EIR Lines of Inquiry Summary Assessment of the NSTX Upgrade Project Performance Baseline

EIR Element	SC Review Team Assessment	Comment
1. Basis of Scope **Input from:** **SC1 Technical** **SC3 Management**	Satisfactory Satisfactory with Comment Unsatisfactory	**Assess whether the Work Breakdown Structure (WBS) and WBS dictionary incorporate all project work scope, and that the defined work scope and system requirements are derived from and consistent with the approved Mission Need. Assess whether the Resource Loaded Schedule (RLS) is consistent with the WBS for the project work scope. Assess if the WBS represents a reasonable breakdown of the project work scope and if it is effective for internal management control and reporting. Identify and assess the basis for and reasonableness of key programmatic, economic, and project scope assumptions as related to the quality and completeness of the WBS, technical and design requirements, and risk management planning and contingency requirements. Identify all underlying technical assumptions and assess whether they are sound and/or appropriately addressed within the Risk Management Plan and adequately supported with funded contingency, particularly for new technologies that have never been developed and/or prototyped within the proposed environment. Assess whether it is reasonable to divide the work scope presented into more than one discrete project. If applicable, identify the basis for managing such discrete projects in an integrated program. Confirm that a Program Requirements Document (PRD) exists and that project planning reflects the PRD. Assess whether "design-to" functions are complete and have a sound technical basis (The EIR team should include safety and external requirements, such as permits, licenses, and regulatory approvals, in their assessment.) Assess whether the requirements have been defined well enough to establish a firm performance baseline. Assess whether the CD-4 (project completion) activities and requirements and project key performance parameters (KPP) are clearly defined in the PRD. Assess whether these activities and requirements are sufficiently defined, under change control and not expected to change, quantified, measurable, and can reasonably be determined as complete. Identify the CD-4 requirements/ activities/KPPs in a separate table in the EIR report, including summary analysis results. Assess adequacy and completeness of standards and requirements to include DOE Directives (e.g., Policies, Orders, Standards, and Guides to include DOE O 413.3A, DOE-STD-1189, etc.) identified as being applicable and appropriate to the project either due to the nature of the project or contract requirements. Identify any areas of non compliance with the identified standards and requirements.** **Project Response**: *Assess whether the Work Breakdown Structure (WBS) and WBS dictionary incorporate all project work scope, and that the defined work scope and system requirements are derived from and consistent with the approved Mission Need.* Per the CD-0 mission need: ” *Based on the above considerations, upgrading the existing NSTX facility is the most likely path to be pursued to close ST capability gaps in a timely and cost-effective manner. The NSTX Collaborative research team developed its Five Year Program Plan for 2009-2013 which was favorably peer reviewed and strongly endorsed in DOE-OFES reviews conducted on July 28-31,2008. The review panel specifically endorsed NSTX upgrade plans which form the central elements of the NSTX Five Year Program Plan. The proposed upgrade capabilities entail a new center-stack and a second neutral beam heating system. As part of the Critical Decision (CD)-1 process, a more detailed analysis will be performed on the proposed alternatives and a selection of the alternative will be made as part of CD-1. Final decisions as to what upgrade capabilities*

		to pursue will be made at CD-2. " The WBS as defined in CD-1 has been iterated but the main scope remains unchanged. *Assess whether the Resource Loaded Schedule (RLS) is consistent with the WBS for the project work scope.* The WBS in the PEP shows scope by WBS and job number which maps directly to the Primavera resource loaded schedule. *Assess if the WBS represents a reasonable breakdown of the project work scope and if it is effective for internal management control and reporting.* Estimated cost and scope have been vetted by internal peer reviews, external independent design reviews (CDR and PDR) as well as and an independent CD-2 readiness review. The SC CD-2 Readiness Review (i.e., "Lehman review") will provide subjective assessment as required. *Identify and assess the basis for and reasonableness of key programmatic, economic, and project scope assumptions as related to the quality and completeness of the WBS, technical and design requirements, and risk management planning and contingency requirements.* The scope, cost and schedule have been approved by DOE via the CD-1 approval package and overarching assumptions were documented in the Acquisition Strategy, Alternative Analysis & Cost/Schedule Range, and the Preliminary Project Execution Plan. The assumptions where further investigated and developed during the development of the Project's baseline which includes the higher resolution expansion of the WBS, General Requirements Document (GRD) and risk assessment. *Identify all underlying technical assumptions and assess whether they are sound and/or appropriately addressed within the Risk Management Plan and adequately supported with funded contingency, particularly for new technologies that have never been developed and/or prototyped within the proposed environment.* This project does not represent new technology. The 2nd neutral beam is the identical hardware and configuration as the first beam installed in 1999 (with minor vacuum vessel configuration and vessel interface). The center stack, while a more robust design, represents the same configuration. However, risks associated with the execution of this fabrication and assembly are identified in the risk registry. Bounding external risks that are not covered in the project are enumerated in the risk management plan contained in the PEP. *Assess whether it is reasonable to divide the work scope presented into more than one discrete project. If applicable, identify the basis for managing such discrete projects in an integrated program.* While not economically desirable or programmatically desirable, the project may be segregated. These work scope options were investigated at time of CD-1 and the lowest cost and earliest delivery, in terms of program mission, was chosen. *Confirm that a Program Requirements Document (PRD) exists and that project planning reflects the PRD.* A general requirements document (GRD) for both the center stack upgrade and 2nd neutral beam has been prepared. *Assess whether "design-to" functions are complete and have a sound technical basis (The EIR team should include safety and external requirements, such as permits, licenses, and regulatory approvals, in their assessment.)* This upgrade to an existing device conforms to existing regulatory requirements including NEPA. It should also be noted that the Project's TPC is less than $100M and not subject to an EIR as per DOE Order 413.3A. It should also be noted that this device (and the proposed upgrade) are 'below nuclear hazard category 3'.

