

# National Compact Stellarator Experiment

## NCSX

### QUALITY ASSURANCE PLAN

NCSX-PLAN-QAP-01

March 22, 2006

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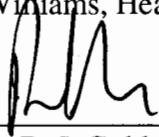
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\* The PPPL QA Plan, EQP-004, requires that project specific QA Plans have the concurrence of the Head, Quality Assurance (QA). Since the Head, QA is also the preparer of the NCSX QA Plan, this concurrence signature is elevated one level in the PPPL organization.

## RECORD OF REVISIONS

| Revision | Date  | Resp. Ind. | Description of Change   |
|----------|-------|------------|---|
| 0        | 11/02 | Malsbury   | Initial Release.  |
| 1        | 3/06  | Malsbury   | Updated to reflect changes in project plans and procedure and the project moving beyond the design stage. |

## 1.0 PURPOSE

The National Compact Stellarator Experiment (NCSX) is a proof-of-principle-scale facility for studying the physics of compact stellarators, an innovative fusion confinement concept. The facility will include the stellarator device and ancillary support systems. NCSX is a joint project of the Oak Ridge National Laboratory (ORNL) Fusion Energy Division and the Princeton Plasma Physics Laboratory (PPPL) Advanced Projects Department.

This document defines the Quality Assurance Plan for NCSX. It is effective from the date of final signatures through first plasma. This Plan satisfies the requirements of the most recent version of DOE O 414.1, Quality Assurance.

## 2.0 RELATED DOCUMENTS

The following are related documents (current versions):

- DOE O 414.1, Quality Assurance
- DOE O 413.3, Program and Project Management for the Acquisition of Capital Assets
- The PPPL Institutional Quality Assurance Plan (IQAP), EQP-004
- The ORNL Fusion Energy Division Management and Integrated Safety Management System Plan, QAP-X-FE-001, Rev. 0, February 2002
- Plans and procedures as indicated in the Appendix

## 3.0 THE NCSX QUALITY ASSURANCE PLAN

Quality assurance requirements for non-nuclear facilities are described in the DOE order on quality assurance, DOE O 414.1. The PPPL Institutional Quality Assurance Plan referenced above has been approved by DOE for non-nuclear work performed at PPPL. The NCSX Quality Assurance Plan described in this document integrates the PPPL Quality Assurance Plan with implementing PPPL and ORNL plans and procedures to assure that an appropriate quality assurance program exists for NCSX. NCSX plans and PPPL procedures will be used for all project work activities, independent of the site at which the work will be performed, unless noted otherwise in the appendix.

The Appendix to this Plan contains the following:

- The quality requirements from DOE O 414.1

- The list of plans, policies, and procedures applicable to work performed for NCSX.

#### **4.0 ASSUMPTIONS**

This Quality Assurance Plan makes the following assumptions:

- As documented in the Project Execution Plan, ORNL is responsible for the design of all WBS 1 systems. PPPL personnel will support ORNL in the design of WBS 1 systems. WBS 1 systems are the stellarator core systems and include the plasma facing components, vacuum vessel and in-vessel structures, TF and PF coil systems, cryostat, machine support structure, modular coil systems, and trim coil systems. Responsibilities include developing designs, generating drawings suitable for fabrication, and specifying additional procurement requirements, such as statements of work or specifications. In support of this effort, fabrication of prototypes may be performed by ORNL.
- PPPL is responsible for all remaining systems and the final assembly and installation of NCSX.
- With minor exceptions, all procurements of hardware are the responsibility of PPPL. However, either Laboratory may procure services, such as analysis or manufacturing studies.

These assumptions impact the choice of procedures invoked on behalf of the NCSX project.

