

## Corrective Action Report Based on Recommendations from the DOE Baseline Validation Review (EIR) of the NCSX Project

rev. 3, July 21, 2004

The Baseline Validation Review of the NCSX project was conducted by the Office of Engineering and Construction Management (OECM) on November 18-20, 2003. The review, which was conducted concurrently with an Office of Science Performance Baseline Review, served as the required External Independent Review (EIR) of the baseline. The final panel report, issued in early January, 2004, contained numerous recommendations as well as a general conclusion that the project was ready for CD-2. A report was submitted documenting the project's corrective action plan in response to the EIR recommendations. In all, thirty-seven items were identified. Only minor cost impacts and no schedule impacts were identified in responding to these recommendations. The two cost items (Items #1 and #2 in the tracking log) were of opposite sign and, practically speaking, cancelled each other. The corrective action plan was approved by OECM.

This report is in the form of a tracking log, which the project has used to track each sequentially-numbered item to closure. At this time all items are considered closed, except for ongoing issues such as continued attention to conserving contingencies (Item #6).

### Other Baseline Reviews

Two other reviews of the NCSX project were held to support the CD-2 process. One was the aforementioned Office of Science Performance Baseline Review, while the other was a Laboratory chartered Preliminary Design Review on October 7-9, 2003. At these reviews, the project presented a plan, denoted the "PDR baseline," with a TEC of \$81.0M and a CD-4 date of September, 2007. Both of these reviews produced a number of recommendations, some of which impacted cost and schedule, as well as the overall conclusion that the project was ready to proceed to CD-2.

Subsequent to these reviews, the Office of Fusion Energy Sciences provided a revised funding profile for the project. The main change relative to the

PDR baseline was a \$4.5M reduction in FY-05 necessitated by anticipated constraints on available funds for that year. Upward adjustments were made in subsequent years to partially offset the schedule impact. Also, the project work scope was re-scheduled within the revised funding envelope to provide more budget contingency earlier in the project, relative to the PDR baseline. The net effect of these profile changes is an additional 2-month extension of the project and an associated cost increase due to carrying costs and escalation.

For CD-2, the project baseline was revised as a result of the three baseline reviews and the changes to the budget profiles. The changes relative to the PDR Baseline are summarized as follows:

### Summary of Changes to the Baseline Cost and Schedule Between PDR and CD-2

	Cost (\$M)	Schedule
PDR Baseline	81.0	Sept., 2007
PDR Recommendations (Oct. 7-9, 2003)	+1.4	+ 2 mos.
PBR Recommendations (Nov. 18-20, 2003)	+3.2	+ 4 mos.
EIR Recommendations (Nov. 18-20, 2003)	0.0	0
Budget profile changes	+0.7	+2 mos.
Total of changes	+5.3	+8 mos.
CD-2 Performance Baseline	86.3	May, 2008

The schedule contingency of 5.5 months remained unchanged from the PDR baseline. The budget contingency as a percentage of the scheduled work remaining was re-evaluated to be 26% based on updated estimate details developed by the project. CD-2 was approved in February, 2004.

### Fabrication Reviews

Two more reviews were conducted in the Spring of 2004, supporting both the project's design process and the DOE management preparations for

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CD-3 determination. A Laboratory-chartered Final Design Review of the Vacuum Vessel Sub-Assemblies (VVSA) and Modular Coil Winding Forms (MCWF), the two critical components, was held May 19-20, 2004. An Office of Science Independent Project Review was held June 8-9. Both reviews found the project ready to proceed with procurement and fabrication and the SC review concluded that the project is ready for CD-3, pending successful outcome of the VVSA and MCWF procurement processes. The findings, comments, and recommendations from these reviews are being tracked by the project.

### Revision Record

Rev.	Date	Comment
0	1/13/04	Original submission to OECM.
1	1/21/04	Corrections requested by OECM
2	1/26/04	Update to reflect items completed for CD-2.
3	7/21/04	Update to reflect completion of all items prior to CD-3.

