Title	Initiated by:	Effective Date:
NCSX Design Review Process	Bob Simmons Digitally signed by Bob Simmons DN: CN = Bob Simmons, C = US Reason: I am the author of this document Date: 2006.02.23 14:03:55 -05'00' NCSX Systems Engineering Support Manager	**February 23, 2006**
Concurrence by: NCSX Quality Assurance Manager	**Concurrence by:** Mike Williams Digitally signed by Mike Williams DN: cn=Mike Williams, c=US, o=PPPL, ou=Engineering, email=williams@pppl.gov Date: 2006.02.23 14:55:53 -05'00' PPPL Head, Engineering & Technical Infrastructure	**Concurrence by:** Jerry Levine 2006.02.23 16:50:52 -05'00' NCSX ES&H Manager
	Approved by: Wayne Reiersen Digitally signed by Wayne Reiersen DN: CN = Wayne Reiersen, C = US, O = PPPL Reason: I am approving this document Date: 2006.02.24 11:27:36 -05'00' NCSX Engineering Manager	**Supersedes:** Rev 1

Record of Revisions

Revision	Date	Description of Changes
0	**4/15/2005**	**Initial Issue**
1	**2/23/2006**	**Revised Attachments 1 & 2 to Clarify ES&H Requirements**

Applicability

- This procedure is applicable to the entire NCSX Project. PPPL Engineering Procedure ENG-033, *Design Verification*, describe the processes and procedures by which design verification activities shall be conducted. ***The NCSX Project is committed to following all the processes and procedures of ENG-033 completely, except that the Project will maintain its design review records in an electronic format (e.g., design review reports, CHITs, and tracking logs) , in keeping with its adoption of an electronic data record system.***

Introduction

The NCSX Systems Engineering Management Plan (NCSX-PLAN-SEMP) provides the project's approach to the conduct of design reviews. Sections B (Peer Reviews) and C (Design Reviews) of PPPL Engineering Procedure ENG-033 address the conduct and requirements for conducting design reviews. The NCSX Project will continue to utilize the CHIT form provided in ENG-033, however, at the completion of the review, this data will be electronically transcribed to an Excel Spreadsheet to facilitate electronic posting of the design review report and CHITs. Additionally, in accordance with this procedure, each CHIT will be tracked and statused on a routine basis to ensure timely closure of each CHIT.

CONTROLLED DOCUMENT

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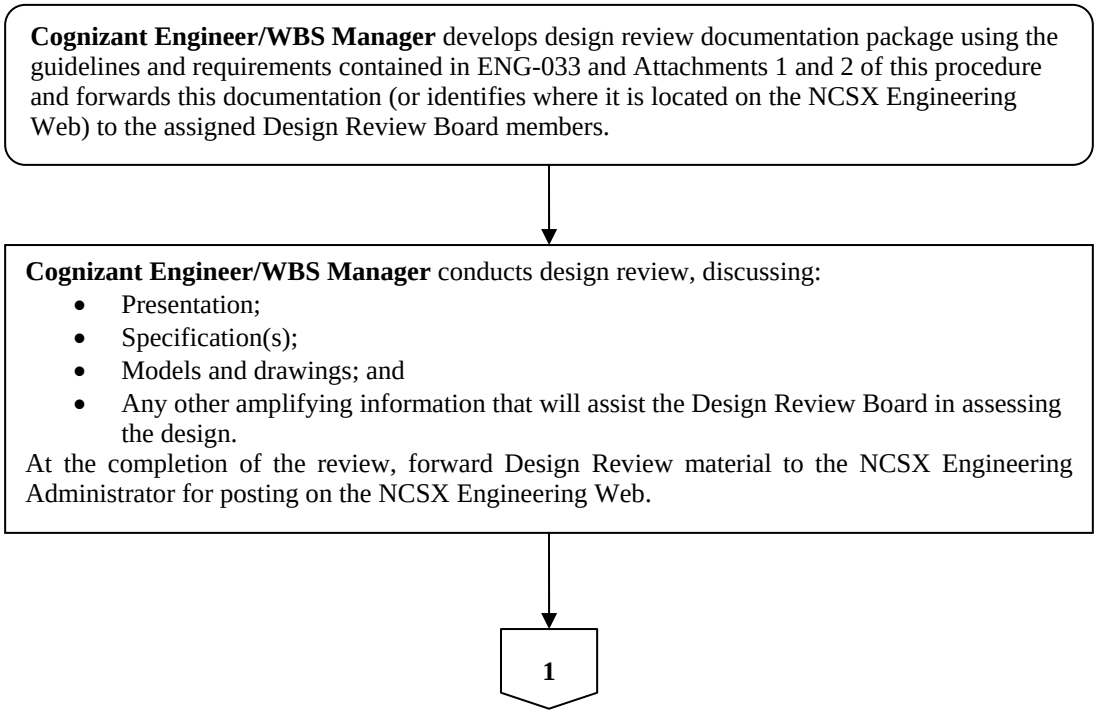
Referenced Documents

