staff and SCMB members regarding the application of configuration management requirements for Credited Controls.

Performance Demonstrations: Observed the configuration of Credited Controls and compare as-built to configuration-managed engineering drawings. NOTE: This will also

be addressed in Software QA, Operations Training and Qualifications, and ASE equipment inspections.

Safety Configuration Management
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Systems with safety significance are consistently managed with a graded approach using a well-defined program.	**Status:** **Evidence:** – Site wide configuration management process applied on a graded approach to personnel safety systems (PSS) and PSS interfaces	
2. Level of configuration management is prioritized to and appropriate to credited controls.	**Status:** **Evidence:** – Conduct of engineering manual and field practices employ highest level of CM to personnel safety systems (PSS) and PSS interfaces	
3. Design requirements, drawings, actual field configuration remain consistent, documented, and accurate.	**Status:** **Evidence:** – Observe that work planning and control processes identify PSS interfaces – System owners with PSS interfaces trained in maintaining CM for credited controls.	
4. The configuration of Credited Controls is properly managed during accelerator operation and maintenance.	**Status:** **Evidence:** – Conduct of engineering manual change control practices – Safety Configuration Management Board charter, interviews, and table-top application of USI process	
5. The configuration of administrative processes related to Credited Controls (e.g. training, procedures, records etc.) are properly managed.	**Status:** **Evidence:** – Conduct of engineering manual required practices for CM on documents and records	
6. Determine adequacy of CM program to support commissioning and routine operations.	Basis for decision	Sign off

A3.6 Commissioning Plan (CP)

Objective:

Verify that there is a documented Commissioning Plan consistent with the DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, SAFETY OF ACCELERATOR FACILITIES (August 2012).

Criteria:

The Commissioning Plan presents sufficient detail to describe the resources (people, equipment, and procedures), the organization, and the procedures necessary for safe commissioning. The Commissioning Plan must have sufficient internal review and oversight to ensure safe commissioning.

Approach:

Record Reviews: Review the results of the June 6-7, 2013, Directors Beam Commissioning Plan Review.

Interviews: Discuss the Beam Commissioning Plan with Operations Director, Accelerator Operators, Commissioning Advisory Board, and CASA staff, and evaluate their level of integration, how well they understand the commissioning goals and their roles (responsibilities, authorities, etc.). Discuss the disposition of Directors Beam Commissioning Plan Review recommendations.

Performance Demonstrations: Evaluate outcomes of pre-Hot Checkout Reviews. Observe Control Room Procedures, Staffing Plans, and Operations and CASA Training activities where possible.

Commissioning Plan (CP)
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Commissioning Plan fully describes roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out the commissioning/operations and any related documented authorizations.	**Status:** **Evidence:**	

LOI	Status/Evidence	ARR Reviewer Notes
2. Commissioning Plan addresses staffing schedules, authority and reporting chain for operational, safety, and scheduling issues procedures (normal and emergency/contingency), administrative controls, and personnel training (including records and qualification for commissioning at the stated intensity).	**Status:** **Evidence:**	
3. Commissioning Plan identifies or properly references engineered safety systems that will be operable for the accelerator.	**Status:** **Evidence:**	
4. Commissioning Plan identifies the operational characteristics for specific modes of commissioning needed to support the safety case for progressively higher power commissioning.	**Status:** **Evidence:**	
5. Lessons learned from previous shut-down periods are incorporated to improve procedures and identify additional procedures that are needed.	**Status:** **Evidence:**	
6. Evaluate Commission Plan progress to date.	**Status:** **Evidence:** – Select one pre-Hot Checkout Review and follow check group progress with respect to dashboard	
7. Determine adequacy of training program to support commissioning.	Basis for decision	Sign off

Appendix 4: Key Accelerator Systems

Table A4 below provides a summary of major systems that are part of Phase 1, hazards identified in the scope statement, whether the system has been modified such that accelerator function was directly affected, and whether the system has an associated credited control.

Table A4 – Summary of Major Systems that are part of the ARR – Phase 1

Accelerator System(s)	Principal Hazard(s) Addressed	Modification for 12 GeV	Safety Related Documentation	Credited Control in ASE
Facilities	Electrical Fire Pressure/Vacuum Other Mech.	Yes – Hall D Construction		Yes - shielding
Cryogenics	Electrical Other Mech. Pressure/Vacuum Cryogenics Oxygen Deficiency	Yes – Central Helium Liquefier upgrade and Hall D Refrigerator		
Safety System	Radiation Oxygen Deficiency Electrical Magnetic Fields	Yes – extension to Hall D and modifications		Yes – beam containment and access controls
Software	Radiation			No
Magnets	Electrical Other Mech. Pressure/Vacuum Magnetic Fields			No
Instrumentation and Controls	Electrical Radiation			No
SRF/RF Power	Electrical Radiation			Yes

Due to a series of lessons learned from the accelerator community, the following systems all receive specific review: Personnel Safety Systems, Operations, Procedures, and Training. Systems that underwent a significant change during the 12 GeV Upgrade are preferentially reviewed by the ARR Team. Other accelerator systems are to be viewed on a graded approach. The CRADs and LOIs presented in Appendix 5 provide a generic template based on hazards that can be applied to verify each system's readiness.

Appendix 5: CRADs/LOIs for Key Accelerator Systems

The following CRAD/LOI Documents are designed to assess the readiness of key accelerator systems.

A5.1 Accelerator Readiness Review (ARR) Process and Plan

Objective:

Determine that Jefferson Lab, in accordance with the Accelerator Readiness Review (ARR) program, has completed an internal readiness plan in preparation for the ARR. Determine that the Jefferson Lab ARR program and its associated plan provides an effective approach for verifying that hardware, personnel, and administrative systems/programs are ready. Determine that successful completion of the ARR provides adequate basis for DOE approval of operations.

Criteria:

The ARR process should include:

a. A readiness plan identifying those elements of accelerator operations ready for verification by the ARR Team, expected milestones to be achieved, and the process for assuring safe operation;
b. A verification process to ensure accelerator hardware, personnel, and administrative systems/programs are in place and adequate to support safely the full scope of activities proposed for commissioning;
c. An ARR scope that reflects the size, complexity, and hazards associated with the accelerator facility;
d. Verification of compliance with the safety program elements of the CRD for 420.2C and the ASE;
e. Documentation reviews, inspections, management/staff interviews, and attendance at specific operations/ training as appropriate; and
f. A report that adequately documents team activities, review scope, review criteria, review results, and a recommendation on whether the ARR supports approval for operations.

Approach:

Document Review: Review the status of the Jefferson Lab ARR Plan. Review the Jefferson Lab ARR plan, scope and schedule, and CRADs/LOIs to determine adequacy of hardware, personnel, and administrative systems/program readiness review. Review the Jefferson Lab ARR Plan to ensure that it addresses (directly, or by proper reference):

a. Roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out the commissioning;

b. Procedures, personnel training and qualification, and other administrative controls for commissioning at the stated intensity;
c. Engineered safety systems that will be operable for the accelerator and accelerator-associated experimental facilities; and
d. Specific facilities, sub-systems, and modes of commissioning to be exercised.

Staff/Management Interviews: Interview Jefferson Lab management and Jefferson Lab internal review team members on the Jefferson Lab internal readiness review. Interview management/staff on the scope of ARR preparations. Ensure that the following elements incorporated or referenced in the ARR Plan are effectively understood and implemented at the appropriate organizational level:

a. Reporting chain to whom problems encountered are reported (e.g., operational, safety, scheduling problems);
b. Responsible party who makes the necessary notifications or arrangements for authorizations;
c. Authorizations and training records to be audited; and
d. Number and types of qualified personnel required for commissioning activities.

Performance Review: Perform selected inspections/walkthroughs identified in the ARR Plan to verify that hardware and administrative processes are ready for the appropriate commissioning or operational phase. Engage selected management/staff in interviews/discussions to verify readiness to conduct activities for the appropriate commissioning or operational phase.

Performance Demonstrations: View work evolution involving Control Room and on-call support or maintenance staff for the October ARR.

Accelerator Readiness Review (ARR) Process
Lines of Inquiry, Status/Evidence and ARR Notes

LOI ARR Process	Status/Evidence	ARR Reviewer Notes
1. The Accelerator Readiness Review process includes an ARR plan that identifies those elements of accelerator operations ready for verification by the ARR Team.	– Accelerator Readiness Review Program – CRAD/LOI identified in ARR Plan – Appendices	
2. The ARR process provides for verification that accelerator hardware, personnel, and administrative systems/programs are in place and adequate to support safely the full scope of activities proposed for commissioning.	– Accelerator Readiness Review Program – CRAD/LOI identified in ARR Plan – Appendices	
3. The ARR scope reflects the size, complexity, and hazards associated with the accelerator facility.	– CRAD/LOI identified in ARR Plan – Appendices	

LOI ARR Process	Status/Evidence	ARR Reviewer Notes
4. The ARR provides for verification of compliance with the safety program elements of the CRD for 420.2C and the ASE.	– CRAD/LOI identified in ARR Plan – Appendices	
5. The ARR provides for the review of documentation, inspections, management/staff interviews, and attendance at specific operations/ training as appropriate.	– CRAD/LOI identified in ARR Plan – Appendices	
6. The ARR process provides for a report that adequately documents team activities, review scope, review criteria, review results, and a recommendation on whether the ARR supports approval for operations.	– Accelerator Readiness Review Program	
7. ARR Process verifies readiness to commission.	Basis for decision	Sign off

Accelerator Readiness Review (ARR) Plan
Lines of Inquiry, Status/Evidence and ARR Notes