ID No.	Section Ref	Recommendation	WBS / Responsibility	Action Needed	Status
1	2.1.3.2.1	Clean up the cost documentation for TF coil procurement, make the numbers consistent, and ensure that the cost basis is clear and defensible.	WBS 13 Kalish	A review of the manufacturing cost estimate revealed errors in arithmetic and rates. The corrected estimate is \$1,026k (vs \$956k). The net increase is \$81k, including profit. The baseline estimate and backup have been revised accordingly.	Complete
2	2.1.3.5.1	Review the labor estimate for ducting and insulation, and revise as appropriate if an error is found.	WBS 62 Gettelfinger	A review of the backup revealed both an arithmetic error and an estimating error. The correction reduces the estimate by approximately \$100k, including associated G&A. The baseline estimate and backup have been revised accordingly.	Complete - the labor correction was a \$116k reduction.
3	2.1.3.6.2	Develop activities in the WBSs which support the System Integrated Testing WBS, resource load them, and provide logic ties to WBS 85.	WBS 85 Gentile	Revise WBS dictionary and repost. Coordinate subsystem responses. Prepare written response	The NCSX Test and Evaluation Plan has been revised to provide linkages to reflect the Pre-Operational Test Procedures leading to the NCSX ISTEP and first plasma. The TEP will be the single point document that provides a comprehensive listing of items, actions, procedures, etc. required for startup and first plasma. Complete
4	2.1.3.6.2	Adjust the schedule to eliminate the one day of float and place Activity 920.005, Integrated System Testing, on the critical path.	WBS 81 Strykowski	Correct Schedules - By CD-2	Completed
5	2.2.3.1.1	Tie the cost estimating backup to the resource-loaded schedule using standardized cost estimating input forms and an expanded WBS dictionary.	WBS 81 Strykowski	Develop standardized format and simple procedure - By next Lehman review.	Documented in the Cost and Schedule Guidance document. Completed
6	2.2.3.1.1	Create a Basis of Estimate or Estimate Assumptions document that clearly presents the key estimating criteria and assumptions for the project.	WBS 81 Strykowski	Prepare addendum to estimating guidelines addressing items - By next Lehman review.	Documented in the Cost and Schedule Guidance document. Completed
7	2.2.3.1.2	Re-evaluate contingency for Project Management.	WBS 8 Neilson	This will be considered as part of updating the baseline for CD-2.	Completed

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8	2.2.3.1.2	Re-work the various project documentation so that PM costs are consistent throughout.	WBS 8 Neilson	Revise & post backup revision and/or submit revisions to master schedule. Submit validation memo as part of backup - By CD-2.	Completed
9	2.2.3.1.3	Revise project cost documentation to clearly show escalation dollars.	WBS 81 Strykowsky	Information can be provided as needed.	Completed
10	2.2.3.1.4	Review the current contingency methodology and approach, and determine whether it is the best method to use for determination of contingency dollars.	WBS 81 Strykowsky	Review the current contingency methodology and approach, and determine whether it is the best method to use for determination of contingency dollars.	Completed - PPPL approach useable and appropriate
11	2.2.3.1.6	Correct the unreasonable floats included in the schedule.	WBS 81 Strykowsky	Review floats and adjust as necessary - By CD-2.	Completed
12	2.2.3.1.6	Develop a set of Schedule Assumptions and place them under document control.	WBS 81 Strykowsky	Develop a set of Schedule Assumptions and place them under document control - By next Lehman review.	Documented in the Cost and Schedule Guidance document. Completed
13	2.2.3.1.6	Develop a Milestone Dictionary for key project milestones that defines clearly what constitutes successful milestone completion.	WBS 82 Simmons	Prepare a description of each milestone and post.	Completed and posted 12/15
14	2.2.3.1.6	Include additional milestones at Level II, as appropriate, for WBS elements that do not have well spaced milestones	WBS Managers	Add milestones at Level III as part of monthly WAF updating, and at Level II as requested by Federal Project Director.	Completed
15	2.2.3.1.6	Develop and use a consistent definition for the schedule baseline in the PEP.	WBS 8 Simmons	Modify PEP as recommended.	Completed
16	2.2.3	Perform a consistency check of the WBS, WBS Dictionary, cost estimate, and schedule.	WBS 8 Simmons/ Strykowsky	Ensure that WBS, WBS Dictionary, and cost and schedule details utilize a consistent WBS scheme.	Completed
17	2.2.3	Consider expanding the WBS dictionary to provide greater detail and usefulness to the NCSX Project, and greater continuity and traceability between the WBS Manager's estimate and resource-loaded schedule.	WBS 8 WBS Managers	Consider expanding the WBS dictionary to provide greater detail and usefulness to the NCSX project.	Consideration was given to expanding the WBS dictionary and it was concluded that the present dictionary provides an adequate description of the scope of the work packages. Complete
18	2.2.3	Add an activity "Develop integrated Startup Test Plan" to the WBS dictionary for WBS element 85, "Preoperational and Integrated Systems Testing."	WBS 82 Simmons	Add an activity "Develop integrated Startup Test Plan" to the WBS dictionary for WBS element 85, "Preoperational and Integrated Systems Testing."	Completed. WBS Dictionary revised to reflect this suggestion.