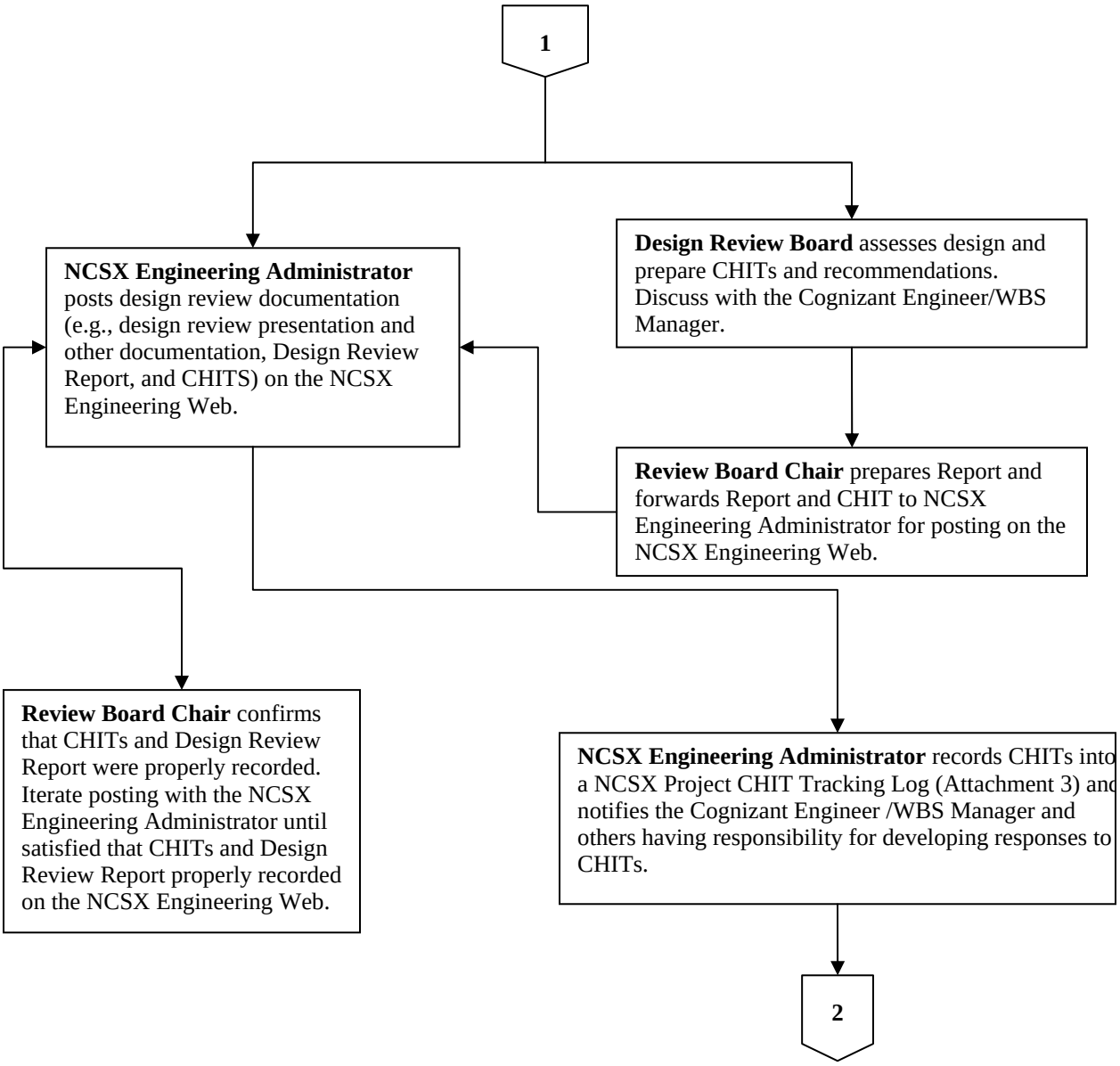
NCSX Systems Engineering Management Plan (NCSX-PLAN-SEMP)
PPPL Policy 010, "Design Reviews"
PPPL Procedure ENG-033, "Design Verification"
ES&HD 5008, "PPPL ES&H Manual"