		Assess whether the requirements have been defined well enough to establish a firm performance baseline. The GRDs, design data sheet, in-depth detail analyses, design & analytical models, R&D, and critical vendor input to date form a sound basis for the project's cost and schedule estimate. All designs are at or beyond the preliminary design point as validated by an external independent preliminary design review. *Assess whether the CD-4 (project completion) activities and requirements and project key performance parameters (KPP) are clearly defined in the PRD.* The GRD defines the upgrade operational design-to requirements. The CD-4 technical performance baseline parameters, demonstrated performance at completion, and objective performance baseline scope have been documented in the PEP. *Assess whether these activities and requirements are sufficiently defined, under change control and not expected to change, quantified, measurable, and can reasonably be determined as complete.* The planning documents at CD-0 and CD-1 are based upon input from the fusion community including the Office of Fusion Energy Science (OFES) and consistent with OFES strategic plans, science and technology advisory committees (STAC) and the NSTX program advisory committee. The Project Execution Plan further defines the scope, cost and schedule of these activities and requirements via measurable cost performance system (earned value management), establishment of level 1 and 2 milestones, list of CD-4 deliverables, specified desired machine performance expectations, and change control methodology deployed during the life of the project. The SC CD-2 Readiness Review (i.e., "Lehman Review") will further provide subjective assessment of the Project's readiness by reviewing the subject areas described above. *Identify the CD-4 requirements/ activities/KPPs in a separate table in the EIR report, including summary analysis results.* The NSTX-U Project has a TPC less than $100M and therefore not required to have an EIR as per DOE Order 413.3A. However, the CD-4 requirements are documented in the PEP. *Assess adequacy and completeness of standards and requirements to include DOE Directives (e.g., Policies, Orders, Standards, and Guides to include DOE O 413.3A, DOE-STD-1189, etc.) identified as being applicable and appropriate to the project either due to the nature of the project or contract requirements. Identify any areas of non compliance with the identified standards and requirements.* The NSTX device is an existing 'below hazard category 3' experiment at PPPL and is bound by the operational requirements and standards specified in the M&O contract between DOE and Princeton University. The NSTX-U Project is also covered by the terms of the M&O contract including DOE O 413.3A. **Committee Response**

2. Basis of Cost **Input from:** **SC2 Cost/Sche**		**For selected WBS elements (typically, those constituting significant cost and/or risk), summarize the detailed basis for the cost estimate. Assess the method of estimation and the strengths/weaknesses of the estimates for each WBS element reviewed. Identify and assess the basis for and reasonableness of key programmatic, economic and project cost assumptions as related to the quality of estimates for each WBS element, and risk management planning and contingency requirements. Perform Independent Cost Review (ICR) or Independent Cost Estimate (ICE) as appropriate or requested. For MSA projects, the ICR or ICE required by DOE O 413.3A will be coordinated with the Office of Cost Analysis (CF-70). Assess the amount of and basis for escalation. Assess reasonableness of resource loading, including what resources are loaded. Identify whether the estimated costs for the project are reasonable based on professional expertise, parametric estimates, historical data, etc. Verify that the cost value of schedule contingency is included in the TPC. Provide a completed project cost profile table Excel worksheet will be provided as part of the EIR SOW). Based on the project cost profile table, develop summary baseline cost tables of the proposed costs for the EIR report.** **Project Response**: *Assess the method of estimation and the strengths/weaknesses of the estimates for each WBS element reviewed.* The estimate preparation phase began with the issuance of guidance and instructions from the Project Manager and encompassed each element of the Project WBS. A disciplined and uniform approach was used for developing the cost estimates for all elements of the WBS. The PPPL Job Manager (Cost Account Manager) was responsible for and prepared the cost estimate. An Excel based spreadsheet (i.e., the laboratory standard Work Authorization Form (WAF)) was used by each Job Manager to develop the cost estimate that included the following elements: Tab A – Work scope description; Tab B – Detail estimate; Tasks, resource estimates (labor hours by skill and material cost), schedule and task durations, basis of estimates, and task-by-task contingency estimate; Tab C – Estimate uncertainty and Risk, (Estimate uncertainty = design maturity and complexity; Risk = likelihood, cost and schedule impact). Once each estimate was completed it went through a thorough internal engineering department review that included the PPPL Engineering and Infrastructure, Associate Director of Engineering, the NSTX-U Project Manager, the CSU and NBI Managers as well as other members of the PPPL staff with relevant experience for each WBS element's scope to provide crucial independent assessment and review. *Identify and assess the basis for and reasonableness of key programmatic, economic and project cost assumptions as related to the quality of estimates for each WBS element, and risk management planning and contingency requirements.* For the NSTX-U Project the amount of contingency is established at the beginning of the project based on a risk assessment performed as part of the cost estimating process. A quantitative, analysis of outstanding risks and estimating uncertainties is used to estimate the amount of contingency required. Risk are documented in a risk

		registry which will be updated at least monthly via the normal project status meeting, technical meetings and as part of normal project communications. During all phases of the NSTX Upgrade Project, priority is placed on identifying and mitigating risks. Risk mitigation activities are incorporated into the project's cost and schedule baselines, as appropriate. A risk registry has been prepared and implemented for tracking all identified risks in addition the project has established a review recommendation log to track all open chits and recommendations from formal reviews. Contingency is used to address realized risks that could not be mitigated. The methodology used by the project to develop contingency incorporates a bottoms-up, task-by-task job manager (CAM) assessment of risk and provides a credible CD-2 estimate. Contingency is included in the NSTX-U TPC but not included in the proposed PMB. *Perform Independent Cost Review (ICR) or Independent Cost Estimate (ICE) as appropriate or requested. For MSA projects, the ICR or ICE required by DOE O 413.3A will be coordinated with the Office of Cost Analysis (CF-70).* An independent cost review of the NSTX-U Project will be performed by the DOE-SC Project Management Support Office (Office of Project Assessment). NSTX-U is not a MSA (The NSTX-U TPC <$100M, therefore ICR or ICE is not required per DOE O 413.3A. *Assess the amount of and basis for escalation. Assess reasonableness of resource loading, including what resources are loaded.* The amount of labor and non-labor escalation used to develop the NSTX-U PMB is 2.5% per year. A well detailed resource loaded schedule exists and provides the basis for all costs and schedules. There is a corresponding activity in the Projects Resource loaded schedule (Primavera data-base) for each task that was developed on the Excel based spreadsheet (laboratory standard Work Authorization Form (WAF)) used by each Job Manager to develop the cost estimate. In addition each separate resource, both labor categories in hours and non-labor categories in dollars, is assigned to its corresponding Primavera activity. Approved institutional labor rates and associated overheads are then applied to each resource to develop the required funding baseline. *Identify whether the estimated costs for the project are reasonable based on professional expertise, parametric estimates, historical data, etc.* This project does not represent new technology for PPPL. The 2nd neutral beam is the identical hardware and configuration as the first beam installed in 1999 (with minor vacuum vessel configuration and vessel interface). The center stack, while a more robust design represents the same configuration. Therefore, prior expertise and historical data where used in the development of the cost estimate. In addition, estimated cost and scope have been vetted by internal peer reviews, external independent design reviews (CDR and PDR) as well as and an independent CD-2 readiness review. Lehman review team subjective assessment required. *Verify that the cost value of schedule contingency is included in the TPC.* The schedule contingency was quantified by applying the CAM's contingency estimates to the Primavera task durations and computing a potential late finish completion date. This potential schedule extension was augmented by assuming 2 shift operation which limited the schedule contingency to 8 months. This 8 months was multiplied by the management and oversight cost (a.k.a.standing army) of $282K/mo. to yield a contingency of $2.26M. *Provide a completed project cost profile table Excel worksheet will be provided as part of the EIR SOW).* See detail cost table by job and year.