## Appendix

### List of Implementing Plans and Procedures for the NCSX Project

| Requirement from DOE O 414.1   | Applicable Plans and Procedures  |
|--|--|
| <p>1.0, Management /Program</p> <p>(a) A written QAP must be developed, implemented, and maintained.</p> <p>(b) The QAP must describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the work.</p> <p>(c) The QAP must describe the management processes, including planning, scheduling, and resource considerations.</p>   | <p>NCSX Project Execution Plan</p> <p>NCSX Quality Assurance Plan (this plan)</p>  |
| <p>2.0, Management /Personnel Training and Qualification</p> <p>(a) Personnel must be trained and qualified to ensure they are capable of performing their assigned work.</p> <p>(b) Personnel must be provided continuing training to ensure that job proficiency is maintained.</p>  | <p>Design, Fabrication, and Construction Activities: NCSX Training Plan, NCSX-PLAN-TRNG</p>  |
| <p>3.0, Management /Quality Improvement</p> <p>(a) Processes to detect and prevent quality problems must be established and implemented.</p> <p>(b) Items, services, and processes that do not meet established requirements must be identified, controlled, and corrected according to the importance of the problem and the work affected. Correction must include identifying the causes of problems and working to prevent recurrence.</p> <p>(c) Item characteristics, process implementation, and other quality-related information must be reviewed and the data analyzed to identify items, services, and processes needing improvement.</p> | <p>PPPL QA-005, Control of Nonconformances</p> <p>PPPL QA-012, Corrective Action Request</p> <p>PPPL QA-017, PPPL Tracking and Trending System</p> <p>PPPL QA-019, Root Cause Analysis</p> |

\* See [http://ncsx.pppl.gov/SystemsEngineering/Plans\\_Procedures/NCSX\\_Mgmt\\_Plans.htm](http://ncsx.pppl.gov/SystemsEngineering/Plans_Procedures/NCSX_Mgmt_Plans.htm) for NCSX Plans, <http://www.pppl.gov/eshis/procedures.html> for PPPL procedures, [http://www.pppl.gov/eshis/ESHD\\_MANUAL/sm.html](http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html) for the PPPL ES&HD 5008 Manual. and <http://oorm-1-priv.pppl.gov/users/pro/policies/default.htm> for the PPPL Procurement Manual.

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| 4.0, Management /Documents and Records<br>(a) Documents must be prepared, reviewed, approved, issued, used, and revised to prescribe processes, specify requirements, or establish design.<br>(b) Records must be specified, prepared, reviewed, approved, and maintained. | NCSX Documents and Records Plan, NCSX-PLAN-DOC<br>NCSX Data Management Plan, NCSX-PLAN-DMP<br>NCSX Interface Control Management Plan, NCSX-PLAN-ICMP<br>NCSX Configuration Management Plan, NCSX-PLAN-CMP<br>PPPL ENG-010, Control of Drawings, Software, and Firmware<br>NCSX Procedure-007, NCSX Electronic Model and Drawing/INTRALINK Processes<br>NCSX procedure-006, Control of NCSX Supplier and In-House Fabrication Information |

\* See [http://ncsx.pppl.gov/SystemsEngineering/Plans\\_Procedures/NCSX\\_Mgmt\\_Plans.htm](http://ncsx.pppl.gov/SystemsEngineering/Plans_Procedures/NCSX_Mgmt_Plans.htm) for NCSX Plans, <http://www.pppl.gov/eshis/procedures.html> for PPPL procedures, [http://www.pppl.gov/eshis/ESHD\\_MANUAL/sm.html](http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html) for the PPPL ES&HD 5008 Manual. and <http://oorm-1-priv.pppl.gov/users/pro/policies/default.htm> for the PPPL Procurement Manual.

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|--|---|
| <p>5.0, Performance /Work Processes</p> <p>(a) Work must be performed to established technical standards and administrative controls, using approved instructions, procedures, or other approved means.</p> <p>(b) Items must be identified and controlled to assure their proper use.</p> <p>(c) Items must be maintained to prevent their damage, loss, or deterioration.</p> <p>(d) Equipment used for process monitoring or data collection must be calibrated and maintained.</p> | <p>Most of the work, excluding design, will be performed at PPPL. For these work activities, normal PPPL procedures will be followed. Typical ones are:</p> <p>ENG-002, Control of Measuring and Test (MTE) Equipment</p> <p>ENG-010, Control of Drawings, Software, and Firmware</p> <p>ENG-012, Identification &amp; Control of Items</p> <p>ENG-014, Hydrostatic and Pneumatic Testing</p> <p>ENG-016, PPPL Preventive Maintenance Program</p> <p>ENG-021, Hoisting and Rigging Program</p> <p>ENG-030, PPPL Technical Procedures for Experimental Facilities</p> <p>ENG-032, Work Planning Procedure</p> <p>ENG-037, General Welding and Brazing Requirements</p> <p>PPPL Engineering Standards</p> <p>ES&amp;H Manual, ES&amp;HD 5008</p> <p>ESH-004, Job Hazards Analysis</p> <p>ESH-016, Control of Hazardous/Energy Sources – Safing/ Lockout/Tagout</p> <p>Field work performed at ORNL will follow ORNL procedures.</p> <p>Specific to NCSX:</p> <p>NCSX procedure-004, NCSX Work Authorization Process</p> |