LOI ARR Plan	Status/Evidence	ARR Reviewer Notes
1. The ARR Plan captures elements 1-6 of the ARR process outlines in the table above.	– ARR Plan	
2. The ARR Plan has sufficient scope and development to verify hardware, personnel, and administrative system/program are in place to support safely the full scope of activities proposed for commissioning.	– ARR Plan Appendices with CRAD/LOI documents regarding hardware, personnel, and administrative system/programs	
3. The ARR Plan provides for the review of Contractor Assurance System; Configuration Management; Quality Assurance; and Commissioning Plan.	– CRAD/LOI identified in ARR Plan – Appendices	
4. The ARR Plan specifies engineered safety systems that will be operable for accelerator commissioning.	– ARR Plan Appendix for Credited Controls in ASE	

LOI ARR Plan	Status/Evidence	ARR Reviewer Notes
5. The ARR Plan specifies or makes proper reference that specify roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out commissioning.	– A specific CRAD/LOIs is developed for each and that the CRAD/LOIs have elements that provide for verification that the systems are performing as intended	
6. The ARR Plan provides for the verification that affected staff understand the scope of the ARR and the necessary preparations	– CRAD/LOIs contain provisions for inspections/walkthroughs or participation in discussions with subject matter experts to determine the hardware and administrative processes readiness	
7. The ARR Plan provides for verification that procedures, personnel training and qualification, and other administrative controls for commissioning at the stated intensity	– CRAD/LOIs contain provisions for evaluation of procedures, personnel training and qualification, and other administrative controls	
8. The ARR Plan supports activities to verify readiness to commission	Basis for decision	Sign off

A5.2 Work Planning and Control

Objective:

Determine that Jefferson Lab has an effective work controls program consistent with both DOE and contractor requirements. Determine that Jefferson Lab 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 Jefferson Lab configuration management program.

Criteria:

The Jefferson Lab work control program should include:

a. Approved work plans for proposed work, particularly those systems with safety significance;
b. Review of proposed work and approval/authorization before starting;
c. Work assignments only for qualified and authorized personnel;
d. Management validation of work for completeness and functionality;
e. Document control of the program and any updates/revisions as necessary; and
f. Effective communication of information on controlled work scope.

Approach:

Document Review: Review Jefferson Lab work control program documentation. Review selected work control procedures on those accelerator systems associated with engineered controls.

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

Performance Review: Assess process for communicating work status and any modifications to work controls. Review work processes to determine if work was properly completed and whether lessons learned were developed.

Performance Demonstrations: Attend selected operations/maintenance activities performed under specific work controls. Interview operations/maintenance staff regarding the process to update or revise procedures if work scope changes.

Work Planning and Control
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Work planning approach employs ISM: Integrates safety into work planning.	**Status:** **Evidence:** – Review program to develop, manage, update, and revise Jefferson Lab work controls – Review Jefferson Lab work control program documentation	
2. Work planning includes graded approach to hazard controls and work approval/authorization based on the hazard.	**Status:** **Evidence:** – Review work planning and integration tools – Review applicable portions of ESH Manual	
3. Work hazards are effectively identified.	**Status:** **Evidence:** – Observe work practices and compare with work planning and control documents	

LOI	Status/Evidence	ARR Reviewer Notes
4. Work hazards are effectively mitigated.	**Status:** **Evidence:** – Observe radiological work planning for ALARA – Use of hierarchy of controls – Implementation of ALARA	
5. Training is an integral part of work hazard mitigation.	**Status:** **Evidence:** – Review selected training records	
6. Proposed work on safety systems is properly evaluated and pre-approved.	**Status:** **Evidence:** – Review selected qualifications and authorizations	
7. Management verifies work for quality, completeness, functionality, etc.	**Status:** **Evidence:** – Interview selected management/staff on their role in the work control program	
8. Work documents are controlled, updated/revised as necessary.	**Status:** **Evidence:** – Review selected safety procedures	
9. There is effective communication, especially for scope changes.	**Status:** **Evidence**: – Discuss work control program with selected management and workers regarding communicating changes in work controls	
10. Work controls program supports commissioning and operations.	Basis for decision	Sign off

A5.3 Lessons Learned Program

Objective:

Determine that Jefferson Lab has an effective program to identify Jefferson Lab routine or non-routine occurrences that would serve as a valuable lessons learned internally or to other DOE and non-DOE organizations. Determine that Jefferson Lab implements an effective program to access and utilize relevant lessons learned from other DOE facilities and non-DOE industrial or academic organizations. Determine that Jefferson Lab has a systematic program to disseminate lessons learned within Jefferson Lab and communicate to other DOE laboratories as warranted.

Criteria:

An effective lessons learned program is comprised of the following elements:

a. A coordinated site-wide program to identify those routine and non-routine Jefferson Lab occurrences that elevate to the level of a valuable lessons learned for the Jefferson Lab site as well as other DOE facilities;
b. A systematic process to access lessons learned at other DOE and non-DOE facilities that of value for Jefferson Lab; and
c. A program to effectively disseminate Jefferson Lab lessons learned and lessons learned from other sites to those Jefferson Lab management/staff best suited to utilize the information.

Approach:

Document Review: Review Jefferson Lab lessons learned program documentation and procedures. Review selected examples of lessons learned previously disseminated to Jefferson Lab management/staff. Review Jefferson Lab actions taken in response to selected lessons learned.

Staff/Management Interviews: Interview Jefferson Lab lessons learned coordinator and selected management on their role in the Jefferson Lab lessons learned program. Interview selected staff regarding their access to and benefits from the lessons learned program.

Performance Review: Participate in a discussion with selected management/staff to address the effectiveness of the Jefferson Lab lessons learned program and the criteria for identification of valuable lessons learned.

Performance Demonstrations: N/A

Lessons Learned Program
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Jefferson Lab lessons learned program procedures and documents to verify coordinated site-wide program.	– Review program procedures – Review criteria for identifying lessons learned – Review lessons learned documents/records	
2. Verify that the program identifies routine and non-routine Jefferson Lab occurrences that elevate to the level of lessons learned.	– Review selected lessons learned recently evaluated and distributed	
3. Verify that the program identifies and evaluates lessons learned at other DOE and non-DOE facilities.	– Interview Jefferson Lab lessons learned coordinator – Discuss role in the Jefferson Lab lessons learned program	
4. Verify that there is a Jefferson Lab program to effectively disseminate lessons learned to those best suited to use the information.	– Interviews with selected Jefferson Lab management/ staff/subject matter experts regarding their systems	
5. Verify that recent external accelerator-based lessons learned have been effectively evaluated and incorporated into current Accelerator Readiness Review.	– Interviews with selected Jefferson Lab management/ staff/subject matter experts regarding their systems – Review effectiveness of lessons learned program based on materials presented	
6. Lessons learned processes effectively support commissioning and operations.	Basis for decision	Sign off

A5.4 Software QA

Objective:

Verify that accelerator and safety system software used to control the accelerator is developed according to standards and protocols that provide adequate protection from conditions that could exceed requirements in the Accelerator Safety Envelope.

Criteria:

There is a documented program and associated processes that provide suitable quality assurance for computer software programs used to control accelerator functions. The quality assurance processes should be based on current industry best practices. Quality

assurance processes should provide protection from software based errors that can result in a failure of accelerator protection systems or processes.

Approach:

Record Reviews: Review software design processes, post installation software performance data (e.g. error logs), requests for software maintenance, etc. Review risk-based software grading process and documentation commensurate with grading level and procedures applied.

Interviews: Interview Jefferson Lab Computer Engineering and Safety Systems Group staff regarding the effectiveness of quality assurance processes in the design and use of accelerator and safety system controls software. Interview software end users.

Performance Demonstrations: Observed installed software function for safety related applications, evidence of real-time function, and evidence of performance such as automated logging.

Software QA
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. The development of accelerator controls and safety system software is governed by applicable standards.	**Status:** **Evidence:**	
2. The applicable standards require, at a minimum: a) written requirements or specifications b) software version management c) documentation	**Status:** **Evidence:**	
3. Accelerator controls and safety system software have accurate configuration information from users/system owners for device control and data translation.	**Status:** **Evidence:**	
4. There are resources that allow controls and safety system software to be tested before implementation.	**Status:** **Evidence:**	
5. The interface for programmers needing information or analysis data is controlled.	**Status:** **Evidence:**	
6. Software users are adequately trained and authorized depending on the level of control afforded by accelerator and/or safety system software before being allowed access.	**Status:** **Evidence:**	

LOI	Status/Evidence	ARR Reviewer Notes
7. There is an adequate user feedback mechanism to resolve software issues.	**Status:** **Evidence:**	
8. Accelerator controls and safety system software are configuration managed.	**Status:** **Evidence:**	
9. There are adequate personnel resources to maintain the accelerator controls and safety system software applications. Personnel are trained and authorized.	**Status:** **Evidence:**	
10. There are adequate fiscal resources to maintain accelerator controls and safety system software applications.	**Status:** **Evidence:**	
11. There is adequate infrastructure to maintain and support accelerator controls and safety system software applications.	**Status:** **Evidence:**	
12. Software QA supports activities related to accelerator commissioning and operation	Basis for decision	Sign off

A5.5 Cyber Security

Objective:

Verify adequate protection of the confidentiality, integrity, and availability of data processed in accelerator control systems and safety systems. Verify that these systems are identified and adequately mitigated from the standpoint of risks with the potential to create conditions exceeding the accelerator safety envelope.