		Based on the project cost profile table, develop summary baseline cost tables of the proposed costs for the EIR report See summary cost table in the PEP. **Committee Response**

3. Basis of Schedule **Input from: SC2 Cost/Sche**		**For the selected WBS elements, summarize the detailed basis of schedule estimate. Assess the method of estimation and the strengths/weaknesses of estimates. Identify/assess the basis for and reasonableness of key programmatic, economic and project schedule assumptions as related to the quality of estimates for each WBS element, and risk management planning and contingency requirements. Assess reasonableness of resource loading, including what resources are loaded. Determine if schedule contingency is derived quantitatively and if the calculated duration is placed between the end of the last project critical path activity and the "Submit Request for CD-4" milestone. Identify whether the estimated schedule for the project is reasonable based on professional expertise, parametric estimates, historical data, etc. Include CD milestone data on the project cost profile table referenced above and include summary baseline schedule tables of the proposed 15 milestones (i.e., CD dates and other significant or critical project dates) in the EIR report.** **Project Response**: *For the selected WBS elements, summarize the detailed basis of schedule estimate.* All schedule tasks are estimated in WAF's (as discussed in #2 above). These tasks, their durations, and logical interdependencies are entered into Primavera for computation into a project schedule. Task durations are based upon the CAM judgment. The planning basis for the integrated schedule assumes only one shift with no overtime, and no weekend work. Typical holidays are included. *Assess the method of estimation and the strengths/weaknesses of estimates.* The estimate preparation phase began with the issuance of guidance and instructions from the Project Manager and encompassed each element of the Project WBS. A disciplined and uniform approach was used for developing the cost and schedule estimates for all elements of the WBS. The PPPL Job Manager (CAM) was responsible for, and prepared, the cost and schedule estimate. An Excel based spreadsheet (i.e., the laboratory standard Work Authorization Form (WAF)) was used by each Job Manager to develop the cost and schedule estimate that included the following elements: Tab A – Work scope description; Tab B – Detail estimate; tasks, resource estimates (labor hours by skill and material cost), schedule and task durations, basis of estimates, and task-by-task contingency estimate; Tab C – Estimate uncertainty and Risk, (Estimate uncertainty = Design maturity and complexity; Risk= likelihood, cost and schedule impact). Once each cost and schedule estimate was completed, it went through a thorough internal engineering department review that included the PPPL Engineering and Infrastructure, Associate Director for Engineering, the NSTX-U Project Manager, the CSU and NBI Managers as well as other members of the PPPL staff with relevant experience for each WBS element's scope to provide crucial independent assessment and review. This uniform approach applied by each Job Manager (CAM) to develop the cost and schedule estimate helped insure the consistency in the level of detail and planning that went into the cost and schedule estimate process. *Identify/assess the basis for and reasonableness of key programmatic, economic and project schedule assumptions as related to the quality of estimates for each WBS element, and risk management planning and contingency requirements.* Lehman review team subjective assessment required.

		Assess reasonableness of resource loading, including what resources are loaded. A well detailed resource loaded schedule exists and provides the basis for all costs and schedules. There is a corresponding activity in the Projects Resource loaded schedule (Primavera data-base) for each task that was developed on the Excel based spreadsheet (i.e., laboratory standard Work Authorization Form (WAF)) used by each Job Manager to develop the cost estimate. In addition each separate resource, both labor categories in hours and non-labor categories in dollars, is assigned to its corresponding Primavera activity. Approved institutional labor rates and associated overheads are then applied to each resource to develop the required funding baseline. *Determine if schedule contingency is derived quantitatively and if the calculated duration is placed between the end of the last project critical path activity and the "Submit Request for CD-4" milestone.* For the NSTX-U Project, a model was developed to determine schedule contingency that should be applied to the calculated project end date (i.e., the early finish date of integrated systems testing). The contingency percentage assigned to each task on the critical path was multiplied by the task duration and reduced by the ability to apply double shift coverage for on-site assembly tasks (WBS 8) at PPPL. The resulting contingency duration was calculated to be 8 months. This 8 month duration was added to the projects Integrated Systems Test early finish date of July 2014 to establish the CD-4 date of March 2015. (Refer to the detailed resource loaded schedule.) *Identify whether the estimated schedule for the project is reasonable based on professional expertise, parametric estimates, historical data, etc. Include CD milestone data on the project cost profile table referenced above and include summary baseline schedule tables of the proposed 15 milestones (i.e., CD dates and other significant or critical project dates) in the EIR report.* A well detailed resource loaded schedule exists (in Primavera) and provides the basis for all costs and schedules. There are approximately 1,950 separate tasks with, 2,631 links identified and over 2,600 individual resources loaded. A standard work week comprised of 8hrs/day, 5 days/week with no overtime, 2nd shift, or Saturday work planned; and holidays have been accounted for. Tasks and their durations are based on deliverables and/or tasks identified by the individual job managers and internal milestones (e.g., PDRs, FDRs, contract awards) have been included. Task durations are based on realistic resource loading & crew sizes. Since a significant portion of the NSTX-U project involves replacing components that we have experience in constructing, or repeating tasks that have been previously accomplished (e.g., removals & relocations of diagnostic equipment and electrical racks, installing a 2nd NBI and its associated utilities, removals and replacements of diagnostic equipment to modify and install new structural supports and removal of the NSTX CS and replacing it with a new improved version), a large portion of the estimated schedule durations is based on first hand engineering experience at PPPL. (refer to the details included in WAF estimates 24$$/8250/8200). For purchases of materials necessary for new fabrication (e.g., CFC materials, copper conductor, bellows, Torus Interface Valves, etc.), vendors were contacted to provide estimates for fabrication and delivery. In the case of new fabrications being performed (e.g., fabricating the new inner TF coil and winding the new OH solenoid), a breakdown was developed that detailed each of the specific fabrication and winding steps including the number of technicians and crew sizes per day for each step of the fabrication. (refer to the details included in WAF estimate 1305). Based on the details included in the project's resource loaded schedule, the CD milestone dates (DOE level I milestones) were established and a set of additional DOE level II milestones have been established that correspond to key objectives that support the overall project schedule (refer to section 2.2.4 Fabrication Project Schedule on page 4 of the Project PEP) .