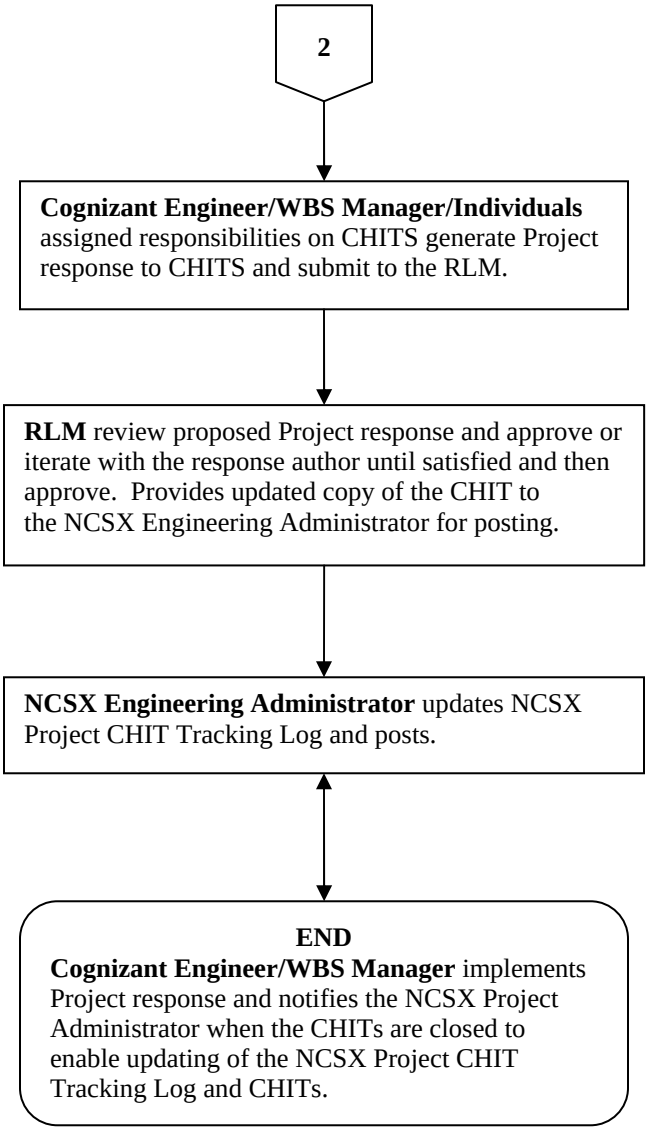
Procedure

A. NCSX Design Review Process

The NCSX Project will fully implement the requirements and processes for conducting and documenting design reviews with the exception that all design review records will be stored electronically on the NCSX Engineering Web site and not as hard copies in the PPPL Operations Center.




1
NCSX Engineering Administrator posts design review documentation (e.g., design review presentation and other documentation, Design Review Report, and CHITS) on the NCSX Engineering Web.
Design Review Board assesses design and prepare CHITs and recommendations. Discuss with the Cognizant Engineer/WBS Manager.
Review Board Chair prepares Report and forwards Report and CHIT to NCSX Engineering Administrator for posting on the NCSX Engineering Web.
Review Board Chair confirms that CHITs and Design Review Report were properly recorded. Iterate posting with the NCSX Engineering Administrator until satisfied that CHITs and Design Review Report properly recorded on the NCSX Engineering Web.
NCSX Engineering Administrator records CHITs into a NCSX Project CHIT Tracking Log (Attachment 3) and notifies the Cognizant Engineer /WBS Manager and others having responsibility for developing responses to CHITs.
2



