Accelerator Readiness Review (ARR) Plan for the Vertical Test Area (VTA) and the Cryomodule Test Facility (CMTF)

Preamble:

Both the CMTF and the VTA have been successfully operated under criteria established by Jefferson Lab's Integrated Safety Management program. The Laboratory is currently operating under this safety basis but is looking forward to routine operation of these facilities under the revised Accelerator Safety Order, DOE O420.2D, Safety of Accelerator Facilities (ASO). The Laboratory has formed a team to conduct this ARR.

This ARR Plan was developed in accordance with Accelerator Readiness Review Program, Document Number: COO-ESH-34690, Revision Number: 5.0. The goal of the ARR is to verify that the existing systems and equipment, processes and procedures, and the people who maintain, repair, and operate the accelerator systems and equipment can do so effectively, safely, and according to the requirements in the ASO.

Process

The ARR is scheduled to start on May 20, 2025, and conclude on May 22, 2025. The plan is for a 3day review consisting of updates to facilities and responses to findings from previous Internal Readiness Reviews (IRRs), field visits to both the VTA and the CMTF facilities to include discussions with operations staff, review of process and procedures, and executive session time. A closeout with Laboratory management and the Thomas Jefferson Site Office (TJSO) is expected on Thursday at approximately noon and an initial report for factual accuracy by Jefferson Lab staff is expected by the end of day Thursday. The format of the report is appended. The Charge to the ARR Team and associated questions follow.

The members of the ARR Team have been selected from among the participants of the two previous ARRs for UITF and CEBAF/LERF and from the two previous IRRs for CMTF and VTA to ensure familiarity with the Jefferson Lab facility and processes. The members of the ARR Team are accelerator safety experts from Argonne National Lab (ANL), Fermi National Accelerator Lab (FNAL), Oak Ridge National Lab (ORNL), and the SLAC National Accelerator Facility. The ARR Team consists of two groups: one group is on-site for the review and a second group with two additional members who are participating virtually. The virtual team members are from ANL and FNAL. The team is joined by two JLab Staff members making eight total reviewers.

The committee should present Findings, Opportunities for Improvement, Noteworthy

Practices, and specific answers to the charge questions at a closeout meeting with Jefferson Lab's management. Findings are items that should be addressed by JLab as either prerequisites to the proposed activities under review or shortly after the start of operations indicated in the finding. Findings will be categorized as pre- or post-operational. Opportunities for improvement are items that don't rise to the level of a finding, but the review team feels that JLab should consider in the near future. Noteworthy Practices are items that, in the opinion of the review team, JLab does well.

The ARR Team shall make a recommendation to the Jefferson Lab Director as to whether the lab is ready to safely conduct the proposed activities.

The ARR Committee will develop a DRAFT report, containing the information presented during the closeout, for factual accuracy review before the Chair leaves the review. The ARR Team will complete a Final Report within two work weeks based on the ARR Final Report (Format and Guidance) as presented below.

Team Members

<u>Principal External Boots-on-the-ground:</u> Kelly Mahoney, Chair, ORNL Jessica Malo, FNAL John Woodford, ANL Amy Ecclesine, SLAC

Supporting External Virtual: Maddie Schoell, FNAL Laura Boon, ANL

Supporting Internal: Brian Freeman, JLAB Operations Dave Gaskell, JLab Physics

Invited Observers:

Josh Harmon DOE TJSO Derek Favret, DOE HQ John Presgraves, DOE TJSO

ARR Facilitators:

Harry Fanning, Accelerator Division Safety Officer, JLab Bob May, Accelerator Safety Program Manager, JLab

Charge and Charge Questions

To verify readiness to operate the VTA and the CMTF under the ASO, the Laboratory is undertaking an Accelerator Readiness Review (ARR). The Committee is requested to conduct a readiness review of the UITF and address the following charge questions.