Criteria:

There is a documented cyber-security program and associated processes and equipment that provide a suitable graded risk management approach to mitigate risks for data processed by system hardware and software used to control accelerator functions. The cyber-security program, processes, and equipment should be based on current NIST and DOE recommended standards and practices, as well as accepted good practice at other DOE Office of Science accelerator facilities. The cyber-security program and its processes and equipment should protect against unintended actions by laboratory users and staff as well as intentional tampering by internal and external actors. The cyber security program should also include continuously monitoring and forensic functions to identify and react to potential cyber intrusions.

Approach:

Record Reviews: Review plans, equipment specifications, installation and test procedures and results, internal controls, and performance data.

Interviews: Interview Jefferson Lab staff regarding the operation and maintenance of cyber-security equipment and processes.

Performance Demonstrations: Observe installed equipment, evidence of real-time function, and evidence of performance such as automated logging of hardware self-checks and faults or security challenges.

Cyber Security
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1 There is a plan that addresses cyber security on a site-wide basis and specifically for accelerator controls.	**Status:** Complete **Evidence:** https://cc.jlab.org/cert10/pdf/site-cspp.pdf https://cc.jlab.org/cert10/pdf/ac-secplan.pdf	
2 The cyber security risk assessment for accelerator controls adequately identifies threats and vulnerabilities specific to the operating environment.	**Status:** **Evidence:** – Cyber Security Risk Assessment – Documentation	
3 The cyber-risk assessment for accelerator controls adequately identified risks and counter measures to reduce risks to an acceptance level.	**Status:** **Evidence:** – Cyber Security Risk Assessment – Documentation	
4 There is an authority to operate the system used to control accelerator functions within acceptance risks.	**Status:** **Evidence:** – System Security Test and Evaluation plan – An Authority- to-Operate the system memo issued from the TJSO Authoring Official	

LOI	Status/Evidence	ARR Reviewer Notes
5 The cyber-security plan incorporates the following recommended practices and protocols: a. defense-in-depth by layering b. physical security c. network segmentation and isolation d. Internal/ external fire-walling e. mitigation of insecure processes and protocols f. access control from on and off-site g. authentication management h. user auditing i. configuration management including patches j. monitoring and use analysis k. vulnerability scanning and periodic l. Incident Response/Contingency Planning m. Control of external media devices n. Remote access	**Status:** **Evidence:** – System Security Plan	
6 There are adequate personnel resources to maintain the cyber-security program and processes: a. personnel are trained and authorized	**Status:** **Evidence:** – Site CSPP Roles and Responsibilities – Information Security Site Manager – Information System Security Officer – System Administrator – Incident response personnel	
7 There are adequate fiscal resources to maintain the cyber-security program equipment through near-term software and hardware upgrades	**Status:** **Evidence:** – Exhibit 53 or 300 or similar management and investment information for system hardware and software used to control accelerator functions.	
8 There is adequate infrastructure to maintain and support cyber-security for accelerator controls.	**Status:** **Evidence:** – Cyber System Security plan – Internal Network Segmentation – Network Perimeter Protection	
9 Software QA supports activities related to accelerator commissioning and operation.	Basis for decision	Sign off

A5.6 Operations Training and Qualification Program

Objective:

Verify that Jefferson Lab has developed and is implementing an effective accelerator operations training program consistent with DOE O 420.2C requirements.

Criteria:

DOE O 420.2C requirement (in a.) and guidance suggests that the site training program provide:

a. Clearly defined roles and responsibilities for accelerator activities;
b. A description of the overall operations training program and its relationship to the lab-wide training process;
c. Training for operators that includes the training normally provided for individuals who work in and around the accelerator facility based on site safety programs, site hazards, and emergency procedures;
d. Training for operators includes specific training and qualification for beam control and delivery, as well as systems that control access to the accelerator enclosure (credited controls);
e. Training for operators includes specific training and qualification for activities shared by operators that support maintenance and diagnostic duties (to include job-specific procedures and controls); and
f. Ongoing monitoring of personnel training program to assess overall effectiveness and support continuous improvement.

Approach:

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

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

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

Performance Demonstrations: Observe training event or training verification event in so far as possible. Otherwise, engage in panel discussion on the plans for bringing operations staff back from the field and retraining/requalification.

Operations Training and Qualifications Program
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. There is a documented training and qualification process designed to ensure operator competence for operations personnel.	– Review Jefferson Lab site training program documentation and procedures – Interview Jefferson Lab Training and Performance Manager or associated staff regarding program – Review Operator Training program	
2. Operator training and qualification process includes clearly defined roles and responsibilities for accelerator operational activities.	– Review Operator Training program	
3. Operator training and qualification process considers applicable physics and engineering principles.	– Review Operator Training program	
4. Operator training and qualification process includes specific training and qualification for beam control as well as systems that control access to the accelerator enclosure (credited controls).	– Review training approach with respect to individual responsibilities regarding SAD, ASE, and USI	
5. Operator training addresses normal and abnormal condition and emphasizes development of diagnostic skills for early recognition of abnormal conditions.	– Review Operator Training program for applicable emergency procedures Interview selected Jefferson Lab personnel regarding training	
6. Operator training includes training that is normally provided for individuals who work in and around the accelerator, such as ODH, RadCon, etc.	– Review use of facility or hazard specific training modules – Attend/review selected training modules – Interview selected Jefferson Lab personnel regarding training – Observe selected job assignments and compare with job-specific training	
7. Training program incorporates periodic testing and performance checks, and re-qualification requirements.	– Review Operator Training program documentation – Interview selected Jefferson Lab operations personnel regarding training	
8. Operator training, documentation includes auditable records of training received.	– Interview selected Jefferson Lab operations personnel regarding training – Observe Operator Training records	
9. Determine adequacy of training program to support commissioning.	Basis for decision	Sign off

A5.7 Operations Procedures

Objective:

Determine that Jefferson Lab has an effective operational procedures program consistent with DOE and contractor requirements. Determine that the Jefferson Lab operational procedures program addresses the accelerator operations with safety significance. Determine that Jefferson Lab procedures are controlled complete with processes for regular updates and revisions. Determine that procedural updates and revisions are effectively communicated consistent with the Jefferson Lab 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. Be controlled documents with specific attention to those procedures that reflect ASE requirements.

Approach:

Document Review: Review Jefferson Lab procedures program documentation. Review selected operational procedures with safety significance.

Staff/Management Interviews: Interview Jefferson Lab procedure manager(s) on procedures program. Interview selected Jefferson Lab 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.

Performance Demonstrations: N/A

Operations Procedures
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Review Jefferson Lab procedure program documentation.	**Status:** **Evidence:** – Review process to develop, document, control, update, and revise Jefferson Lab operational procedures.	
2. Interview Jefferson Lab procedure manager(s) regarding program.	**Status:** **Evidence:** – Discuss with process of ensuring that procedure creation, updates and revisions are effectively communicated – Discuss process for procedures management supporting ASE requirements	
3. Interview selected management/staff on their role in the Jefferson Lab operational procedure program.	**Status:** **Evidence:** – Discuss with 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. Observe selected job assignments with job-specific procedures.	**Status:** **Evidence:** – Observe operator execution of PSS certification procedure – 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	
5. Determine adequacy of procedure program to support commissioning.	Basis for decision	Sign off

A5.8 Industrial System Safety (ISS)

Objective:

Jefferson Lab uses industrial (electrical/mechanical) systems to support accelerator operations. These systems present hazards. Determine that the process for managing hazards, addresses the full range of hazards associated with the system, from the initial stages of design/modification through installation and operational checkout. Determine that the industrial hazards are effectively integrated into accelerator work planning and control processes. Determine that the Jefferson Lab ISS incorporate lessons learned from previous accelerator operations or external events.

Criteria:

Systems with industrial safety considerations are:

a. Designed with industrial hazard mitigations in place where possible;
b. Documented such that systems, their interfaces and dependencies, are well understood;
c. Well understood and controlled using best industry practices and lessons learned;
d. Effectively integrated with laboratory work planning and control program; and
e. Effectively integrated with accelerator operations

Approach:

Document Review: Review design specifications, if applicable. Review system documentation. Observe operational safety procedures, bench-top procedures, etc. to verify industrial hazards from routine and non-routine (trouble-shooting, maintenance, repair) operations are properly addressed. Determine if system documentation, associated training, provides an effective operations interface.

Staff/Management Interviews: Interview subject matter experts on their participation in the repair, maintenance, or upgrade to their systems. Discuss the industrial hazards associated with their systems and how those hazards are mitigated with; focus on changes that meet the hazards associated with accelerator commissioning or operations following the 12 GeV upgrade.

Performance Review: Perform facility/building walkthrough and inspection activity on selected equipment with focus on upgraded or new systems/equipment. Performance options include observing selected work activities such as system installation, ongoing maintenance and repair, or observing system operation. Conduct workplace discussion with staff regarding changes to or additional hazards associated with system upgrades.

Performance Demonstrations: Observing on-going work on the system or observe field activity to properly "safe" the system before repair/inspection.

