Objective Criteria for Assessing

Safe NSTX-U Startup

NSTX-U Readiness for Operation Review

Lines Of Inquiry

DRAFT

Prepared: Alfred von Halle
Digitally signed by Alfred von Halle
DN: cn=Alfred von Halle, o, ou, email=avonhalle@pppl.gov, c=US
Date: 2014.11.25 14:50:14 -05'00'

A. von Halle, Head, NSTX Engineering Operations

Reviewed: Jerry D. Levine
Digitally signed by Jerry D. Levine
DN: cn=Jerry D. Levine, o, ou=PPPL, email=jlevine@pppl.gov, c=US
Date: 2014.11.25 16:23:02 -05'00'

J. Levine, Head, ESH&S

Charles A. Gentile
Digitally signed by Charles A. Gentile
DN: cn=Charles A. Gentile, o, ou, email=cgentile@pppl.gov, c=US
Date: 2014.11.26 09:50:38 -05'00'

C. Gentile, Chair, ACC

Approved: Mike Williams
Digitally signed by Mike Williams
DN: cn=Mike Williams, o=PPPL, ou=Engineering, email=williams@pppl.gov, c=US
Date: 2014.11.26 09:55:35 -05'00'

M. Williams, Assoc. Director Engineering

Arnie Kellman
2014.12.05 12:28:14 -08'00'

A. Kellman, Chair, Readiness For Operations

1. Safety Documentation

2. Roles and Responsibilities

3. Safe Operating Envelope

4. Activity Certification

5. Operational Readiness

6. Project Objectives

1.0 Safety Documentation

1.1 Objective

Determine if the approved NSTX-U Safety Assessment Document (SAD) and pending Safety Certificate adequately define the safe operating envelope for NSTX-U operations.

1.2 Criteria

The PPPL Health and Safety Manual ESHD 5008 requires that the SAD:

- Identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operation and credible accidents.
- Contain sufficient descriptive information and analytical results pertaining to specific hazards and risks identified during the safety analysis process to provide an understanding of risks of proposed operations.
- Provide detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., procedures) put in place to eliminate, control, or mitigate hazards from operation.
- Include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation.

1.2 Approach

Safety Assessment Document (SAD) and Failure Modes and Effects Analysis (FMEA) reviews.

SAD/FMEA Author and Activity Certification Committee Chairman Interviews.

Lines of Inquiry	Assessment Methodology
1. Are the safety aspects of the NSTX-U facility and systems adequately described in the SAD?	1. Review SAD Chapter 3 and associated FMEAs. Consider follow up interviews with cognizant systems engineers.
2. Are the hazards of NSTX-U operations, as described in the SAD reasonably complete, and adequately assessed?	2. Review SAD Chapter 3 and associated FMEAs, and review SAD Chapter 4. Consider follow up interviews with cognizant systems engineers, SAD author, ACC chair.
3. Will the mitigating factors described in the SAD adequately protect workers, the public and the environment from the potential consequences of NSTX-U	3. Review SAD Chapter 3 and associated FMEAs, and review SAD Chapter 4. Consider follow up interviews with cognizant systems engineers, SAD

hazards?	author, ACC chair.
4. Does the Safety Envelope described in the SAD (from which the Safety Certificate will be derived) address the key mitigating factors to protect against the potential consequences of NSTX-U hazards?	4. Review SAD Chapters 2 and 5. Consider follow up interviews with cognizant systems engineers, SAD author, ACC chair.
5. Were the review and approval processes for the SAD and pending Safety Certificate robust?	5. Review ESHD 5008 Section 11. Interview SAD author and ACC Chair on processes. Examine SAD Review comments and resolutions.

2.0 Roles and responsibilities

2.1 Objective

Determine if there are there clearly defined roles, responsibilities and training for NSTX-U operations personnel.

2.2 Criteria

PPPL and NSTX-U Administrative Procedures define and document roles and responsibilities of operations personnel, and prescribe training requirements.

2.3 Approach

Reviews of the NSTX-U Administrative Procedures defining the roles, responsibilities, and training of operating personnel.
Management/Staff interviews.

Lines of Inquiry	Assessment Methodology
1. Is the NSTX-U operations organization clearly defined and documented?	1. Review of the Administrative Procedure on the NSTX-U Chain of Command (OP-AD-56)
2. Are the roles and responsibilities of each member of the NSTX-U operations organization unambiguously defined, documented and understood by the organization members and their supervisors?	2. Interviews with the NSTX-U Head of Engineering Operations and a NSTX-U Chief Operating Engineer (COE). Interviews of operating staff as appropriate.
3. Are the training requirements for each member of the NSTX-U operations organization clearly defined, including required refresher frequencies if applicable?	3. Review the NSTX-U Operator Training Matrix (OP-NSTX-12)
4. Have the members of the NSTX-U operations organization received their required training, or are there plans to have this training completed as needed to support operations?	4. Interview with the PPPL Office of Human Resources Training Manager.

3.0 Safe Operating Envelope

3.1 Objective

Determine if there are clearly defined operating procedures that ensure that NSTX-U is commissioned and operated within the safe operating envelope defined by the NSTX-U Safety Assessment Document (SAD) and Safety Certificate (including off-normal events).