ARR Charge Questions

1. Are the necessary program elements of the Contractor Requirements Document for DOE O 420.2D, Safety of Accelerator Facilities, in place?

a. A safety analysis or analysis of postulated worst-case accident for the VTA and CMTF that are incorporated into a Safety Assessment Document (SAD)

b. Clearly defined roles and responsibilities for VTA and CMTF activities including activities related to training and procedures

c. A current listing/inventory of accelerators managed under the ASO including exemptions or equivalencies to the ASO

d. A DOE approved Accelerator Safety Envelope (ASE) that lists the credited controls necessary for safe operation of the facility

e. A DOE approved Unreviewed Safety Issue (USI) Process

f. An ARR Process

g. A Contractor Assurance System that maintains an internal assessment process

h. A Facility Configuration Management Program that addresses accelerator safety

i. Appropriate administrative processes related to accelerator safety (e.g. training, procedures, etc.)

2. Are the necessary credited controls, accelerator hardware, controls and monitoring systems fully operational?

3. Are there sufficient trained personnel, and administrative processes in place and adequate resources to support the safe and efficient operation, maintenance, and repair of the VTA and CMTF?

Process steps to investigate lines of inquiry

The ARR Team shall use the following process steps as necessary:

1. Review the documents provided by the ARR Facilitators including the SAD and ASE documents, implementing procedures, training records, design drawings, ALARA reviews and other applicable documents.

- 2. Tour the facility and conduct walkdowns to validate any facility modifications and conditions, and readiness state for safety related systems and components
- 3. Observe operational or maintenance activities that demonstrate selected implementing procedures.
- 4. Observe upset response condition demonstrations (can be round-table discussions).
- 5. Interview selected facility and support personnel.
- 6. Collect objective evidence, evaluate evidence against acceptance criteria, and evaluate findings; this may be an iterative process.
- 7. Identify issues, strengths, and opportunities for improvement.
- 8. Convene an ARR out-brief meeting to discuss the assessment, assessment results, findings (e.g., pre-start findings, post-start findings, strengths, and improvement opportunities), and schedule for the ARR Final Report.
- 9. Prepare a DRAFT ARR Report following the format guidance below. Present the report and work through the ARR Facilitators to resolve and factual accuracy issues
- 10. Develop sections of the ARR Final Report and sign the report.

Notes:

- 1. The ARR will not use results from the IRR as a substitute for verifying the review areas or lines of inquiry.
- 2. The ARR Chair shall notify an ARR Facilitator as soon as possible of any noncompliance, deviation from applicable requirements, or a condition that may impact implementation of the SAD and/or ASE.
- 3. The Supporting External Virtual Team will provide their review input through a member of the External Boots-on-the-ground Team. This will help manage the information developed by the comparatively large team. The External Boots-on-the-ground Team will provide the principal input for the ARR Final Report
- 4. Preliminary notifications may be made to provide management an opportunity to refute or resolve findings before the end of the ARR.

Prerequisite Documentation

The following documents will be made available to the ARR Committee in advance

- 1. Current (signed) Safety Assessment Document (SAD)
- 2. Copies of internally reviewed Accelerator Safety Envelope (ASE) documents sent to TJSO for review and approval
- 3. Unreviewed Safety Issue (USI) Process Document approved by TJSO
- 4. Current Unreviewed Safety Issue (USI) Procedure document
- 5. Current Safety Configuration Management Board (SCMB) Charter
- 6. CMTF and VTA Operating Procedures
- 7. Training Records

Reviewer Lines of Inquiry (LOI)

The following table of LOI is intended to be guiding questions when evaluating the readiness of the Jlab CMTF and VTA to operate safely under the ASO. The ARR committee will use these LOI to support the development of answers to charge questions above. The ARR Team is not constrained by these LOI and may pursue other topics germane to goal of verifying readiness to operate under the ASO.