Industrial System Safety (ISS)
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Are the industrial hazards of the system well understood?	– Operational Safety Procedures, electronic task list entries for system	
2. Were the hazards of the system considered during the design phase?	– Discuss design efforts to develop systems that interfaces with existing controls – System design and procurement specifications	
3. Does the system design, where possible, use engineered safeguards to minimize industrial hazards during operation?	– Design efforts – Design documents – Observed system features	
4. Is the system design documented?	– Observe design, fabrication, or related documents	
5. Does the system interface to other industrial systems and is that interface documented?	– Observe documentation – Discussion with subject matter expert – Observed system features	
6. Does the system interface to the PSS?		
7. Are the documents available to staff that work on the system?	– Documentation available in the field – Discussion with maintenance, repair, and operation staff	
8. Was the system checked to ensure it performed according to design when it arrived at the lab (or at the point of assembly)?	– Observe receipt inspection and/or test results, if applicable	
9. Are there further operational checks needed before it is placed in service?	– System operational checks, checklists, and signoff	
10. Are there system integration checks needed before the systems is placed in service?	– System operational checks, checklists, and signoff – Demonstration of system operation	
11. Are the hazards of working on (installing, trouble-shooting, repairing, maintaining) the installed system mitigated on the basis of a laboratory industrial safety program?	– Operational Safety Procedures and electronic task list entries for system repairs	

LOI	Status/Evidence	ARR Reviewer Notes
12. Are the hazards of working on the system mitigated as part of an integrated laboratory work planning and control process?	– Review work planning and integration tools – Review applicable portions of ESH Manual – Observe work practices and compare with work planning and control documents	
13. Is the staff that works on the system qualified and are they authorized to conduct work on the system?	– Review qualifications and authorizations	
14. Is the system incorporated into the Hot Checkout Process?	– Review Hot Checkout System documentation	
15. Are there lessons learned from previous operational experience with this system? Have they been implemented?	– Discussions with subject matter experts regarding lessons learned from previous operations and applications to 12 GeV commissioning and operations	
16. Are industrial systems ready to support commissioning?	Basis for decision	Sign off

A5.9 General Radiological Protection Program

Objective:

Determine that Jefferson Lab Radiological Protection Program RPP is formally defined and supports accelerator operations during both routine and non-routine operations. Determine that Jefferson Lab radiological protection program addresses the full range of radiological hazards associated with Jefferson Lab operations. Determine that Jefferson Lab radiological protection program incorporates lessons learned from previous accelerator operations. Determine that Jefferson Lab radiological protection program is effectively integrated into accelerator work planning and control. NOTE: RPP changes to support 12 GeV commissioning and operations are included in an additional CRAD/LOI document.

Criteria:

The Jefferson Lab radiological protection program:

a. Is based on a DOE approved program plan the meets applicable federal statutes;
b. Is formally defined, controlled, and fully implemented laboratory program;
c. Adequately reflects scope of accelerator radiological hazards for prompt ionizing radiation and activated materials;
d. Is effectively integrated with accelerator operations and other safety and health disciplines;
e. Is effectively integrated as part of the laboratory work planning and control process; and
f. Is effective in maintaining radiological exposures to personnel are maintained as low as reasonably achievable (ALARA).

Approach:

Document Review: Review the Jefferson Lab radiological program (RP) to verify that it is in compliance with DOE radiological protection requirements. Review Jefferson Lab documentation to verify that the RP addresses the range of radiological hazards from routine and non-routine operations including credible accident scenarios. Determine if program documentation (procedures, permits, etc.) provides an effective interface with other safety and health disciplines and supports accelerator operations.

Staff/Management Interviews:
Interview the Radiological Program Manager on effectiveness of the current program and the changes in the program to meet anticipated radiological protections. Interview selected management/staff on their interface with the radiological protection program with emphasis on effective communication and program implementation during the upgrade activities.

Performance Review: Perform selected facility/building walk-through and inspections. Participate in a table top discussion to review radiological protection practices to address hazards associated with facility upgrade activities.

Performance Demonstrations: Observe selected work activities such as radiological surveys, monitoring, sampling, job coverage, and radiological support functions as available. Review an activity associated with the performance of Assigned Radiation Monitor (ARM) duties of Accelerator Operations personnel.

General Radiological Protection Program
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Is Jefferson Lab RP based on a DOE approved program plan the meets applicable federal statutes?	– Jefferson Lab RPPP	
2. Is Jefferson Lab RPP a formally defined, controlled, and fully implemented laboratory program?	– Jefferson Lab RPP Supplement to ES&H Manual – Jefferson Lab RP procedures – Jefferson Lab RP work authorizations including radiological work permits (RWP) – Jefferson Lab accelerator enclosure entry control requirements	
3. Does Jefferson Lab RPP reflect scope of accelerator radiological hazards for prompt ionizing radiation and activated materials?	– Jefferson Lab RPPP – Jefferson Lab RPP Supplement to ES&H Manual – Jefferson Lab RP procedures – Jefferson Lab RP work authorizations – Interviews with RP Manager to discuss evolution of program to meet operational needs	

LOI	Status/Evidence	ARR Reviewer Notes
4. Does the Jefferson Lab RPP utilize lessons learned from internal and external events?	– Discussions with RP Manager on incorporation of lessons learned from previous operations and application to future operations	
5. Is a hierarchy of controls effectively implemented including engineering and administrative controls?	– Jefferson Lab RPP Supplement to ES&H Manual – Jefferson Lab RP procedures – Jefferson Lab RP work authorizations – Discussions with RP staff, Accelerator operations and Engineering support staff	
6. Is Jefferson Lab RPP effectively integrated with accelerator operations and other safety and health disciplines?	– Accelerator Operations Directives – Discussions with RP staff, Accelerator operations staff – Discussions with ESH&Q Program Manager	
7. Is Jefferson Lab RPP effectively integrated as part of the laboratory work planning and control process?	– Review ATLis and other Task List work planning and integration tools – Review applicable portions of ESH Manual – Observe work practices and compare with work planning and control documents for affected task	
8. Is Jefferson Lab RPP effective in maintaining radiological exposures to personnel are maintained as low as reasonably achievable (ALARA)?	– Review procedures for dose investigations – Review annual dosimetry reports – Perform selected facility walkthroughs/inspections and observe selected work activities	
9. Is the Jefferson Lab RP providing adequate support to upgrade activities?	– Discuss changes to radiological conditions associated with upgrade to facility with RP Manager and selected radiological protection personnel – Query internal stakeholders	
10. Determine adequacy of radiation protection program to support commissioning.	Basis for decision	Sign off

A5.10 Radiological Protection for 12 GeV Commissioning and Operation

Objective:

Determine that Jefferson Lab Radiological Protection Program has fully evaluated and addressed the impact of accelerator commissioning and operations at 12 GeV in the upgraded accelerator facility.

Criteria:

The Jefferson Lab radiological protection program resources:

a. Evaluated the (calculated/modeled) relevant radiation source terms for the upgraded accelerator energy and facility;
b. Evaluated operational and environmental impact associated with the upgraded accelerator energy and facility modifications;
c. Identified and incorporated or facilitated necessary changes in structures, infrastructure, processes, and procedures to reflect upgraded accelerator energy;
d. Modified RP programs and processes to reflect upgraded accelerator energy and facility;
e. Identified and planned necessary tests, measurements, and activities to verify calculated and modeled radiation source terms and installed shielding effectiveness; and
f. Worked with operations to effectively integrate RP programs, processes, and tests associated with commissioning and operating upgraded accelerator facility.

Approach:

Document Review: Review Jefferson Lab documents that serve as the evaluation for and technical basis for 12 GeV Operations. Review Radiological Protection Program (RPP) procedures and processes that address 12 GeV operations.

Staff/Management Interviews:
Interview the RPP Manager and selected staff regarding evaluation of operational and environmental impact for 12 GeV commissioning and operations. Interview selected accelerator operations management/staff on their RPP staff interface with emphasis on effective communication of pending changes associated with upgrade activities.

Performance Review: Participate in table top discussions with RPP staff and Operations staff to review changes to radiological protection practices associated with facility upgrade activities.

Performance Demonstrations: Conduct selected facility/building walk-throughs and observe implementation of RPP generated changes to facilities. Review an activity associated with the performance of Assigned Radiation Monitor (ARM) duties of Accelerator Operations personnel related to the 12 GeV Upgrade.

Radiological Protection for 12 GeV Commissioning and Operation
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Have the relevant radiation source terms for the upgraded accelerator energy and facility been fully evaluated?	– Jefferson Lab Final SAD, ASE – Technical Basis for Shielding Design	
2. Have the operational and environmental impacts associated with the upgrade been evaluated?	– Technical Basis for Shielding Design – Interviews of 12 GeV Upgrade with Safety Manager and others	
3. Have the facility modifications and program changes necessary to commission been effectively communicated and implemented?	– Technical Basis for Shielding Design – Technical Notes on C100 Cryomodule – Interviews of 12 GeV Upgrade with Safety Manager, others	
4. Is there a plan to test assumptions regarding source term and effectiveness of shielding?	– Interviews with RP Manager and staff – DRAFT Tests Plans and RPP Procedures	
5. Are the necessary program changes effectively integrated into commissioning and operations?	– Interviews with RP Manager and Accelerator Operation Manager to discuss evolution of program to meet operational needs – Observation of ARM duties associated with upgraded facility changes	
6. Determine adequacy of radiation protection program to support commissioning.	Basis for decision	Sign off

A5.11 Emergency Management Program

Objective:

Determine that Jefferson Lab has an effective emergency management program that supports accelerator operations during both routine and non-routine operations. Determine that the emergency management program addresses the full range of hazards and personnel risks associated with Jefferson Lab operations. Determine that the Jefferson Lab emergency management program effectively addresses the types of occurrences derived from historical records. Determine that the emergency response program effectively utilizes mutual aid relationships.

Criteria:

The Jefferson Lab emergency management program should:

a. Include a technical basis document and an emergency management program plan;

b. 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;
c. Benefit from programmatic lessons learned; and
d. Effectively utilize mutual aid relationships.

Approach:

Document Review: Review the Jefferson Lab Technical Basis Document for Emergency Planning and Emergency Management Plan to determine if the planning documents incorporate identified FSAD hazards, credible accident scenarios, mutual aid relationships, and emergency management lessons learned. Review Jefferson Lab selected emergency response procedures. Review selected emergency response documentation on post-event analysis and programmatic lessons learned.