Attachments

1- **Generic Design Checklist for Preliminary Design**
2- **Generic Design Checklist for Final Design**
3- **Sample NCSX Project CHIT Tracking Log**

Item	Requirement	Success Criteria
Configuration Identification	Configuration Items (CI's) represent the lowest level of control under configuration management and may be a single physical or functional item or collection of items that will satisfy a final end product or deliverable. A CI may be a subsystem, a component, assembly, or subassembly. The WBS Manager will determine the appropriate level of the CI. The process of identifying and agreeing to the interfaces between CIs is key to fully understanding requirements and design constraints.. Acquisition plans should address build v. buy issues.	Spec tree, design review schedule, and acquisition plans updated and posted on Web. Project detailed schedule updated by PC Mgr.
Specifications	Performance requirements are finalized and documented in approved development ("design-to") specifications , which are under change control. No TBDs are allowed. The NCSX Systems Engineering Management Plan (SEMP) and the NCSX Engineering Web page (specifications provides guidance on content and format of these specs.	Approved specification(s).
Design vs. Requirements	Document design approach. Demonstrate how the design concept satisfies requirements and design constraints in the relevant development specifications.	Documented in Design Basis Document prior to PDR. Approved by responsible Project Engineer.
Resolution of Design Recommendations	Document resolution of chits from prior design reviews. PPPL Procedure ENG-033 provides guidance.	Resolution of chits from prior design reviews documented on Web. Action items completed.
Interface Identification	Signed scope sheets for all primary interfaces. No TBDs allowed. The NCSX Interface Control Management Plan (ICMP) and NCSX Procedure 003 provide details of content and format expected.	Approved by Systems Engineering Support Manager
	Signed ICDs for all primary interfaces. TBDs allowed with closure plans. The NCSX Interface Control Management Plan (ICMP) and NCSX Procedure 003 provide details of content and format expected.	Approved by Systems Engineering Support Manager

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Item	Requirement	Success Criteria
Models and Drawings	Sufficient drawings to support developmental design and analytical evaluation of the inherent ability of the design to attain the required performance. The drawings shall be sufficient to develop manufacturing approaches and cost estimates. All models and drawings promoted to Preliminary Design Release. Drawings shall be provided which define where the equipment will be located in the facility. Preliminary Design Release models and drawings should form a self-consistent package and provide the basis for cost and schedule estimates. The NCSX Pro/INTALINK Users Guide provides information on handling models and drawings.	Models and drawings approved for promotion by the responsible Project Engineer
	Develop a drawing tree with at least enough detail to identify all components necessary to support final design and production planning.	Approved by the cognizant Project Engineer
Analysis	Design criteria to establish limits for acceptability are in place. Sufficient analysis shall be provided to establish that the proposed design is feasible and meets established design criteria. Analyses must be documented in an auditable way – in analysis reports, not viewgraph presentations. The following analyses shall be accomplished as appropriate: structural, thermal, seismic, eddy current, radiation, and circuit analyses. Other analyses shall be included as appropriate.	Design criteria documented. Material properties characterized and documented. Analysis reports reviewed by responsible Project Engineer, summarized in Design Basis Document.
Manufacturability	Provide evidence (if necessary) from R&D activities that the design is manufacturable and has been optimized for manufacturability.	Manufacturing studies conducted as appropriate and results documented in Design Basis Document.
Qualification and Acceptance Testing	Qualification and acceptance test plans consistent with verification requirements in the development specifications. Identify when these tests would be performed. These plans provide the basis for subsequently developing test procedures. PPPL Procedure ENG-030 provides guidance.	Qualification and acceptance test plans documented and approved.
Constructability	Document plans for assembly, installation, and test. Provide evidence that risk-related issues have been satisfactorily addressed. These plans provide the basis for subsequently developing assembly, installation, and test procedures. PPPL Procedure ENG-030 provides guidance.	Assembly, installation, and test plans documented and approved.