Charge Question	Guiding Question or Phrase	Reference IRR#2 Report	420 CRD Reference	Conclusion (Y/N or NA)	Comments /Pre- starts/post-starts (if applicable)
1	Are the necessary program elements of the Contractor Requirements Document for DOE O 420.2D implemented for the CMTF/VTA, in place?		2		
1	<i>Is there a documented 420.2D implementation plan that includes the CMTF and VTA?</i>		2.a		
1.a	<i>Is there a documented safety analysis or analysis of postulated worst-case accident for the CMTF/VTA?</i>	F1.a.1	2.a.1, 2.b.2		
1.a	<i>Is there a clear connection between documented safety analyses, the SAD, credited controls and the ASE?</i>	F1.b.2, F1.d.2, F1.i.2			
1.b	Are operating and ASE restrictions captured in operations documentation and training?	F1.b.2, F1.d.2, F1.d.3			

Charge Question	Guiding Question or Phrase	Reference IRR#2	420 CRD Reference	Conclusion (Y/N or NA)	Comments /Pre- starts/post-starts (if
		Report			applicable)
1.a	Is the methodology for determining necessary Credited Controls based on the Maximum Credible Incident (MCI) analysis appropriate, and is it clear in the updated documentation?	F1.a.2, F1.a.3	2.b.2		
1.b, 1.i	Are there Clearly defined roles and responsibilities for CMTF/VTA activities including those for training and procedures	F1.i.4	2.a.2		
1.b, 1.i	Where are R2A2s described? Are personnel aware of their R2A2s? Who is responsible for training? How are operators qualified?	F1.i.3			
1.c	Does JLab's current listing/inventory of accelerators managed under the ASO include the CMTF and VTA?	O.1.c.2, NP1.c.1	2.a.3		
1.a	Is there an approved SAD that includes the CMTF and VTA?	F1.a.1	2.b.1		
1.d	Has the ASE been submitted to the site office for approval?	F1.d.5, F1.d.6	2.b.2		
1.e	<i>Is there a Site Office approved USI process that includes the CMTF and VTA?</i>	F1.e.1	2.b.3		
1.f	<i>Is there an approved ARR process that includes the CMTF and VTA?</i>	F1.f.1	2.b.4		

Charge Question	Guiding Question or Phrase	Reference IRR#2 Report	420 CRD Reference	Conclusion (Y/N or NA)	Comments /Pre- starts/post-starts (if applicable)
1.g	Does the Jlab the Contractor Assurance System include processes to review the CMTF/VTA accelerator safety program elements?		2.c		
1.d	Has the CMTF/VTA ASE been approved by Jlab Management and submitted to the Site Office for approval?	F1.d.5, F1.d.6	2.d.1		
1.e	Is there a documented process or procedure that describes the steps to be taken if a discovered condition potentially exceeds the ASE? Does this process meet the requirements of 420.2D	F1.d.3, F1.e.1, F1.e.2, F1.e.3	2.d.2		
1.a	<i>z.u.z?</i> Is there an approved ISM plan that includes hazards found in the CMTF and VTA?	01.c.1	2.e.		
1.e	What is the process to notify the DOE Site Office to modifications to the SAD?	F1.e.2	2.e.1		
1.b, 2	Are the risks of operating the CMTF and VTA understood at the appropriate level? e.g. management, oversight, worker?		2.e		

Charge Question	Guiding Question or Phrase	Reference	420 CRD Reference	Conclusion	Comments /Pre-
		IRR#2			starts/post-starts (if
		Report		(17 N OF NA)	applicable)
	Are the risks of making				
	modifications to the CMTF				
10162	and VTA understood at the				
1.a, 1.b, S	appropriate level? e.g.				
	management, oversight,				
	worker?				
	Does the approved SAD				
10162	incorporate CMTF and VTA	F1.f.1	2.0		
1.a, 1.0, 5	accelerator-specific hazards,	F1.a.2,	2.0		
	risk, and required controls?				
		F1.a.3			
	ls there a documented USI	F1.e.1,			
1.e	process that includes the	F1.e.3,			
	CMTF and VTA?	F1.e.4			
	Does the USI process				
	evaluate proposed activities	F1.e.3,			
	and discovered conditions	F1.e.4			
	for?				
	modifications,				
1.e	temporary changes,				
	permanent changes				
	new activities				
	Does the USI procedure				
	include a means to promptly	F1.d.3, F1.e.1, F1.e.2, F1.e.3			
1.e	notify the DOE site office of a				
	potential CMTF/VTA ASE				
	exceedance?				
1.g	Does the Jlab CAS include	NP1.g.1,			
	assessments for the		2.g.1		
	CMTF/VTA?	INF 1.g.Z			
1.h, 2, 3	ls there a configuration				
	management program that		2.g.2		
	includes CMTF/VTA credited				
	controls?				