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19	2.4.3	Consider expanding the Risk Management Plan, as appropriate, to include actions required from identified individuals to enact mitigation strategies.	WBS 81 Schmidt	Develop and maintain a critical issues tracking list which has a finer degree of granularity than the RMP itself, identifies individuals, and is tracked week to week by the System Integration Team.	Completed. Critical issues list implemented.
20	2.4.3	Ensure that the Risk Management Plan is managed as an official, controlled project document, with appropriate endorsements included.	WBS 81 Neilson	We agree that the Risk Management Plan should be managed as a living document that is controlled, tracked and updated periodically.	Completed. Placed under formal document control for future updates.
21	2.4.3	Conserve schedule contingency in order to allow as much as possible to be available during the "Field Period Assembly" to "First Plasma" portion of the project.	WBS 81 Neilson	Conserve schedule contingency in order to allow as much as possible to be available during the "Field Period Assembly" to "First Plasma" portion of the project. Examples are: taking delivery of the vacuum sectors as they become available, splitting the winding form order between the two suppliers if both qualify, and procuring tooling for a second winding line. All of these increase schedule flexibility. We agree that the Field Period Assembly and integrated testing activities have schedule risks but note that they also have schedule flexibility, namely the possibility of two-shift execution, when the time comes.	We are actively looking at ways to improve the near-term schedule to minimize the utilization of schedule contingency. As a recent example, two critical-path R&D activities, the twisted racetrack coil and the full-scale prototype coil fabrication, were merged by substantially de-scoping the latter. The twisted racetrack activity has been re-planned to accomplish the critical risk-reduction goals of the two activities in less time and at less cost. This has enable the project to maintain its schedule contingency, offsetting some delays in precedent tasks.
22	2.5.3	Adjust the Performance Baseline, as appropriate, once all Preliminary Design Review recommendations have been addressed and the cost and schedule impacts have been assessed.	Neilson	The detailed responses to the Preliminary Design Review (PDR) recommendations are documented in the PDR disposition plan. Those with cost and schedule impacts have been addressed. All cost and schedule impacts, including those from the PDR, are summarized in the Performance Baseline Review disposition plan and incorporated in the Performance Baseline.	Complete. The PDR recommendations were closed out for the VVSA/MCWF Final Design Review in May, 2004.