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Item	Requirement	Success Criteria
Value Engineering	Determine what design areas would likely benefit from additional value engineering/management assessments at the beginning of Preliminary Design. Conduct and document results of value engineering studies (if any). NCSX Project Execution Plan (PEP) provides approach and the Value Engineering Report provides examples.	Results of value engineering studies (if any) documented in Design Basis Document.
RAM	Provide FMECA per PPPL Procedure ENG-008 identifying potential failure modes and recovery provisions. Explain how design has been optimized for reliability, maintainability, and safety through systematic evaluation of design options and application of proven design approaches.	FMECA documented. Summary of findings and design recommendations provided in Design Basis Document.
ES&H	Review existing NEPA documentation per PPPL Procedure ESH-014. Submit new NEPA Planning Form if new hazards are identified.	Approved by NCSX ES&H Manager.
COTS and Legacy Equipment	Identify use of commercial, off-the-shelf (COTS) as appropriate or legacy equipment. Describe plan for testing the performance of legacy equipment.	Documented in Design Basis Document.
Human Engineering	Demonstrate that sound human engineering principles have been followed in the design.	Documented in Design Basis Document.
Standardization Considerations	Identify how design has been optimized for standardization, including a list of standardized components	Documented in Design Basis Document.
Software and Firmware	Identify and describe all planned software and firmware, including the functional requirements allocated to them, how they will be validated and verified. This may be part of a Manufacturing, Inspection, and Test Plan (MITP).	Documented in Design Basis Document.

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Item	Requirement	Success Criteria
Preliminary Weight and Size Data	Demonstrate that weight and sizes are compatible with structural supports and size constraints	Documented in Design Basis Document.
Risk Management	Identify areas of significant risk and mitigation plans. The NCSX Project Execution Plan (PEP) describes the approach and the NCSX Risk Management Plan (RMP) provides specific risk mitigation strategies.	Documented in Design Basis Document.
Baseline Maintenance	Update cost and schedule estimates in Primavera Project Planner (P3) database consistent with proposed technical baseline as defined by Preliminary Design Release Level models and drawings and other documentation. Cost and schedule updates should generally be of a higher quality than the prior estimate with increased input from industry.	Approved by the cognizant Project Engineer. Coordinated with Engineering Manager. Incorporated in P3 database by Project Control Manager.
	Provide input to ECP to reflect proposed changes to the technical, cost, and schedule baselines. ECP will be processed after chits that have significant design, cost, or schedule impacts have been addressed. New baselines will be established upon approval of ECP and implementation of approved changes. The NCSX Configuration Management Plan (CMP) and NCSX Procedure 002 provide guidance on developing and processing an ECP.	Approved by the responsible Project Engineer. Coordinated with the Engineering Manager.

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Specifications and drawings	Documentation (specifications and drawings) required for product acquisition (to build or buy) is complete. Product ("build-to") specifications are approved and under change control. No TBDs allowed. The NCSX Systems Engineering Management Plan (SEMP) and the NCSX Engineering Web page (specifications provides guidance on content and format of these specs. All models and drawings should be checked (reviewed for consistency, completeness, and adherence to drawing standards) and promoted to Final Design Release level. Drawings need not be signed (promoted to Fabrication Release Level) pending outcome of the review and chit resolution. The NCSX Pro/INTALINK Users Guide provides information on handling models and drawings.	Documentation package for product acquisition is complete.
Design vs. Requirements	Document significant design changes since the PDR. Demonstrate how the final design concept satisfies requirements and design constraints in the relevant development specifications. Update Design Basis Document with regard to considerations previously addressed at the PDR, including: manufacturability; COTS and legacy equipment; human engineering; standardization; software and firmware; weight and size data; and risk management.	Update Design Basis Document for FDR. Design Basis Document approved by responsible Project Engineer.
Resolution of Design Recommendations	Document resolution of chits from prior design reviews. PPPL Procedure ENG-033 provides guidance.	Resolution of chits from prior design reviews documented on Web. Action items completed.