Staff/Management Interviews: Interview the Jefferson Lab Emergency Management manager on the evolution of the Jefferson Lab Emergency Management program. Interview selected management/staff regarding their understanding of the Jefferson Lab Emergency Management program.

Performance Review: Participate in a table top discussion to review Jefferson Lab emergency management capabilities for selected types of occurrences. Visit the Tornado Shelter below the North Access Building with special attention to penetrations in the room to mitigate ODH hazard.

Performance Demonstrations: Tornado warning siren test and voice notification systems.

Emergency Management Program
Lines of Inquiry, Status/Evidence and ARR Notes

LOI	Status/Evidence	ARR Reviewer Notes
1. Site has an emergency management program (EMP) supported by documentation and procedures.	– Emergency Management Plan	
2. EMP includes a technical basis document and an emergency management program plan.	– Jefferson Lab Technical Basis Document for Emergency Planning	
3. EMP includes procedures relevant to accelerator operations.	– Jefferson Lab Operations Directives and Operations directives supplements	

4. EMP addresses onsite and offsite hazards (if applicable) and associated impacts for both normal operations and credible accidents.	– Emergency Management Plan – Jefferson Lab Technical Basis Document for Emergency Planning	
5. Jefferson Lab EMP benefits from programmatic lessons learned.	– Interview Jefferson Lab emergency management (EM) manager and Operations Staff for suitable examples of lessons learned and familiarity with related changes to lab policy/practice	
6. Jefferson Lab effectively utilizes mutual aid relationships.	– Discuss with Jefferson Lab EM Manager (and interview City of Newport News, if possible) to verify – View training materials provided by Jefferson Lab to City, Newport News	
7. Accelerator Operations personnel have an effective understanding of EM.	– Interview selected Jefferson Lab Accelerator regarding roles in EM program to verify: 1) Familiarity with safety documentation 2) Understanding of credible scenarios 3) Understanding and mutual aid relationships	
8. Accelerator Operations personnel have an effective understanding of the application of programmatic lessons learned.	– Conduct one or more lines of inquiry: 1) Conduct tabletop exercise 2) Participate in a table top discussion with accelerator personnel 3) Review a previous event for effective application of lessons learned	
9. Observe function of site-wide notification system.	– Observe Tornado warning siren test Also check effectiveness of voice notification system.	
10. Determine adequacy of emergency response program to support commissioning and routine operations.	Basis for decision	Sign off

A5.12 Credited Controls (CC)

Objective:

Verify that the Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for the respective commissioning 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 DRAFT Accelerator Facility Safety Implementation Guide for DOE O 420.2C, SAFETY OF ACCELERATOR FACILITIES (August 2012).

Criteria:

Credited Controls identified in the Accelerator Safety Envelope (ASE), necessary for the respective commissioning phase or 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, commissioning records for Credited Controls where applicable. Review records and procedures associated with the maintenance, operations, and function of Credited Controls.

Interviews: Interview Jefferson Lab Engineering Department, Safety Systems Group Staff, Operations Staff, and SCMB members regarding the installation, maintenance, and operation of configuration management of Credited Controls.

Performance Demonstrations: Physically observe Credited Controls installed in situ. Where possible, observe the function/actuation (or the result of actuation) of Credited Controls. Observe selected Accelerator Operations interfaces (software, certification procedures, etc. NOTE: This will also be addressed in part in CRAD-LOIs for Software QA, Operations Training and Qualifications, and Accelerator Safety Envelope.

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 ARR Plan Appendix 6 are installed and operational.	**Status:** **Evidence:** – In-situ observation of installed Credited Controls – Observation of function/actuation of selected Credited Controls	
2. Verify that Credited Passive, Active, and Administrative Controls in ARR Plan Appendix 6 are properly managed.	**Status:** **Evidence:** – SCM CRAD-LOI results – Observe Accelerator Operators interact with Safety System (actuate and verify) – Discuss how off-normal Safety System function is managed – Observe the results of safety system certification – Discuss Accelerator Operations/Safety Systems Group/RadCon Group interactions	
3. Verify that defense-in-depth controls also have Configuration Management applied on a graded approach.	**Status:** **Evidence:**	
4. Determine adequacy of Credited Controls to support commissioning and routine operations.	Basis for decision	Sign off

Appendix 6: Other Supporting Materials

Credited Controls List and Configuration Management

Credited Passive Engineered Controls	Review Activity	Frequency
1. Permanent Shielding Including Labyrinths	Verify configuration	Review after change
2. Movable Shielding	Verify configuration	Annually and before operations start
3. Penetration Shielding	Verify configuration	After change
4. Accelerator Site Safety Fence	Verify configuration	Daily
5. Nitrogen Gas Supply Orifices	Controlled configuration	Review after change

Credited Active Engineered Controls	Review Activity	Frequency
1. PSS System Level Controls	Full System Checkout	Semiannual
2. PSS Critical Devices	Full System Checkout	Semiannual
3. PSS Access Controls	Full System Checkout	Semiannual
4. PSS Sweep Procedures		
5. PSS Interlocks	Full System Checkout	Semiannual
6. PSS Multiple Protection Functions	Full System Checkout	Semiannual
7. PSS Alarm and Warning Devices	Full System Checkout	Semiannual
8. PSS — ODH Monitoring and Alerts	ODH Head Calibration	Annual
9. Cryomodule Primary Helium Vent Above Ground	Controlled configuration	Review after change
10. Moller Polarimeter Helium and Nitrogen Gas Vent to Hall C	Controlled configuration	Review after change

Credited Administrative Controls	Review Activity	Frequency
1. Radiation Survey before Access		
2. Locked Doors		
3. Warning Signs, Lights, etc.		
4. Worker Awareness Training		
5. Earth Shielding – Excavation Management		
6. CEBAF Experiment Review Process		
7. FEL Experiment Review Process		
8. CEBAF Operations Staffing – Sweep and Controlled Access		

Appendix 7: Current and DRAFT Guidance Crosswalk on Accelerator Readiness Reviews

Current Guide Language	August 3, 2012 DRAFT Guide Language
i and ii An accelerator safety program may not need to fully implement all sections of this guidance to satisfy the requirements of DOE O 420.2B; a tailored approach, based on the complexity of the accelerator facility, can be used when applying this document. The Guidance is not intended as an audit/assessment tool and should not be used as such without prior agreement between the contractor and DOE.	2.10.4 The scope of the ARR should reflect the size, complexity and hazards associated with the accelerator facility. A tailored approach may be used to perform an ARR based upon that size, complexity, and hazards. The basis for implementation of the tailored approach should be documented as part of the readiness review process.
4.a. An ARR is not a method for achieving readiness, but for verifying it. An ARR is conducted both to verify the information that is submitted in support of a request to undertake accelerator activities and to assure that the data address the full scope of activities proposed. An ARR is not an extensive wall-to-wall assessment of all the contractor analyses, but rather an overview of the operation, inspection of the hardware and a sampling based on a review of supporting documentation and, if available, past operational experience.	2.10 The Accelerator Readiness Review (ARR) provides a means to verify that an accelerator facility's personnel, documentation, and equipment are adequate to support safely the full scope of activities proposed for commissioning and/or routine operations. The ARR provides a basis for the applicable DOE manager to approve commissioning and/or routine operation. 2.10.4 The ARR is not a method for achieving operational readiness but rather is a structured method for verifying that hardware, personnel, and procedures associated with commissioning and/or routine operations are ready to permit the activity to be undertaken safely. An ARR is not an extensive wall-to-wall assessment of all the contractor analyses and operations, but an overview or sampling of the full scope of proposed activities.
The ASO places the requirement to perform an ARR solely on the contractor	2.10.2. DOE 420.2C places the requirement to perform an ARR solely on the contractor and requires that DOE "ensure the safe operation of accelerator facilities through implementation of this Order".
The ARR team may be composed of DOE employees, contractor personnel and/or consultants and all possess expertise in their assigned area. To the extent practicable, the team members should have minimal current involvement with the activity being reviewed, and past involvement sufficiently distant or of such a nature that they have reasonable independence from the activity being assessed.	The ARR team membership is selected by the contractor. The contractor would typically confer with the DOE field element on an upcoming ARR including items such as the approach to conducting the ARR (phased, modular, etc.), the ARR team membership, etc. The team may be composed of contractor personnel and/or consultants and may include DOE employees. All should possess expertise in their assigned area. To the extent practicable, the team members should have minimal current involvement with the activity being reviewed, and past involvement should be sufficiently distant or of such a nature that they have reasonable independence from the activity being assessed.

Current Guide Language	August 3, 2012 DRAFT Guide Language
A readiness review may be undertaken and accomplished using a variety of methodologies, provided that it truly verifies the readiness of the proposed activity. Where commissioning of an accelerator facility is accomplished in discrete segments, the ARR must also be performed incrementally.	2.10.3 In preparing for the ARR, a readiness plan should be developed and implemented prior to the ARR. The readiness plan should specify the expected milestones to be achieved and the process for assuring safe operation. Such milestones could include items such as low power measurements taken to verify key safety related parameters (e.g., shielding effectiveness) and other operational characteristics needed to support the safety case for higher power operations. 2.10.4 The contractor may choose a modular approach, which allows for portions of the accelerator facility to be reviewed for readiness. This provides a basis for commissioning of that particular section of the facility.
The ARR should include applicable portions of support functions such as training, maintenance, health physics, environmental monitoring, waste management, and pollution prevention.	2.10.3 Primarily, the scope of the readiness plan should identify which aspects of the accelerator commissioning and organization are to be ready for verification by the ARR team: • roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out the commissioning consistent with external and internal requirements; • procedures, administrative controls, and personnel training and qualification for commissioning at the stated intensity; • engineered safety systems that will be operable for the accelerator and accelerator-associated experimental facilities; and • specific facilities, sub-systems, and modes of commissioning to be exercised.
	A schedule of the most current plan, and the planned date for achieving readiness for the on-site ARR should be established. In order to facilitate an effective ARR, the readiness plan should also briefly describe the following: • reporting chain to whom problems encountered are reported, (e.g., operational, safety, scheduling problems); • responsible party who makes the necessary notifications or arrangements for authorizations; • location of documented authorizations; • training records to be audited; • number and types of qualified personnel required to maintain periodic or round-the-clock commissioning, whichever is applicable; • list of procedures required for commissioning readiness; • use of contingency procedures for situations that use equivalent safety or protection techniques when commissioning large accelerator facilities. Contingency procedures that may be invoked to ensure safe, environmentally sound, and reliable operations; and • a list of open actions items from various internal and external safety reviews that will remain open at the time of the ARR.