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23	2.5.3	Consider developing and implementing a plan to simulate the welding of the spool pieces.	WBS 12 Goranson	Consider developing and implementing a plan to simulate the welding of the spool pieces.	Added to R&D plan and baseline.
24	2.6.3	Evaluate the potential benefits of modifying the design and fabrication of the winding forms so that two of the three coils are on a single form.	WBS 14 Reiersen	Evaluate the potential benefits of modifying the design and fabrication of the winding forms so that two of the three coils are on a single form.	Evaluated and determined to introduce additional complexity.
25	2.7.3	As design progresses, assess the potential of a significant release of nitrogen during operation of the stellarator and evaluate the need to add monitors or alarms, for example, for low oxygen conditions.	WBS 62 Gettelfinger	As design progresses, assess the potential of a significant release of nitrogen during operation of the stellarator and evaluate the need to add monitors or alarms, for example, for low oxygen conditions.	The cost of additional monitors has been added to the NCSX project cost. Complete
26	2.7.3	As the project continues, analyze potential hazards in detail based on final design and incorporate them into the NCSX PHA and SAD.	WBS 83 Levine	Ongoing.	This is an ongoing task that will continue throughout the NCSX fabrication project and into operations. The PHA will be modified as the design progresses and will be incorporated into the SAD.
27	2.7.3	Ensure that the Value Engineering Task Force document is managed as an official, controlled project document, with appropriate endorsements included.	WBS 8 Simmons	Modify PEP.	Completed
28	2.7.3	Add wording to the "NSCX Value Engineering Taskforce" document indicating that "shared savings" clauses (the "voluntary" component of value management) will be considered in all procurements awarded after Critical Decision-2, when appropriate.	WBS 8 Simmons	To be incorporated in Procurement Plan being developed.	Completed
29	2.9.3	Institute a system for document control of the cost estimates and schedules that includes a formal issuance system for revisions/updates.	WBS 82 Simmons	Address in Document Control Plan	The cost and schedule baselines are under configuration control. The current detailed basis and archived basis is posted on the Engineering WEB.
30	2.9.3	Consider adding project controls support staff to bolster the project EVMS capabilities in the event project performance data begins to degrade in accuracy and timeliness.	WBS 81 Neilson	Consider adding project controls support staff to bolster the project EVMS capabilities in the event project performance data begins to degrade in accuracy and timeliness.	Completed. Project Control Manager increased to a full-time assignment.

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31	2.9.3	Evaluate the <i>PPPL Project Control System Description, Revision 0, July 1996</i> to ensure that it remains viable and consistent with current practice at the laboratory.	WBS 81 Strykowski	Review and update PCS Manual as appropriate.	We have reviewed the Project Control System Description and have concluded that it remains viable and consistent with laboratory practices. Complete.
32	2.10.3	Ensure that the PEP is given a general "housekeeping" revision prior to submittal.	WBS 8 Simmons	Modify PEP as recommended.	Completed
33	2.10.3	Provide a reference to the document identifiers for the complete WBS and WBS dictionary.	WBS 82 Simmons	Modify PEP to reference where complete WBS and WBS Dictionary can be found.	Completed
34	2.11.3	Consider establishing a single and separate document that includes all items required for startup. Details in the document should feed from the various WBS sections and include cost of labor, materials, etc.	WBS 85 Gentile	The NCSX Test and Evaluation Plan has been revised to provide linkages to reflect the Pre-Operational Test Procedures leading to the NCSX ISTP and first plasma. The TEP will be the single point document that provides a comprehensive listing of items, actions, procedures, etc. required for startup and first plasma.	Completed.
35	2.12.3	Include wording in the Acquisition Plan to the effect that cost savings incentive clauses in contracts awarded post CD-2 will be considered and incorporated where practical.	WBS 8 Simmons	Modify PEP with the recommended wording.	PEP has been revision. The AEP is not intended to be a living document so that items such a cost, schedule, etc. will be reflected in the PEP which is updated periodically. Completed
36	2.12.3	Consider combining of the coil procurements to attempt to obtain more favorable bids.	WBS 13 Kalish	Address in Procurement Plan being developed.	Procurement Plan posted. Completed
37	2.12.3	Ensure that all outdated references in the AEP are noted and corrections made ready to include in the next general revision.	WBS 8 Simmons	Markup AEP as recommended.	Completed.