\* See [http://ncsx.pppl.gov/SystemsEngineering/Plans\\_Procedures/NCSX\\_Mgmt\\_Plans.htm](http://ncsx.pppl.gov/SystemsEngineering/Plans_Procedures/NCSX_Mgmt_Plans.htm) for NCSX Plans, <http://www.pppl.gov/eshis/procedures.html> for PPPL procedures, [http://www.pppl.gov/eshis/ESHD\\_MANUAL/sm.html](http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html) for the PPPL ES&HD 5008 Manual. and <http://oorm-1-priv.pppl.gov/users/pro/policies/default.htm> for the PPPL Procurement Manual.

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|---|--|
| <p>6.0, Performance /Design</p> <p>(a) Items and processes must be designed using sound engineering/scientific principles and appropriate standards.</p> <p>(b) Design work, including changes, must incorporate applicable requirements and design bases.</p> <p>(c) Design interfaces must be identified and controlled.</p> <p>(d) The adequacy of design products must be verified or validated by individuals or groups other than those who performed the work.</p> <p>(e) Verification and validation work must be completed before approval and implementation of the design.</p> | <p>NCSX Interface Control Management Plan, NCSX-PLAN-ICMP</p> <p>PPPL ENG-010, Control of Drawings, Software, and Firmware</p> <p>PPPL ENG-032, Work Planning Procedure</p> <p>PPPL ENG-033, Design Verification</p> <p>NCSX Reliability, Availability, and Maintainability Plan, NCSX-PLAN-RAM</p> <p>PPPL Engineering Standards</p> <p>NCSX Materials Properties<br/> <a href="http://ncsx.pppl.gov/NCSX_Engineering/Materials/index_Materials.htm">           (http://ncsx.pppl.gov/NCSX_Engineering/Materials/index_Materials.htm)         </a></p> <p>NCSX Vacuum Mterials Committee and results<br/> <a href="http://ncsx.pppl.gov/NCSX_Engineering/Materials/Vacuum_Materials/index_VacuumMaterials.htm">           (http://ncsx.pppl.gov/NCSX_Engineering/Materials/Vacuum_Materials/index_VacuumMaterials.htm)         </a></p> <p>NCSX Design Criteria<br/> <a href="http://ncsx.pppl.gov/NCSX_Engineering/Design_Criteria/index_design_criteria.htm">           (http://ncsx.pppl.gov/NCSX_Engineering/Design_Criteria/index_design_criteria.htm)         </a></p> <p>NCSX procedure-009, Request for Deviation Process</p> <p>NCSX procedure 010, NCSX Design Review Processes</p> |

\* See [http://ncsx.pppl.gov/SystemsEngineering/Plans\\_Procedures/NCSX\\_Mgmt\\_Plans.htm](http://ncsx.pppl.gov/SystemsEngineering/Plans_Procedures/NCSX_Mgmt_Plans.htm) for NCSX Plans, <http://www.pppl.gov/eshis/procedures.html> for PPPL procedures, [http://www.pppl.gov/eshis/ESHD\\_MANUAL/sm.html](http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html) for the PPPL ES&HD 5008 Manual. and <http://oorm-1-priv.pppl.gov/users/pro/policies/default.htm> for the PPPL Procurement Manual.