Current Guide Language	August 3, 2012 DRAFT Guide Language
	2.10.2 Normally, for large and complex facilities, an ARR is warranted both prior to commissioning and prior to routine operations because the nature of activities associated with each phase are markedly different. In some cases, depending on facility specific circumstances, the DOE field element may grant a single approval for both commissioning and routine operations at the same time following performance of a single ARR. This case would be for situations where the readiness to both safely commission and operate is clearly verified by a single ARR. 2.10.4 The scope of the ARR should reflect the size, complexity and hazards associated with the accelerator facility. A tailored approach may be used to perform an ARR based upon that size, complexity, and hazards. The basis for implementation of the tailored approach should be documented as part of the readiness review process. For large and complex facilities, an ARR may be warranted both prior to commissioning and prior to routine operations because the nature of activities associated with each phase are markedly different. In some cases, depending on facility-specific circumstances, the DOE field element may grant a single approval for both commissioning and routine operations at the same time following performance of a single ARR.
While this guidance addresses verifying the readiness of items important to environment, safety and health, the scope of an ARR can be expanded as desired by the contractor's senior management to address other “best management practice” topics.	2.10.3 The guidance provided here is only intended to address accelerator safety aspects of commissioning. No attempt has been made to address other programmatic drivers (mission accomplishment, preservation of capital equipment, etc.) that may also be present during the commissioning phase of a project’s life.
	Commissioning periods may be tailored to the needs of each facility and there may be great variations in their duration, breadth, and formality, but in all cases the commissioning activities will be bounded by an ASE and preceded by an ARR.
	Commissioning often can be done in phases or modules, where each module is brought on-line safely before proceeding to the next module. These modules can follow or correspond to geographical locations within a facility (e.g., a specific beam line) or can represent stages of operation (e.g., step functions of increased intensity, energy, or…
Where commissioning of an accelerator facility is accomplished in discrete segments, the ARR must also be performed incrementally.	2.10.4 Where commissioning of an accelerator facility is accomplished in discrete segments (i.e. a modular approach), the ARR should be performed incrementally as well. For ARRs performed under the modular approach, when considering elements to cover in the ARR, credit may be taken for those elements that have not appreciably changed since performance of the previous ARR(s). In other words, those unchanged elements that were covered in a previous ARR may be omitted from the next ARR; however, the omission and justification for omission should be

Current Guide Language	August 3, 2012 DRAFT Guide Language
	2.10.3 Under some conditions, commissioning activities may encompass operations under restricted conditions that are necessary in order to accomplish specific tasks. An example would be the need to conduct specified measurements of the prompt radiation levels needed to support the ASE. Other examples could include magnetic field measurements, measurements of beam losses, flammable gas levels, or airborne radioactivity levels.
	At the conclusion of commissioning, the accelerator is ready for performance of an ARR for routine operations, or directly for routine operations if the commissioning process justifies advance to operations.
	2.10.4 If available, the ARR should incorporate past operational experience.
The role of the responsible DOE organization in the ARR process is to: Require the contractor to perform an ARR when changes in operations warrant.	2.10.2 The DOE field element manager is responsible for ensuring that an appropriate ARR has been conducted prior to approving commissioning activities.
The role of the responsible DOE organization in the ARR process is to:	The process used by the DOE Field Element for ensuring an appropriate ARR involves many factors and may include activities such as:
Maintain cognizance of the contractor plans for conducting an ARR and obtain and evaluate detailed information related to this activity as necessary as a component of operational awareness activities;	maintaining awareness of the contractor plans for conducting the ARR;
	evaluating information related to the planned activity as necessary as a component of oversight activities;
Provide sufficient real-time oversight, supplemented where needed by first-hand sampling to support a determination by DOE of the appropriateness of the contractor ARR results;	providing sufficient real-time oversight, supplemented where needed by first-hand sampling to support a determination by DOE of the appropriateness of the contractor ARR results;
	participating in an observer capacity;
Provide authorization to proceed when satisfied that the findings identified by the ARR have been adequately addressed;	verifying that findings/observations of the ARR are satisfactorily addressed; and
Keep Headquarters informed of the progress and results of the ARR;	informing line management and/or headquarters of status as appropriate.
The review should be conducted within the facility's ISM program.	
…and requires [i.e. 5.b.(1)(b)] that DOE ensure that the contractor's review was conducted with appropriate scope and depth.	The implementation of the order includes essential elements that include "an accelerator readiness review (ARR) program that ensures facilities are adequately prepared for safe commissioning and/or operations…"

Current Guide Language	August 3, 2012 DRAFT Guide Language
	2.10.4 The ARR should review whether the following accelerator facility programs are in place:
Procedures necessary for the safe operation of the activity have been developed, reviewed, and approved, and an appropriate process for the development, review and approval of new and revised procedures is in place. Procedures to deal with abnormal and emergency situations have been prepared and are approved for use. An appropriate USI process has been developed.	approved procedures program including an appropriate USI process; An appropriate USI process developed in accordance with DOE Order 420.2C;
Training and qualification programs relevant to safe operation in compliance with the ASO and ISM have been established.	approved training and qualification programs;
	appropriate internal review program;
Records important for operational and post-operational activities are controlled.	effective records management program; Records important for operational and post-operational activities are controlled including NEPA documentation, local, state, and federal regulatory permits;
An acceptable SAD (or its equivalent) has been properly developed in accordance with DOE Order 420.2B requirements, and has been reviewed and approved with the contractor internal safety review system.	reviewed and approved SAD adequate to support approval of the ASE; Through the ARR process, the contractor should also demonstrate compliance with the following institutional management programs: An acceptable SAD developed in accordance with DOE Order 420.2C that has been reviewed and approved by contractor management;
An adequate ASE has been developed in accordance with the ASO and is supported by the SAD	approved ASE including an effective Credited Control program; Through the ARR process, the contractor should also demonstrate compliance with the following institutional management programs: An acceptable approved ASE developed in accordance with the DOE Order 420.2C;
	an appropriate readiness plan.
An appropriate commissioning plan has been developed.	2.10 The basis for implementation of the tailored approach should be documented in the commissioning plan as well as the SAD/ASE and other facility documentation.
Equipment and systems having safety importance meet criteria established in the SAD and have been appropriately tested.	2.10.4 Equipment and systems having safety importance (including credited engineered controls) meet criteria established in the SAD and have been appropriately tested; and

Current Guide Language	August 3, 2012 DRAFT Guide Language
Staffing requirements specified in the ASE are met.	
	Through the ARR process, the contractor should also demonstrate compliance with the following institutional management programs:
	Contractor Assurance System;
	Configuration Management program; and
	Quality Assurance program.
	In addition to the required items listed above, the ARR should additionally verify the following:
	Clearly defined roles and responsibilities for accelerator activities including those for training and procedures as related to accelerator safety;
	An appropriate process for the review of the contractor accelerator safety program elements as specified in the CRD of DOE Order 420.2C
	Compliance with ASE requirements.
	Clearly defined roles and responsibilities for accelerator activities including those for training and procedures as related to accelerator safety;
The ARR report should adequately document the activities of the review committee and be formally transmitted to DOE Site Office or other designated DOE official specified by the Contracting Officer.	The ARR team should draft a report that adequately documents the activities of the review team. The report should document the review and address items such as:
	Team members
	Scope of the review
	Review criteria (e.g., the elements listed above may be used)
	Results of the Review (includes findings, deficiencies, etc.)
	Conclusion that indicates whether the accelerator safety implementation is adequate to support operations

DRAFT Decision Matrix	Approval Authority												
Activity	**Lab Dir.**	**Accel. Div. Head**	**Dir. of Ops.**	**Comm. Plan Team**	**Comm. Advis Board**	**12GeV Proj.**	**B-Team**	**Accel. Ops**	**Oprb Mgr**	**Prog Dep**	**Geog. Coords.**	**Line Org.**	**Ext. Rev.**
Implement AOD Supplement		X											
Develop draft Integrated Commissioning Plan (ICP) for review			X	X			X?						Dir Rev
Review draft ICP	X	X	X	X	X								
Present draft ICP to Director for review		X											
Review and accept draft ICP	X												ARR
Authorize HCO		X	X		X								
Implement HCO											X	X	
Authorize ICP Implementation	X												
Implement ICP			X	X	X		X				X		
Periodic review of ICP and progress				X	X				X				
Develop detailed plans							X	X	X				
Day-to-day implementation								X					
Approve AOD Supplement			X										
Approve Draft ICP		X	X	X	X	X	X	X	X				Dir Rev
Approve External Review of ICP					X								
Approve ICP	X												ARR
Accelerator System Readiness Review Process for 12 GeV Commissioning reports accepted			X										
Authorize HCO			X					X	X				
Charter ARR Team													
Approve ARR Report	X	X	X										
Authorize Commissioning	X												TJSO