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Item	Requirement	Success Criteria
Interface Identification	Signed ICDs for all primary interfaces. No TBDs allowed. The NCSX Interface Control Management Plan (ICMP) and NCSX Procedure 003 provide details of content and format expected.	Approved by Systems Engineering Support Manager
Analysis	All required analysis shall be performed and checked to establish that the proposed design is feasible and meets established design criteria. Analyses must be documented in an auditable way – in analysis reports, not viewgraph presentations.	Design criteria documented. Material properties characterized and documented. Analysis reports and calculation checks reviewed by responsible Project Engineer, summarized in updated Design Basis Document.
Qualification and Acceptance Testing	Document plans and procedures for product qualification and acceptance. PPPL Procedure ENG-030 provides guidance.	Qualification and acceptance test plans documented and approved. Required procedures in place.
Constructability	Document plans and procedures for assembly, installation, and test. PPPL Procedure ENG-030 provides guidance.	Assembly, installation, and test plans documented and approved. Required procedures in place.
RAM	Update the FMECA prepared per PPPL Procedure ENG-008 during Preliminary Design based on the additional design information available.	FMECA documented. Summary of findings and design recommendations provided in updated Design Basis Document.
ES&H	Submit new NEPA Planning Form if new hazards are identified.	Approved by NCSX ES&H Manager.

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Baseline Maintenance	Update cost and schedule estimates in Primavera Project Planner (P3) database consistent with proposed technical baseline as defined by Final Design Release Level models and drawings and other documentation. Cost and schedule updates should generally be of a higher quality than the prior estimate with increased input from industry.	Approved by the responsible Project Engineer. Coordinated with Engineering Manager. Incorporated in P3 database by Project Control Manager.
	Provide input to ECP to reflect proposed changes to the technical, cost, and schedule baselines. ECP will be processed after chits that have significant design, cost, or schedule impacts have been addressed. New baselines will be established upon approval of ECP and implementation of approved changes. The NCSX Configuration Management Plan (CMP) and NCSX Procedure 002 provide guidance on developing and processing an ECP.	Approved by the responsible Project Engineer. Coordinated with the Engineering Manager.

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NCSX Engineering CHIT Tracking Log

Design Review [Cog Engr/RLM/Chair]	Rvw Date	#	Chit Finding [Originator]	Review Board Recommendation	Project Disposition	Responsibility	Status	Due Date
Modular Coil Assembly Fixture Brown/Nelson/Dudek	2/16/2005	6	Ask vendor to perform and test (prior to delivery) to prove that the system can go to a pre-determined location and back and forth with the required accuracy and precision. [Raftopoulos]	Concur	Verification in achieving this control is in the QA conformance inspection /verification section of the Spec.			Done
TRC - Chill Plate and Clamp Modification [Williamson/Nelson/Neilson]	1/27/2005	10	Impact of lead extension on field errors need to be look at for the production coils. [Reiersen]	Concur	Impact of extending leads an additional 2" on field errors will be assessed and addressed at the comprehensive Type C FDR.	Brooks, Art		2/28/2005
Modular Coil Assembly Fixture Brown/Nelson/Dudek	2/16/2005	16	Perform seismic analysis to see if the present design is ok. Investigate sudden accelerations and decelerations as well. [Reiersen]	Concur	A preliminary analysis will be performed to qualify the reference design feasibility. Seismic and safety performance requirements are in the Spec.	Brown		4/22/2005
Modular Coil Assembly Fixture Brown/Nelson/Dudek	2/16/2005	4	Need to articulate a concept for a control system. [Reiersen]	Concur		Brown / Viola		4/22/2005
Modular Coil Assembly Fixture Brown/Nelson/Dudek	2/16/2005	1	Consider providing table of coordinates for 3 seats at flange ends at each trajectory step. [Nelson]	Concur	The three point data has been generated. It needs to be put in a table format and included as data provided within the Spec	Brown, Tom		4/22/2005
Modular Coil Assembly Fixture Brown/Nelson/Dudek	2/16/2005	3	Assemble tolerance information into one place to verify uses and approach of modular coil to vacuum vessel and	Concur	Analysis will be documented in a mem	Brown, Tom		4/22/2005
ACC Review of Manufacturing Facility - Station 2	10/21/2004	1	A joint Management/ACC final walk down of the facility be conducted. [Barnes]			Chrzanowski, Jim		COMPLETED Approved by Larry Dudek
ACC Review of Manufacturing Facility - Station 2	10/21/2004	2	The ACC believes it would be prudent to assure that the issues affecting each stage are addressed prior to commencing that stage. [Barnes]			Chrzanowski, Jim		COMPLETED Approved by Larry Dudek