		Committee Response:

4. Funding Profile and Budget **Input from: SC2 Cost/Sche**		Review and provide the basis for the Funding Profile (e.g., latest Project Data Sheet). Compare the annual budget with the cost requirements, and provide an assessment of whether the costs and budget are reasonably linked and can withstand normal budget turbulence during fiscal year transition periods (e.g., continuing resolutions, new start restrictions, etc.) Identify any significant disconnects between the performance baseline requirements and budget/out-year funding. Determine the reasonableness of the Budget Authority versus Budget Obligation profiles and assess the affordability of the project within the Program's budget profile. Include budget/funding information in the project cost profile table referenced above. **Project Response**: *Compare the annual budget with the cost requirements, and provide an assessment of whether the costs and budget are reasonably linked and can withstand normal budget turbulence during fiscal year transition periods (e.g., continuing resolutions, new start restrictions, etc.) Identify any significant disconnects between the performance baseline requirements and budget/out-year funding.* The DOE-OFES has provided an annual budget profile for the NSTX Program that covers the period of the NSTX-U Project duration from FY2010 through FY2015. The NSTX base program has approved a plan to operate NSTX from FY2010 through FY2012, followed by an outage in FY2013 through FY2014 while the NSTX upgrades are installed. A corresponding annual budget requirement has been also been developed to support the NSTX base program needs. Subtracting this annual budget requirement for the base NSTX Program needs from the annual DOE-OFES total NSTX program guidance results in a "NSTX-U annual Project guidance" budget. Using the NSTX-U detailed **integrated** resource loaded schedule, an annual cost requirement for the NSTX-U Project was developed that is consistent with the annual project guidance and establishes a performance baseline. Sufficient contingency was then allocated annually to support the project needs with no disconnect between the performance baseline and the out-year funding (reference Table 1 NSTX Upgrade Project Preliminary Funding Profile in the NSTX PEP page 3 section 2.2.3). Normal budget turbulence during the fiscal year transition periods will not be an issue since the NSTX program has sufficient GSO to cover continuing resolution issues, and, in view of the fact that the NSTX-U Project has already had CD-1 approval and is a 'major-item-of-equipment (MIE) project vs. line item capital funded, it therefore will not have any new start restrictions. *Determine the reasonableness of the Budget Authority versus Budget Obligation profiles and assess the affordability of the project within the Program's budget profile. Include budget/funding information in the project cost profile table referenced above.* The NSTX-U Project expects to support the baseline profiles with the Budget Authority (BA) being equal to the Budget Obligation (BO). This is achievable since the NSTX-U performance baseline is dominated by on-site labor (approximately 76% of the total cost) that does not require an up- front BA commitment. Although at this time the NSTX-U project does not foresee any issues, any contract that might need a higher BA commitment than the annual BO (across a fiscal year boundary) could readily be covered within the NSTX Program Facility Operations GSO which is valued at approximately $2M. **Committee Response**:

5. Critical Path **Input from:** **SC2 Cost/Sche**		Assess whether the Critical Path is reasonably defined. Assess whether the Critical Path reflects an integrated schedule and schedule durations are reasonable. □Provide the duration between the Critical Path completion date and the Project Completion date (CD-4). Assess whether the schedule contingency (float) is reasonable for this type of project. □Determine if there is a clearly defined critical path leading to submission of the CD-4 request. □Assess the critical path schedule for level of effort activities. □Verify that "near critical paths" are clearly identified. **Project Response**: *Assess whether the Critical Path reflects an integrated schedule and schedule durations are reasonable □Provide the duration between the Critical Path completion date and the Project Completion date (CD-4). □* As indicated earlier (in Section 3) a well detailed integrated resource loaded schedule exists (in Primavera) and provides the basis for all costs and schedules. There are approximately 1,950 separate tasks with, 2,631 links identified and over 2,600 individual resources loaded items. A standard work week is assumed comprised of 8hrs per day, 5 days per week with no overtime, 2nd shift, or Saturday work planned. Holidays have been accounted for. Tasks and their durations are based on deliverables and/or tasks identified by the individual job managers. Internal milestones (e.g., PDRs, FDRs, contract awards) have been included and identified. Task durations are based on realistic resource loadings and crew sizes. The duration between the Critical Path completion date of July 2014 and the Project Completion Date (CD-4) of March 2015 is eight (8) months (i.e., the project's schedule contingency). *Assess whether the schedule contingency (float) is reasonable for this type of project.* For the NSTX-U Project a model was developed to determine schedule contingency that should be applied to the calculated project end date (i.e., the early finish date of integrated systems testing). The contingency percentage assigned to each task on the critical path was multiplied by the task duration and reduced by the ability to apply double shift coverage for on-site assembly tasks (WBS 8) at PPPL. The resulting contingency duration was calculated to be 8 months. *Determine if there is a clearly defined critical path leading to submission of the CD-4 request. Assess the critical path schedule for level of effort activities □Verify that "near critical paths" are clearly identified.* The NSTX-U Project's critical path runs through the new Center Stack (CS) fabrication (the core components of the CS are the Inner TF Bundle, the OH Solenoid and the Plasma Facing Components that cover the outside of the CS), through the installation of the CS, and into integrated system testing that supports the CD-4 request. There are no level-of-effort activities on the critical path. The primary critical path starts with the procurement cycle of the conductor for the Inner TF Bundle; preparation of the conductor followed by the Inner TF Bundle fabrication; winding of the OH Solenoid onto the Inner TF Bundle; assembly of the CS; installation of the CS followed by pump-down and integrated system testing (reference to the detailed resource loaded schedule for Jobs 1304, 1305, 1302, 8250, 7900). A near/associated critical path runs through the fabrication and assembly of the CS Plasma Facing Components (PFCs) (reference detailed resource loaded schedule for Job 1101) that are installed onto the CS assembly prior to its installation. **Committee Response**:

6. Risk and Contingency Management **Input from:** **SC2 Cost/Sche** **SC3 Management**		**Describe the approach used to identify project risks and assess the adequacy of this approach. Assess adequacy and completeness of both DOE and contractor risk management planning including the method(s) used to identify risks, and whether a reasonably complete list of potential risks was developed for analysis. List key risks and risk rankings in a table, and provide the EIR team's assessment of the risk. Assess whether all appropriate risk handling and mitigation actions, including accepted risks and residual risks, have been incorporated into the performance baseline. Identify/assess cost and schedule contingency (contractor/DOE). Provide assessment of whether the analysis for and basis of contingency is reasonable for this type of project and its associated risks. Assess adequacy of the qualitative analysis and rating (high, medium, or low) of current risks for probability of occurrence and for consequence of occurrence. Evaluate the extent and adequacy of quantitative risk analysis. Evaluate whether the risk watch list and risk assessment sheets appear to be complete. Evaluate the adequacy of the management control process for risk status/updating.** **Project Response**: *Describe the approach used to identify project risks and assess the adequacy of this approach.* Risks are first identified during the estimate (WAF) preparation phase in tab C of the WAF form. These risks are vetted via an internal review process for completeness and likelihood occurrence. After this review, the risks are entered into the global project risk registry. *Assess adequacy and completeness of both DOE and contractor risk management planning including the method(s) used to identify risks, and whether a reasonably complete list of potential risks was developed for analysis.* The completeness and adequacy of the project risk registry has been vetted by the external preliminary design review process. However, a recommendation was to identify opportunities that should be proactively explored to potentially offset other risk. The project is pursuing this recommendation. To date, no opportunity risks (events) have been documented. *List key risks and risk rankings in a table, and provide the EIR team's assessment of the risk.* Risks with consequences and rankings are shown in the project risk registry. *Assess whether all appropriate risk handling and mitigation actions, including accepted risks and residual risks, have been incorporated into the performance baseline.* Lehman review team subjective assessment required. *Identify/assess cost and schedule contingency (contractor/DOE). Provide assessment of whether the analysis for and basis of contingency is reasonable for this type of project and its associated risks.* For the NSTX-U Project the amount of contingency is established at the beginning of the project based on a risk assessment performed as part of the cost estimating process. A quantitative analysis of outstanding risks and estimating uncertainties is used to estimate the amount of contingency required. Risk are documented in a risk registry which will be updated at least monthly via the normal project status meeting, technical meetings and as part of normal project communications. During all phases of the NSTX-U Project, priority is placed on identifying and mitigating risks. Risk mitigation activities are incorporated into the project's cost and schedule baselines, as appropriate. The risk registry will track all identified risks. In addition, the project has established a review recommendation log to track all open chits and recommendations from formal reviews. Contingency is used to address realized risks that could not be mitigated. The methodology used by the project to develop contingency

		incorporates a bottoms-up, task-by-task job manager (CAM) assessment of risk and provides a credible CD-2 estimate. Contingency is included in the NSTX-U TPC but not included in the proposed PMB. *Assess adequacy of the qualitative analysis and rating (high, medium, or low) of current risks for probability of occurrence and for consequence of occurrence.* Refer to the risk registry. Lehman review team subjective assessment required. *Evaluate the extent and adequacy of quantitative risk analysis.* Refer to the risk registry. Lehman review team subjective assessment required. *Evaluate whether the risk watch list and risk assessment sheets appear to be complete.* Refer to the risk registry. Lehman review team subjective assessment required. *Evaluate the adequacy of the management control process for risk status/updating.* Refer to the risk management plan contained in the PEP. Lehman review team subjective assessment required. **Committee Response**:

7. Hazards Analysis/Safety		N/A.
8. Basis of Design **Input from:** **SC1 Technical**		Review the basis of design and assess the reasonableness of the design requirements and output for each function/ operation. Summarize the assessment by providing a description of the unit operation, the design parameters, the basis of the design parameters and an assessment of whether the design basis is reasonable. Ensure that design addresses results of reliability, availability, maintainability, and inspectability (RAMI) analyses. **Project Response**: Refer to the preliminary design report. However, in summary, per the report: " *Have the requirements for the NSTX Upgrade Project, delineated in the General Requirements Documents (attached), been addressed? Is the scope of the project adequately and clearly described?* …Yes • The GRD requirements have been specifically detailed in a design point data spreadsheets; • The project WBS has been updated; • The project CD-4 performance baseline scope and demonstrated performance at completion are documented in the PEP, and approved by DOE. " **Committee Response**:

9. Preliminary Design Review and Comment Disposition **Input from: SC1 Technical**		Assess whether the design has progressed far enough (design maturity) to support the proposed performance baseline. Confirm that a design review has been performed by a qualified team, to ensure the adequacy of the preliminary design including adequacy of the drawings and specifications, and assess whether they are consistent with system functions, requirements, and KPPs. Review disciplines and experience of the project design review team. Assess whether the design review team had appropriate experience and technical disciplines on the team. Review the design review comments and responses. Based on a reasonable sample, assess whether comments were incorporated into the design, and whether costs/schedule associated with design changes were incorporated into the performance baseline. **Project Response**: *Assess whether the design has progressed far enough (design maturity) to support the proposed performance baseline.* Excerpt from the PDR report: "A large amount of design and technical analysis was presented by the design team, which was at an appropriate level for a PDR. The major design issues are being addressed and design solutions are being pursued. " Excerpt from the PDR report; • Establish Performance Baseline – *Ready.* • Update Project Execution Plan – *Ready.* • Employ Compliant Earned Value Management System – *Ready for Validation.* • Perform External Independent Cost Review – *Aug Lehman Review.* • Determine that QA Program is Acceptable & Being Applied – *Not Reviewed.* • Update Project Data Sheet – *Not Reviewed.* • Prepare Preliminary Design & Conduct Design Review – *This Meeting.* • Prepare Hazard Analysis Report – *Not Reviewed.* • Update Preliminary Security Vulnerability Assessment Report – *Not Reviewed.* • Acquisition Strategy – *Approved by DOE and Not Reviewed.* • Complete or Obtain Approval of Final NEPA Determination – *Approved by DOE and Not Reviewed.* *Confirm that a design review has been performed by a qualified team, to ensure the adequacy of the preliminary design including adequacy of the drawings and specifications, and assess whether they are consistent with system functions, requirements, and KPPs. Review disciplines and experience of the project design review team. Assess whether the design review team had appropriate experience and technical disciplines on the team.* "..7. Given the current stage of the project, is the project's management structure and team appropriate, and are the plans to support the next phase of the project sufficient? Yes. The NSTX Upgrade project organization has been established and key management positions are filled with experienced staff members, most of whom have demonstrated records of success in managing high-tech, first-of and one-of-a kind projects. The project is staffed with the necessary talents that will be needed for the next phase of the project. The organization brings together individuals with proven project leadership coupled with experienced technical experts in the fields of analysis, design, magnets, power systems, NB systems, I&C, and construction. Staffing level requirements for the entire project have been identified by staff category and compared with present staffing levels. For most job categories there are sufficient manpower resources, but job assignments will require close planning and monitoring by project management to assure availability avoid conflict with other laboratory programs…"

		Review the design review comments and responses. Based on a reasonable sample, assess whether comments were incorporated into the design, and whether costs/schedule associated with design changes were incorporated into the performance baseline. Refer to; • The preliminary design report. • Chits and recommendations log. Of the 8 technical considerations/recommendations from the PDR, 2 are closed and 6 will be included into the final design. Also, 19 technical chits (some reflected in the recommendations) will be investigated as part of the final design. **Committee Response**:

10. Start-Up Planning and Operations Readiness **Input from: SC3 Management**		Ensure the start-up test plan identifies how tests will be determined to be successful, and that associated equipment and instrumentation is included in the preliminary design. Review the startup and operational readiness test requirements. Determine any exceptions taken by contractor or project consultants in meeting startup test specifications. Assess whether cost, time and resource estimates are defensible to accomplish the required startup activities and have been included in the performance baseline. Assess whether there is sufficient cost and schedule contingency for test and equipment failure during start-up testing. Assess whether the start-up plan has been fully integrated with existing functional organizations including security. Assess whether results of tests (e.g., equipment tests, process tests, surrogate tests, etc.) have been factored into startup and operational readiness. **Project Response**: The re-start of NSTX will be in compliance with internal procedure OP-NSTX-02. An Operational Readiness Review (ORA) in compliance with DOE 425.1 plus an Activity Certification Committee review (ACC) will be conducted in compliance with PPPL ES&HD 5008 section II Chapter 2. The planned ACC will review the FMEA and checks to make sure that prescribed actions have made it into procedures. **Committee Response**:

11. Project Controls/Earned Value Management System **Input from: SC2 Cost/Sche**		1) Assess the status of the contractor's project control system to include the EVMS relative to the requirements of the contract and DOE O 413.3A. □ 2) 2) Assess whether project control systems and reports are being used to report project performance, whether the data is being analyzed by the Federal IPT and contractor management, and that management action is taking place as an outcome of the analysis function. □ 3) Evaluate the control process whereby projects incorporate formal changes, conduct internal re-planning, and adjust present and future information to accommodate changes. 4) Determine if changes, including acceptable retroactive changes (correcting errors, routine accounting adjustments, or improving accuracy of the performance measurement data), are documented, justified, and explained. 5) □If the contractor has a certified EVMS, assess whether a surveillance system is in place to maintain the system for continued compliance with the ANSI Standard (EIA-748). 6) □If the project contractor does not have a certified EVMS, assess the likelihood of the EVMS being certified by CD-2, and no later than CD-3. 7) Determine if there is an EVMS certification review scheduled to occur within sufficient time to permit EVMS certification, and assess the status of efforts and management focus on ensuring the EVMS is ready for certification review. 8) If a certification review is in process, assess status of efforts and management focus on resolving open issues to obtain certification within sufficient time preceding the baseline CDs. **Project Response**: 1) The PPPL Project Management System Program Description (PMSPD) describes the Earned Value Management System (EVMS) that PPPL uses to integrate the project management elements necessary to effectively plan, organize, and control complex projects. Appendix A of the PMSPD presents a roadmap of how PPPL project management systems will meet the requirements of DOE Order 413.3A. 2) Although the NSTX-U project has not yet been baselined, following CD-1 approval the NSTX-U Project began generating a monthly Earned Value Cost Performance Report (CPR) at the PPPL Job Level (i.e., cost account (CA)) using the project estimates prepared and submitted at CD-1. The BCWS is generated for each job (CAM) from the CD-1 data-base, ACWP is collected at the PPPL job level (CAM) from the PPPL accounting system, BCWP (earned value) is collected from each PPPL job (CAM) manager at the end of each reporting period. These reports are reviewed by Project Management and distributed to the Job Managers each month. The SPI and CPI indices' are reported to the FPD at the IPT meetings. On a monthly basis a standardized Project Status Report is presented to the PPPL Deputy Director for Operations, this report includes a brief summary of highlights & progress section on status summary, the EMVS indices, and most importantly, a section for decisions or interactions required by management. 3) The PMSPD implementing procedure PM 1.9 on Change Control describes the change control procedure for incorporating formal changes on projects managed under the PMSPD in addition criteria specific to change control on the NSTX-U project are established in the NSTX-U PEP (Section 7.2) . To date the NSTX-U Project has not been baselined and no formal changes have been submitted/recorded. The PPPL NSTX-U team has conducted internal re-planning exercises both prior to the Conceptual Design Review (held October 28-29, 2009) and prior to the Preliminary Design Review (held June 23-24, 2010). This process involved developing/updating the NSTX-U WBS and having the individual job managers use a