Appendix 8: Phase 1A CRAD/LOI Results

Complete | Line of Inquiry has been met | Finding | Opportunity for Improvement

CRAD		LOIs / Findings / OFIs
A3.1 Safety Assessment Document	✓	1. There is an approved FSAD for 12 GeV operations that meets DOE O 420.2C requirements.
	✓	2. The FSAD is maintained current by a process that routinely compares FSAD content to accelerator operations requirements.
	✓	3. There is a process to evaluate unanticipated/discovered conditions against known hazards and determine if an update is necessary.
	✓	4. Operations staff is sufficiently familiar with the FSAD to recognize and implement requirements.
	✓	5. Determine adequacy of FSAD to support commissioning.
A3.2 Accelerator Safety Envelope (ASE)		1. A documented ASE must define the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the SAD. **(CATS: MOA-2013-97-16-01)** • Consider including beam power limits in the ASE. • Consider whether the CEBAF and FEL facilities should have separate SADs and ASEs.
	✓	2. The ASE is submitted to DOE for approval.
	✓	3. An activity expected to exceed the bounding conditions of the ASE requires DOE approval.
		4. Any activity violating the ASE must be terminated immediately and be put in a safe and stable configuration (DOE notification is required). • Consider clearly defining ASE elements to ensure a clear understanding of what constitutes a violation. **(CATS: MOA-2013-97-17-01)**
		5. Any activity that was shut down by DOE must not recommence until DOE approves the activity. • JLab should ensure a clear understanding with the site office that a FEL ASE violation will not require a shutdown of CEBAF operations unless there is a common thread between the two facilities. **(CATS: MOA-2013-97-18-01)**
	✓	6. The ASE must be periodically reviewed to ensure it is maintained current and changes/updates must be supported by safety analysis in the form of a revision or addendum to the SAD.
		7. ASE supports accelerator commissioning and operation.
A3.3 Unreviewed Safety Issues (USI)	✓	1. A documented USI process exists and is based on DOE O 420.2C requirements.
	✓	2. Determine if adequate processes exist to identify intended changes or discovered safety issues which may pose unreviewed hazards.
	✓	3. Review interface of USI process with facility configuration management program.
	✓	4. Determine adequacy of USI process to support commissioning.
A3.4 Contractor Assurance System (CAS)	✓	1. CAS provides a comprehensive internal assessment process.
	✓	2. CAS Program uses external assessment: employs peer reviews and assessments that include accelerator subject matter experts from other accelerator facilities.
	✓	3. CAS Program integrates ASO requirements and includes a periodic assessment of DOE O 420.2C CRD requirements.
	✓	4. CAS Program supports the Accelerator Readiness Review process.
	✓	5. Determine CAS adequacy to support commissioning.

A3.5 Safety Configuration Management (SCM)	✓	1. Systems with safety significance are consistently managed with a graded approach using a well-defined program.
	✓	2. Level of configuration management is prioritized to and appropriate to credited controls.
	✓	3. Design requirements, drawings, actual field configuration remain consistent, documented, and accurate.
	✓	4. The configuration of Credited Controls is properly managed during accelerator operation and maintenance.
	✓	5. The configuration of administrative processes related to Credited Controls (e.g. training, procedures, records etc.) are properly managed.
	✓	6. Determine adequacy of CM program to support commissioning and routine operations.
A3.6 Commissioning Plan (CP)	✓	1. Commissioning Plan fully describes roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out the commissioning/operations and any related documented authorizations.
		2. Commissioning Plan addresses staffing schedules, authority and reporting chain for operational, safety, and scheduling issues, procedures (normal and emergency/contingency), administrative controls, and personnel training (including records and qualification for commissioning at the stated intensity). • Formalize how controls needed to ensure operations within the ASE are incorporated into the beam operations authorization process. **(CATS: MOA-2013-97-04-01)** • Define the minimum required training elements for commissioning operations and ensure that control room operations staff members (operators, accelerator physicists etc.) are trained in these elements. **(CATS: MOA-2013-97-05-01)**
	✓	3. Commissioning Plan identifies or properly references engineered safety systems that will be operable for the accelerator.
		4. Commissioning Plan identifies the operational characteristics for specific modes of commissioning needed to support the safety case for progressively higher power commissioning. **(CATS: MOA-2013-97-12-01)** • Assess whether there are any other instrument or equipment specific commissioning plans, in addition to the radiological controls and surveys, that need to be integrated into the 12 GeV Commissioning Plan. Finalize the 12 GeV Beam Commissioning Plan. • Include guidance in the 12 GeV Beam Commissioning Plan on how to proceed during the execution phase if a step is found to be unclear or steps need to be changed to continue commmissioning.
	✓	5. Lessons learned from previous shut-down periods are incorporated to improve procedures and identify additional procedures that are needed.
		6. Evaluate Commission Plan progress to date. • Populate the CEBAF Element Database with all elements needed for initial commissioning. **(CATS: MOA-2013-97-09-01)** • Close out completed upgrade related activities prior to commencing commissioning operations with beam. **(CATS: MOA-2013-97-01-01)** • Populate Hot Checkout Checklist data base with the required elements needed for Phase 1 start-up and commissioning. **(CATS: MOA-2013-97-02-01)**
		7. Determine adequacy of training program to support commissioning.
A5.1 Accelerator Readiness Review (ARR) Process	✓	1. The Accelerator Readiness Review process includes an ARR plan that identifies those elements of accelerator operations ready for verification by the ARR Team.
	✓	2. The ARR process provides for verification that accelerator hardware, personnel, and administrative systems/programs are in place and adequate to support safely the full scope of activities proposed for commissioning.
	✓	3. The ARR scope reflects the size, complexity, and hazards associated with the accelerator facility.
	✓	4. The ARR provides for verification of compliance with the safety program elements of the CRD for 420.2C and the ASE.
	✓	5. The ARR provides for the review of documentation, inspections, management/staff interviews, and attendance at specific operations/ training as appropriate.

	✓	6. The ARR process provides for a report that adequately documents team activities, review scope, review criteria, review results, and a recommendation on whether the ARR supports approval for operations.
	✓	7. ARR Process verifies readiness to commission.
	✓	8. The Accelerator Readiness Review process includes an ARR plan that identifies those elements of accelerator operations ready for verification by the ARR Team.
A5.1 Accelerator Readiness Review (ARR) Plan	✓	1. The ARR Plan captures elements 1-6 of the ARR process outlines in the table above.
	✓	2. The ARR Plan has sufficient scope and development to verify hardware, personnel, and administrative system/program are in place to support safely the full scope of activities proposed for commissioning.
	✓	3. The ARR Plan provides for the review of Contractor Assurance System; Configuration Management; Quality Assurance; and Commissioning Plan.
	✓	4. The ARR Plan specifies engineered safety systems that will be operable for accelerator commissioning.
	✓	5. The ARR Plan specifies or makes proper reference that specify roles, responsibilities, accountabilities, and authorities that establish the expectations and duties of managers, supervisors, and operators for carrying out commissioning.
	✓	6. The ARR Plan provides for the verification that affected staff understand the scope of the ARR and the necessary preparations.
	✓	7. The ARR Plan provides for verification that procedures, personnel training and qualification, and other administrative controls for commissioning at the stated intensity.
	✓	8. The ARR Plan supports activities to verify readiness to commission
A5.2 Work Planning and Control	✓	1. Work planning approach employs ISM: Integrates safety into work planning.
	✓	2. Work planning includes graded approach to hazard controls and work approval/authorization based on the hazard.
		3. Work hazards are effectively identified. • Populate Hot Checkout Checklist data base with the required elements needed for Phase 1 start-up and commissioning. **(CATS: MOA-2013-97-02-01)**
		4. Work hazards are effectively mitigated. • Clarify the access requirements policy for persons entering accelerator tunnel areas in permitted or controlled access states, with a specific focus on Lock Out Tag Out requirements for work within restricted and limited approach boundaries. **(CATS: MOA-2013-97-13-01)**
	✓	5. Training is an integral part of work hazard mitigation.
		6. Proposed work on safety systems is properly evaluated and pre-approved. • Update and approve procedures needed for Phase 1 start up and commissioning. **(CATS: MOA-2013-97-03-01)**
		7. Management verifies work for quality, completeness, functionality, etc. • Close out completed upgrade related activities prior to commencing commissioning operations with beam. **(CATS: MOA-2013-97-01-01)**
	✓	8. Work documents are controlled, updated/revised as necessary.
	✓	9. There is effective communication, especially for scope changes.
		10. Work controls program supports commissioning and operations.