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**Requirement from DOE O 414.1**

**Applicable Plans and Procedures**

|  |  |
|--|--|
| <p>7.0, Performance /Procurement</p> <p>(a) Procured items and services must meet established requirements and perform as specified.</p> <p>(b) Prospective suppliers must be evaluated and selected on the basis of specified criteria.</p> <p>(c) Processes to ensure that approved suppliers continue to provide acceptable items and services must be established and implemented.</p> | <p>Most of the procurements will be performed by PPPL under the PPPL systems listed below:</p> <p>PPPL Procurement Manual</p> <p>QA-003, Procurement Quality Assurance</p> <p>QA-009, DCMAO Vendor Survey/Surveillance Delegation</p> <p>QA-020, Identifying and Dispositioning Suspect Parts</p> <p>ENG-006, Review and Approval of Specifications &amp; Statements of Work</p> <p>ENG-012, Identification &amp; Control of Items</p> <p>36.003, Subcontract Proposal Evaluation Board (SPEB) Policy</p> <p>NCSX_PROC_006, Control of NCSX Supplier and In-House Fabrication Information</p> <p>A limited number of procurements will be performed by ORNL under the system described by the ORNL Management System Description - Acquisition Management.</p> |
| <p>8.0, Performance /Inspection and Acceptance Testing</p> <p>(a) Inspection and testing of specified items, services, and processes must be conducted using established acceptance and performance criteria.</p> <p>(b) Equipment used for inspections and tests must be calibrated and maintained.</p>   | <p>NCSX Test and Evaluation Plan, NCSX-PLAN-TEP</p> <p>QA-004, PPPL Site Inspection Program</p> <p>QA-009, DCMAO Vendor Survey/Surveillance Delegation</p> <p>ENG-002, Control of Measuring and Test (MTE) Equipment</p> <p>ENG-014, Hydrostatic and Pneumatic Testing</p> <p>ORNL personnel working at ORNL and performing inspection and acceptance testing will follow ORNL procedures.</p>   |
| <p>9.0, Assessment /Management Assessment</p> <p>(a) Managers must assess their management processes.</p> <p>(b) Problems that hinder the organization from achieving its objectives must be identified and corrected.</p>   | <p>ORNL FED Self-Assessment Plan</p> <p>P-026, Assessment and Oversight</p>  |

\* See [http://ncsx.pppl.gov/SystemsEngineering/Plans\\_Procedures/NCSX\\_Mgmt\\_Plans.htm](http://ncsx.pppl.gov/SystemsEngineering/Plans_Procedures/NCSX_Mgmt_Plans.htm) for NCSX Plans, <http://www.pppl.gov/eshis/procedures.html> for PPPL procedures, [http://www.pppl.gov/eshis/ESHD\\_MANUAL/sm.html](http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html) for the PPPL ES&HD 5008 Manual. and <http://oorm-1-priv.pppl.gov/users/pro/policies/default.htm> for the PPPL Procurement Manual.

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|---|---|
| <p>10.0, Assessment /Independent Assessment</p> <p>(a) Independent assessments must be planned and conducted to measure item and service quality, to measure the adequacy of work performance, and to promote improvement.</p> <p>(b) The group performing independent assessments must have sufficient authority and freedom from the line to carry out its responsibilities.</p> <p>(c) Persons conducting independent assessments must be technically qualified and knowledgeable in the areas assessed.</p>   | <p>QA-002, PPPL Audit Program</p>   |
| <p>11.0 Suspect/Counterfeit Items</p> <p>(a) An S/CI prevention process must be developed and implemented as part of the contractor's QAP and must be commensurate with the facility/activity hazards and mission impact... The QAP must address the following elements for S/CI prevention: preventing the introduction and use of S/CIs through engineering involvement, training on S/CI processes and controls, Identifying and dispositioning S/CIs onsite, restricting S/CIs to those found acceptable via engineering analysis and formal disposition processes, disseminating and using the most accurate and up-to-date information on S/CIs, and identifying the management point of contract for S/CI information notices.</p> | <p>P-041, Suspect Parts</p> <p>QA-020, Identifying and Dispositioning Suspect Parts</p> |

\* See [http://ncsx.pppl.gov/SystemsEngineering/Plans\\_Procedures/NCSX\\_Mgmt\\_Plans.htm](http://ncsx.pppl.gov/SystemsEngineering/Plans_Procedures/NCSX_Mgmt_Plans.htm) for NCSX Plans, <http://www.pppl.gov/eshis/procedures.html> for PPPL procedures, [http://www.pppl.gov/eshis/ESHD\\_MANUAL/sm.html](http://www.pppl.gov/eshis/ESHD_MANUAL/sm.html) for the PPPL ES&HD 5008 Manual. and <http://oorm-1-priv.pppl.gov/users/pro/policies/default.htm> for the PPPL Procurement Manual.