3.2 Criteria

Operations Procedures prescribe the necessary steps and approvals for the commissioning and operations of NSTX-U.

3.3 Approach

Reviews of the NSTX-U Pre-Operational Test and Operations Procedures. Management/Staff interviews.

Lines of Inquiry	Assessment Methodology
1. Are there clearly defined NSTX-U operating procedures that address commissioning and operation of NSTX-U?	1. Review the NSTX-U Start-Up Procedure (OP-NSTX-02), particularly the matrix of subsystem pre-operational test and operations procedures.
2. Is the NSTX-U Safety Envelope that is documented in Chapter 5 of the NSTX-U SAD, which will constitute the Conditions/Limitations on the Safety Certificate, adequately addressed in NSTX-U operating procedures, where appropriate?	2. Review the "Hold Points" and approvals to proceed contained in OP-NSTX-02. Review the NSTX-U Integrated System Test Procedure (ISTP-001) which defines the protection system settings and necessary test shots for any changes to the NSTX electromagnetic configuration and/or operating envelope. Interviews with the NSTX-U Head of Engineering Operations and a NSTX-U Chief Operating Engineer (COE). Interviews with the NSTX-U Head of Engineering Operations, a NSTX-U Chief Operating Engineer (COE), the Head of PPPL ESH&S, and the Head of NSTX-U Experimental Operations.

4.0 Activity Certification

4.1 Objective

Determine if the PPPL Activity Certification Committee (ACC) process ensures that configuration changes are adequately reviewed and appropriately documented in the NSTX-U Safety Assessment Document (SAD) and Safety Certificate.

4.2 Criteria

ESHD 5008 and PPPL Engineering Procedures prescribe the necessary steps and requirements for NSTX-U Configuration Control.

4.3 Approach

Reviews the appropriate section(s) of ESHD 5008 and PPPL Engineering Procedures. Management/Staff interviews.

Lines of Inquiry	Assessment Methodology
1. How is it assured that a configuration change that may impact the NSTX-U Safety Envelope would be reviewed and approved by the ACC and relevant other management prior to implementation?	1. Review ESHD 5008 Section 11 & PPPL Work Planning Procedure (ENG-032). Consider, if necessary, reviews of the Design Verification Procedure (ENG-033), Drawing Control Procedure (ENG-010, and the Approval Matrix for Technical Procedures (ENG-030). Interview ACC Chair, Project Management Office Head, Head ESH&S, and the NSTX-U Construction Manager on the operation of the Work Control Center.
2. How does the ACC process regarding configuration changes ensure that approved changes to the NSTX-U Safety Envelope are documented in the SAD and Safety Certificate prior to their implementation?	2. Review ESHD 5008 Section 11 & Work Planning Procedure (ENG-032). Interview ACC Chair, Project Management Office Head, Head ESH&S, others as appropriate.

5.0 Operational Readiness

5.1 Objective

Determine if the PPPL Activity Certification Committee (ACC) process, including approval to proceed by the PPPL ES&H Executive Board Chairperson, ensure that PPPL is indeed ready to begin NSTX-U operations.

5.2 Criteria

ESHD 5008, the ACC, and the PPPL ES&H Executive Safety Board will be used to evaluate and approve NSTX-U's readiness for operation.

5.3 Approach

Reviews the appropriate section(s) of ESHD 5008. Interviews with the ACC and the ES&H Executive Board Chairmen.

Lines of Inquiry	Assessment Methodology
1. What is the ACC process, and how is it designed to allow a defensible judgment to be made by the ACC and the ES&H Executive Board Chair on NSTX-U readiness to operate?	1. Review ESHD 5008 Section 11. Interview ACC Chair, others as appropriate.
2. What specific actions were taken, and will be taken, as part of the ACC process to ensure that a defensible judgment on NSTX-U readiness to operate can be made?	2. Interview ACC Chair, review ACC documentation.

6.0 Project Objectives

6.1 Objective

At the time of project completion, determine if the NSTX Upgrade Project will have delivered the Project Objectives as defined in Section 2.2 of the NSTX-U Project Execution Plan.

6.2 Criteria

Project Objectives and Requirements are described in the NSTX-U Project Execution Plan.

6.3 Approach

Review of the NSTX-U Project Execution Plan and EVMS project data. Interviews with the NSTX-U Project Head, the appropriate section(s) of ESHD 5008. Interviews with

Lines of Inquiry	Assessment Methodology
1. Have NSTX-U PEP items for the centerstack upgrade and for the second neutral beam been completed?	1. Review of the NSTX-U Project Execution Plan. Interviews with the NSTX-U Project Head, the Engineering Managers of the Centerstack and Neutral Beam Groups, and appropriate CAM's.
2. How will the achievement of first plasma, defined as an ohmically heated discharge > 50 kA at a toroidal magnetic field of > 1 kG, be confirmed?	2. Interviews with appropriate CAM's and the Head of NSTX-U Experimental Operations.
3. How will the achievement of a 40,000 electron-volt neutral beam produced and injected into the armor for .050 seconds be confirmed?	3. Interviews with appropriate CAM's and the Head of the Neutral Beam Engineering Group.