A5.3 Lessons Learned Program	✓	1. Review Jefferson Lab lessons learned program procedures and documents to verify coordinated site-wide program.
	✓	2. Verify that the program identifies routine and non-routine Jefferson Lab occurrences that elevate to the level of lessons learned.
	✓	3. Verify that the program identifies and evaluates lessons learned at other DOE and non-DOE facilities.
	✓	4. Verify that there is a Jefferson Lab program to effectively disseminate lessons learned to those best suited to use the information.
	✓	5. Verify that recent external accelerator-based lessons learned have been effectively evaluated and incorporated into current Accelerator Readiness Review.
		6. Lessons learned processes effectively support commissioning and operations. • Continue the process of communicating lessons learned to overcome organizational stovepipes. **(CATS: MOA-2013-97-19-01)**
A5.4 Software QA	✓	1. The development of accelerator controls and safety system software is governed by applicable standards.
		2. The applicable standards require, at a minimum: o written requirements or specifications o software version management o documentation • The grading criteria and required level of documentation for each grade should be incorporated into a SQA Plan for Accelerator Controls to ensure uniform practices. **(CATS: MOA-2013-97-14-01)** ***NOTE: Finding from Out-Brief, but not included in Phase 1A Report.***
		3. Accelerator controls and safety system software have accurate configuration information from users/system owners for device control and data translation. • Populate the CEBAF Element Database with all elements needed for initial commissioning. **(CATS: MOA-2013-97-09-01)**
	✓	4. There are resources that allow controls and safety system software to be tested before implementation.
	✓	5. The interface for programmers needing information or analysis data is controlled.
	✓	6. Software users are adequately trained and authorized depending on the level of control afforded by accelerator and/or safety system software before being allowed access.
	✓	7. There is an adequate user feedback mechanism to resolve software issues.
		8. Accelerator controls and safety system software are configuration managed. • Changes to controls software of CF systems that directly serve the accelerator should be planned, coordinated, and communicated with attention to cyber security and SQA similar to that of other accelerator systems. **(CATS: MOA-2013-97-22-01)** ***NOTE: Finding in Phase 1A Report, but listed as OFI in the Out-Brief. It is agreed that this issue is an OFI, but will remain categorized and closed out as a Finding (MOA-2013-97-11-01) to align with the report, and reissued as an OFI.***
		9. There are adequate personnel resources to maintain the accelerator controls and safety system software applications. Personnel are trained and authorized. • Consider adding an additional engineer to the PSS group to ensure that at least two fully trained and qualified programmers are available to manage the two independent PSS software packages. **(CATS: MOA-2013-97-20-02)**
	✓	10. There are adequate fiscal resources to maintain accelerator controls and safety system software applications.
		11. There is adequate infrastructure to maintain and support accelerator controls and safety system software applications. **(CATS: MOA-2013-97-20-01)** • The Windows XP computers used for PLC programming should be replaced prior to the official end-of-life of the XP operating system.
		12. Software QA supports activities related to accelerator commissioning and operation

A5.5 Cyber Security	✓	1. There is a plan that addresses cyber security on a site-wide basis and specifically for accelerator controls.
	✓	2. The cyber security risk assessment for accelerator controls adequately identifies threats and vulnerabilities specific to the operating environment.
	✓	3. The cyber-risk assessment for accelerator controls adequately identifies risks and counter measures to reduce risks to an acceptance level.
	✓	4. There is an authority to operate the system used to control accelerator functions within acceptance risks.
		5. The cyber-security plan incorporates the following recommended practices and protocols: a. defense-in-depth by layering b. physical security c. network segmentation and isolation d. Internal/ external fire-walling e. mitigation of insecure processes and protocols f. access control from on and off-site g. authentication management h. user auditing i. configuration management including patches j. monitoring and use analysis k. vulnerability scanning and periodic l. Incident Response/Contingency Planning m. Control of external media devices n. Remote access • The cyber security and SQA of Conventional Facilities (CF) control systems should be reviewed and steps taken to manage remote access. **(CATS: MOA-2013-97-10-01)**
	✓	6. There are adequate personnel resources to maintain the cyber-security program and processes: personnel are trained and authorized.
	✓	7. There are adequate fiscal resources to maintain the cyber-security program equipment through near-term software and hardware upgrades.
	✓	8. There is adequate infrastructure to maintain and support cyber-security for accelerator controls.
		9. Cyber Security supports activities related to accelerator commissioning and operation.
A5.6 Operations Training and Qualification Program	✓	1. There is a documented training and qualification process designed to ensure operator competence for operations personnel.
	✓	2. Operator training and qualification process includes clearly defined roles and responsibilities for accelerator operational activities.
	✓	3. Operator training and qualification process considers applicable physics and engineering principles.
		4. Operator training and qualification process includes specific training and qualification for beam control as well as systems that control access to the accelerator enclosure (credited controls). • Define the minimum required training elements for commissioning operations and ensure that control room operations staff members (operators, accelerator physicists etc.) are trained in these elements. **(CATS: MOA-2013-97-05-01)**
	✓	5. Operator training addresses normal and abnormal condition and emphasizes development of diagnostic skills for early recognition of abnormal conditions.
	✓	6. Operator training includes training that is normally provided for individuals who work in and around the accelerator, such as ODH, RadCon, etc.
	✓	7. Training program incorporates periodic testing and performance checks, and re-qualification requirements.
	✓	8. Operator training, documentation includes auditable records of training received.
		9. Determine adequacy of training program to support commissioning.
A5.7 Operations Procedures	✓	1. Review Jefferson Lab procedure program documentation.
	✓	2. Interview Jefferson Lab procedure manager(s) regarding program.
	✓	3. Interview selected management/staff on their role in the Jefferson Lab operational procedure program.

	✓	4. Observe selected job assignments with job-specific procedures.
		5. Determine adequacy of procedure program to support commissioning. • Update and approve procedures needed for Phase 1 start up and commissioning. **(CATS: MOA-2013-97-03-01)**
A5.8 Industrial System Safety (ISS)	✓	1. Are the industrial hazards of the system well understood?
	✓	2. Were the hazards of the system considered during the design phase?
	✓	3. Does the system design, where possible, use engineered safeguards to minimize industrial hazards during operation?
	✓	4. Is the system design documented?
	✓	5. Does the system interface to other industrial systems and is that interface documented?
	✓	6. Does the system interface to the PSS?
	✓	7. Are the documents available to staff that work on the system?
	✓	8. Was the system checked to ensure it performed according to design when it arrived at the lab (or at the point of assembly)?
	✓	9. Are there further operational checks needed before it is placed in service?
	✓	10. Are there system integration checks needed before the system is placed in service?
	✓	11. Are the hazards of working on (installing, trouble-shooting, repairing, maintaining) the installed system mitigated on the basis of a laboratory industrial safety program?
	✓	12. Are the hazards of working on the system mitigated as part of an integrated laboratory work planning and control process?
	✓	13. Are the staff who works on the system qualified and are they authorized to conduct work on the system?
	✓	14. Is the system incorporated into the Hot Checkout Process?
	✓	15. Are there lessons learned from previous operational experience with this system? Have they been implemented?
	✓	16. Are industrial safety systems ready to support commissioning?
A5.9 General Radiological Protection Program (RPP)	✓	1. Is Jefferson Lab RP based on a DOE approved program plan the meets applicable federal statutes?
	✓	2. Is Jefferson Lab RPP a formally defined, controlled, and fully implemented laboratory program?
	✓	3. Does Jefferson Lab RPP reflect scope of accelerator radiological hazards for prompt ionizing radiation and activated materials?
	✓	4. Does the Jefferson Lab RPP utilize lessons learned from internal and external events?
	✓	5. Is a hierarchy of controls effectively implemented including engineering and administrative controls?
	✓	6. Is Jefferson Lab RPP effectively integrated with accelerator operations and other safety and health disciplines?
	✓	7. Is Jefferson Lab RPP effectively integrated as part of the laboratory work planning and control process?
	✓	8. Is Jefferson Lab RPP effective in maintaining radiological exposures to personnel are maintained as low as reasonably achievable (ALARA)?
	✓	9. Is the Jefferson Lab RP providing adequate support to upgrade activities?
	✓	10. Determine adequacy of radiation protection program to support commissioning.

A 5.10 Radiological Protection for 12 GeV Commissioning and Operation		1. Have the relevant radiation source terms for the upgraded accelerator energy and facility been fully evaluated?
		2. Have the operational and environmental impacts associated with the upgrade been evaluated?
		3. Have the facility modifications and program changes necessary to commission been effectively communicated and implemented?
		4. Is there a plan to test assumptions regarding source term and effectiveness of shielding? • JLab should ensure that all parts of the shielding analysis, review, approval, validation, installation, and configuration control are integrated for each of the processes (experiment, temporary, and permanent). **(CATS: MOA-2013-97-06-01)**
		5. Are the necessary program changes effectively integrated into commissioning and operations?
		6. Determine adequacy of radiation protection program to support commissioning. • Complete the plan for radiological control and survey activities needed for commissioning and integrate it into the Commissioning Plan. **(CATS: MOA-2013-97-07-01)**
A5.11 Emergency Management Program	✓	1. Site has an emergency management program (EMP) supported by documentation and procedures.
	✓	2. EMP includes a technical basis document and an emergency management program plan.
	✓	3. EMP includes procedures relevant to accelerator operations.
	✓	4. EMP addresses onsite and offsite hazards (if applicable) and associated impacts for both normal operations and credible accidents.
	✓	5. Jefferson Lab EMP benefits from programmatic lessons learned.
		6. Jefferson Lab effectively utilizes mutual aid relationships. • Distribute Guidance and Rescue Team Guidebook to Newport News Emergency Manager and other responding organizations. **(CATS: MOA-2013-97-21-01)**
	✓	7. Accelerator Operations personnel have an effective understanding of EM.
	✓	8. Accelerator Operations personnel have an effective understanding of the application of programmatic lessons learned.
		9. Observe function of site-wide notification system. • The Emergency Management Team should perform a risk assessment to evaluate emergency communications capabilities in light of the move to VOIP telephones. **(CATS: MOA-2013-97-08-01)**
		10. Determine adequacy of emergency response program to support commissioning and routine operations.
A5.12 Credited Controls (CC)	✓	1. Verify that Credited Passive, Active, and Administrative Controls in ARR Plan Appendix 6 are installed and operational.
	✓	2. Verify that Credited Passive, Active, and Administrative Controls in ARR Plan Appendix 6 are properly managed.
	✓	3. Verify that defense-in-depth controls also have Configuration Management applied on a graded approach.
	✓	4. Determine adequacy of Credited Controls to support commissioning and routine operations.