		standardized format (PPPL Work Authorization Form) to capture all the relevant tasks necessary to complete the scope of each WBS, followed by an internal engineering department review lead by the Associate Director of Engineering and eventual development of a resource loaded schedule to establish CDR and PDR preliminary baselines. Following the PDR by an independent review team the CDR plan was adjusted to reflect the PDR plan. 4) Not applicable. No errors have been found that would require changes to be made. Any retroactive changes will be documented. 5) Although our EVMS system has not yet been certified, the PMSPD implementing procedure PM 1.10 on EVMS System Surveillance and Maintenance is in place to ensure the PPPL site-wide Project Management System is applied consistently over time and that authorized changes to the EVMS are incorporated across all projects governed by EVMS. Accordingly a self assessment of the NSTX-U Project will be scheduled to occur within 3 months of CD-2 approval. This will allow a sufficient size sampling of EVMS data for a group of internal experts on EVMS to assess the NSTX-U level of compliance with the EVMS criteria. 6) Since CD-2 approval is expected by mid-September 2010 the likelihood of being able to pull together a certification review team by CD-2 is small. In addition the system would have to be evaluated based on pre-CD2 data. A draft plan has been developed that would result in a DOE-SC certification review by late April 2011, prior to the planned CD-3 approval of late May 2011. 7) A draft plan has been developed that would result in a DOE-SC certification review by late April 2011, prior to the planned CD-3 approval of late May 2011. 8) EVMS certification review is not yet in process, however a draft plan has been developed that would result in a DOE-SC certification review by late April 2011. Any open issues that result from the certification process will be tracked with appropriate resolutions indicated. **Committee Response**:

12. Quality Control/Assurance **Input from:** **SC3 Management**		Assess the applicability, completeness, adequacy, and flow-down of the Project Quality Assurance Program, including software quality assurance (SQA), based on DOE Order 414.1C and 10 CFR 830 Subpart A. Review the record of QA audits performed on the project and the disposition of the audit findings. Determine if the QA/QC Plan and implementing procedures address personnel training and qualifications, quality improvement programs, document and record management, work processes, receipt inspection, commercial grade dedication, management and independent assessments, acceptance test planning and implementation, and the process for dispositioning field changes. Assure that the contractor QA/QC Plan addressing the scope and content for the CD-2 phase of the project has been reviewed and approved by the appropriate DOE organization. Determine if there are QA/QC requirements for construction planning and work processes. Assess whether QA requirements (NQA-1 if applicable) have been appropriately incorporated into the "Design-to" functions, and costs, time and resources adequately estimated and included in the baseline. **Project Response**: The NSTX Upgrade project will follow and utilize the PPPL QA/QC department policies and procedures. QC vendor oversight and inspections are included in the project plans. The QA/QC cost are included in the project cost via an overhead tax. **Committee Response**:

13. Value Management/ Engineering **Input from: SC3 Management**		Assess the applicability of Value Management/Engineering and if a Value Management/Engineering analysis has been performed with results being incorporated into the proposed performance baseline. Provide an assessment of the Value Management/Engineering process for this project. Include whether the VM team had a reasonable skill mix and experience background. Assess whether life cycle cost analysis was reasonably performed as part of the trade-off studies and various alternatives reviewed. **Project Response**: *Assess the applicability of Value Management/Engineering and if a Value Management/Engineering analysis has been performed with results being incorporated into the proposed performance baseline. Provide an assessment of the Value Management/Engineering process for this project.* The NSTX Upgrade Project has applied value engineering methods from early on in the design process, starting with the pre-conceptual design phase. Numerous design studies have been conducted that have significantly shaped and guided the development of the current design. Value engineering processes include: 1. Weekly center stack meetings composed of analyst, designers, engineers, and program physics; 2. Design internal peer reviews; 3. WAF review process (described in draft Job Cost Estimate Process (ENG-053 R0)). *Include whether the VM team had a reasonable skill mix and experience background.* 1. Weekly center stack meetings composed of analyst, designers, engineers, and program physics: • CS,NBI manager (L. Dudek (chair) and T. Stevenson) • Program physics management (M.Ono, J.Menard) • Lead Analyst (P.Titus) • Systems Integration (C. Neumeyer) • Designers, analyst and Cog engineers • Upgrade Manager (R.Strykowsky) 2. Design internal peer reviews: • Associate director and Head of Engineering (M. Williams) • NSTX Upgrade Manager (R.Strykowsky) • PPPL Project Controls Manager (T.Egebo) • Engineering Division Heads (P.Heitzenroeder, L.Dudek, T.Stevenson, S.Baumgartner) • Construction manager (E.Perry) 3. Applicable cog engineersWAF review process (described in draft Job Cost Estimate Process (ENG-053 R0)): • Associate director and Head of Engineering (M. Williams) • NSTX Upgrade Manager (R.Strykowsky) • PPPL Project Controls Manager (T.Egebo) • Engineering Division Heads (P.Heitzenroeder, L.Dudek, T.Stevenson, S.Baumgartner) • Construction manager (E.Perry) • Applicable cog engineers

		Assess whether life cycle cost analysis was reasonably performed as part of the trade-off studies and various alternatives reviewed. Refer to the NSTX Upgrade Acquisition Strategy approved by DOE Office of Science Deputy Director for Science Programs April 10, 2010 **Committee Response**:

14. Project Execution **Input from:** **SC3 Management**		Review PEP and determine if it establishes a plan for successful execution of the project, if the project is being managed and executed in accordance with the PEP, and if it is consistent with other project documents. Determine if the PEP has been reviewed by appropriate site and Headquarters' organizations, and if all comments have been resolved. Determine if there is a program for integrated regulatory oversight and assess if applicable Federal, state, and local government permits, licenses, and regulatory approvals, including strategies and requirements necessary to construct and operate a facility or to initiate and perform project activities are identified and will be obtained when needed to continue project execution on schedule or milestone dates established. Identify if schedule for receipt of authorization from regulators is realistic and based on experience, and that requirements and milestone dates are updated as necessary and kept current. Assess key inter-site and intra-site coordination issues and determine if they are identified, addressed and resolved or appropriate plans in place to accomplish resolution. Determine if all stakeholders are identified, and assess if their relationship to the project is evaluated, project impacts on them and their interests identified, and required interfaces with external organizations or authorities addressed. Determine if an appropriate Public Participation Plan is in place based on available stakeholder information and size and scope of project, and if specific stakeholder group issues are addressed relative to project goals and objectives, technical issues, project risk, and environmental strategies. Identify applicable GAO, IG, and other oversight body reports and determine if issues or concerns have been resolved or otherwise adequately addressed. Similarly, identify and assess relevant Congressional language in authorization and appropriation bills. **Project Response**: Refer to the PEP. Lehman review team subjective assessment required. **Committee Response**:
15. Acquisition Strategy/Plan		N/A.

16. Integrated Project Team **Input from:** **SC3 Management**		Review Federal and contractor IPT Charters and determine if all appropriate disciplines are included. Confirm that the FPD is certified at the appropriate level to manage this project. Assess both Federal and contractor project management staffing in terms of number of personnel, skill set, effectiveness, quality, organizational structure, division of roles/responsibilities, and processes for assigning work and measuring performance. (Differentiate between full and parttime IPT members.) Assess whether the Federal and contractor project teams can successfully execute the project. **Project Response**: IPT Charter approved May 2009. Posted on the NSTX Upgrade WEB Site. Meetings conducted every 3-4 weeks. IPT Membership: • Jeffrey Makiel, PSO, Chair -NSTX Federal Project Director 609 243-3721 jmakiel@pppl.gov • Barry Sullivan, OFES -NSTX Program Manager 301 903-8438 barry.sullivan@sc.doe.gov • Ron Strykowsky, PPPL -NSTX Upgrade Project Manager 609 243-3016 eperry@pppl.gov • Erik Perry, PPPL -NSTX Upgrade Deputy Project Manager 609 243-3016 eperry@pppl.gov • Mike Williams, PPPL -Engineering Dept Head 609 243-2866 williams@pppl.gov • Masa Ono, PPPL-NSTX Project Director 609 243-2105 mono@pppl.gov • Jon Menard, PPPL, -NSTX Program Director 609 243-2037 jmenard@pppl.gov • Tom Egebo, PPPL -NSTX Project Controls 609 243-2674 rstryk@pppl.gov • Jerry Levine, PPPL -ES&H Head 609 243-3439 jlevine@pppl.gov • Leif Dietrich, SC-PSO -ES&H Team Lead 609 243-3759 ldietrich@pppl.gov • Tim Stevenson, PPPL -Neutral Beam Operations 609 243-2657 tstevens@pppl.gov • Larry Dudek, PPPL -Fabrication & Operations 609 243-2185 ldudek@pppl.gov • Al von Halle, PPPL -Electrical Head **Committee Response**:
17. Sustainable Design		N/A.

18. Safeguards and Security **Input from:** **SC3 Management**		Assess whether a Preliminary Security Vulnerability Assessment Report as defined in DOE M 470.4-1 has been updated as required by DOE O 413.3A. Assess the completeness and accuracy of the applicable safeguards and security requirements, the methods selected to satisfy those requirements, and any potential risk acceptance issues applied to the project and their incorporation into the project. Assess adequacy of incorporation of Design Basis Threat requirements into the baseline. Review the proposed performance baseline to ensure that cost, schedule, and integration aspects of safeguards and security are appropriately addressed. Assess whether all feasible risk mitigation has been identified and that the safeguards and security concerns for which explicit line management risk acceptance will be required are appropriately supported. **Project Response**: The Security Vulnerability Assessment report, prepared in June 2009, has been reviewed and remains unchanged. The assessment did not indicate any negative impact or increased cost to the physical protection, personnel security, emergency operations or protective forces. **Committee Response**:
19. New Technology and Technology Readiness		N/A.

20. Contract Management **Input from:** **SC3 Management**		Assess the current contract including cost, schedule, and work scope against the proposed performance baseline and identify any potential contract and project integration issues. Determine whether the terms of the current contract support the project as currently planned and identify any gaps between the current contract and proposed performance baseline. Assess effectiveness of integrated change control and use of change control boards by both Federal and contractor organizations. Likewise, assess any planned contract modifications and requests for equitable adjustments relative to the proposed performance baseline. Evaluate the status of contract management, and if applicable, plans and schedule to bring the contract up to date. Assess project plans to self-perform construction and operations readiness versus subcontracting that work. Assess draft documents to be provided to the services (e.g., construction) and product (e.g., purchased materials and equipment) subcontractors including submittal of documents by the subcontractors required before notice to proceed (e.g., design requirements, EVMS, and systems testing and turnover requirements). **Project Response**: The NSTX Upgrade project is within the established scope of the NSTX Program which is covered in the DOE contract with Princeton University DE-AC02-09CH11466. Excerpt from section C page 12; *"The NSTX experiment will be the main experimental facility at PPPL in the next 5-10 years. It will be managed as a national facility, and participation in the research team will be available to interested and qualified researchers from the U.S. fusion and plasma science communities. PPPL will develop and manage scientific and facility plans to integrate a broad, diverse national and international research team to maximize the scientific output of the facility, in support of the fusion science program goals. The scientific program will be developed and executed with participation by all members of the research team. Over the next decade, it is expected that PPPL, in concert with its partner research team, will propose and successfully implement upgrades to the NSTX facility to maintain its status as a world-leading fusion research facility."* **Committee Response**:
21. Documentation and Incorporation of Lessons Learned		N/A.