Charge		Reference	420 CRD	Conclusion	Comments /Pre-
Question	Guiding Question of Phrase	Report	Reference	(Y/N or NA)	starts/post-starts (if applicable)
	Are CMTF/VTA implementing				
1.b, 1.h, 3	documents under	F1.b.1	2.g.2		
	configuration control?				
	Are Engineered Credited Controls	F1.i.7, F1.i.10, F2.1	2.g.3		
	identified				
2	Documented				
	In place				
	Under configuration				
	Management				
	Are Administrative Credited		0 ~ 0		
	controls		2.g.3		
	identified				
	Documented				
	In place				
	Under configuration				
	Management				
1.i	Are operating procedures	F1.b.1, F1.i.8, F1.i.2, F1.i.3	2.g.3		
	Identified				
	Documented				
	In place				
3	Under configuration				
	Management				
	Are personnel trained and		0 < 0		
	qualified on		z.g.s		
	Safe operations				
	ASE Requirements				
	and Restrictions				
	USI recognition				

Charge Question	Guiding Question or Phrase	Reference IRR#2 Report	420 CRD Reference	Conclusion (Y/N or NA)	Comments /Pre- starts/post-starts (if applicable)
2	Are the necessary credited controls, CMTF/VTA hardware, controls and monitoring systems fully implemented and operational?	F2.1			
2, 3	Are CMTF/VTA credited controls explicitly identified in JLab's work planning processes and tools?	01.i.1	2.g.3		
2	Topic 3: Are there sufficient trained personnel, administrative processes in place, and adequate resources to support the safe and efficient operation, maintenance, and repair of the VTA and CMTF?	F1.e.4, F3.1, F3.2, F3.4, F3.5	2.g.3		
3	Do personnel understand their roles in safe operations and recognition of potential USI and ASE exceedance?		1.b		
1.b, 3	Are personnel presently operating the CMTF and VTA using the documentation and training developed for the new ASE?		1.b, 2.a		

ARR Final Report (Format and Guidance)

The ARR Team Chair and their team shall develop a report according to the request in the letter of invitation. Unless otherwise indicated in the letter of invitation, the report shall contain:

- Cover/signature page.
- Signatures verifying required systems are ready.
- A Management Summary
- Description of the accelerator system(s) to which the document applies.
- Confirmation that any issues identified during the ARR have been resolved (including any related outstanding issues from previous review).
- Description of any appendices including appendices that address the readiness of safety related accelerator systems.
- Evaluation of readiness with respect to the readiness criteria and any associated lines of inquiry in the ARR plan.
- Description of any observations and/or findings associated with the ARR. Findings shall be classified as to whether resolution is required pre- or post-start.
- Statement of readiness for commissioning and / or operation as appropriate.

The report should contain:

• A section containing Findings, Opportunities for Improvement, and Noteworthy Practices resulting from the ARR and any unresolved issues from previous accelerator safety assessments documented in accordance with the Jefferson Lab Issue and Corrective Action Management Procedure.

Note: The table of LOI as annotated by the ARR Team may be used as this section.

The Safety Configuration Management Board (SCMB) shall review the ARR Report with the purpose of evaluating factual accuracy and completeness. The SCMB may use ad hoc members to assist in the evaluation. The SCMB shall report the results of their evaluation to the ESH AD. The ASPM shall transmit factual accuracy comments back to the ARR Team Chair for resolution.

The ARR Team Chair, in consultation with the ARR Team, dispositions factual accuracy comments and delivers a final ARR Report.

The Accelerator Safety Program Manager (ASPM) shall:

- Ensure that the results of the ARR Report are correctly captured by the lab's issues management system.
- Provide updates to the ESH AD

• Prepare a draft letter for the Jefferson Lab Director's signature that transmits the ARR Final Report to TJSO and requests approval to begin commissioning, or operations as applicable.

Based on the SCMB review and disposition of factual accuracy comments in the Final ARR Report, the ASPM and ESH AD will accept the report on behalf of the laboratory.