Office of Basic Energy Sciences
Office of Science

CD-2, Approve Performance Baseline for the Center for Nanophase Materials Sciences (CNMS) A Nanoscale Science Research Center at Oak Ridge National Laboratory

A. Purpose

The purpose of this paper is to document the review by the Office of Science Energy Systems Acquisition Advisory Board-equivalent for the Critical Decision "Approve Performance Baseline (CD-2)" for the Center for Nanophase Materials Sciences (CNMS), a Nanoscale Science Research Center (NSRC) at Oak Ridge National Laboratory (ORNL).

B. Mission Need

ORNL will establish a highly collaborative and multidisciplinary CNMS that will provide a unique resource for nanoscale science research. The CNMS will integrate nanoscale research with neutron science, synthesis science, and theory/modeling/simulation (TMS).

The CNMS will provide the research infrastructure and environment needed for a user facility with highly collaborative and interdisciplinary research. The user community will include resident scientific collaborators and both long- and short-term visiting scientists. The CNMS will also provide the necessary infrastructure for the research including technical support personnel, synthesis and characterization facilities, high quality and novel research materials, properties measurement facilities, and nanofabrication capabilities, within its research focus areas. This will permit assembling teams to tackle research problems of a scope, disciplinary breadth, and complexity that cannot be done by small-group efforts. More than half the users of the Center will be researchers from academia, industry, and other national laboratories. The Center will provide a unique training opportunity to introduce young scientists and engineers to nanoscale science, neutron science, and advanced synthesis and TMS tools.

C. Project Performance Scope Baseline

The CNMS facility will consist of a multi-story building including the main laboratory and office building and a single-story Nanofabrication Research Laboratory (NRL). Based on the Title I (preliminary) design, the total gross area of the new building will be approximately 80,000 square feet, providing state-of-the-art clean rooms, and general laboratories for sample preparation, fabrication and analysis. Included will be initial equipment for nanoscale materials research such as surface analysis equipment, nanofabrication facilities, etc. A list of this equipment will be maintained under configuration control as part of the Systems Requirements

Document. The facility, co-located with the Spallation Neutron Source (SNS) complex, will house ORNL staff members and visiting scientists from academia and industry.

D. Project Performance Cost and Schedule Baseline

The performance baseline Total Estimated Cost (TEC) of $64.0 million and performance baseline Total Project Cost (TPC) of $65.0 million are based on receiving the following funding levels (in thousands of dollars):

Fiscal Year	Total Estimated Cost		Other Project Costs	Total Project Cost
	Project Engineering & Design	Construction	Conceptual Design, NEPA, Hazard Analysis, Other, and Pre-Operations	Total
Prior			250	250
2002	1,500		225	1,725
2003	1,000	24,000	100	25,100
2004		20,000	250	20,250
2005		17,500	100	17,600
2006			75	75
	2,500	61,500		
Total	64,000		1,000	65,000

The performance schedule baseline is as follows:

CD-0	Approve Mission Need	June 2001
CD-1	Approve Preliminary Baseline Range	February 2002
CD-2	Approve Performance Baseline	September 2002
CD-3	Approve Start of Construction	February 2003
CD-4a	Approve Start of Initial Operations	December 2004
CD-4b	Approve Start of Full Operations	September 2006

E. Preliminary Design, Performance Baseline External Independent Review, and Review of Contractor Project Management System

Based on the CNMS preliminary design documents and cost estimate, JUPITER Corporation conducted the performance baseline External Independent Review (EIR)/Independent Cost Review (ICR) in July 2002 and issued the final report in August 2002. In consultation with the CNMS Program Manager in BES, the review findings have been addressed and the Corrective Action Plan is attached.

F. Environmental Strategy

The CNMS will be designed, constructed and operated in compliance with all requirements of the National Environmental Protection Act (NEPA) and its implementing regulations. Construction and operation activities of the CNMS have been evaluated and are covered by the approved NEPA Environmental Assessment (EA) for the ORNL Facilities Revitalization Project. A Finding of No Significant Impact (FONSI) dated June 01, 2001 has been issued. The modified scope (size and location) of the project proposed in the CDR has been compared to that evaluated in the above EA, and it was determined that the FONSI remains valid.

G. Preliminary Safety Assessment

A Facility and Project Safety Assessment of the CNMS has been completed and issued on November 27, 2001. This included an initial hazard screening for the facility to identify potential hazards associated with the construction and operation of the proposed CNMS. This assessment concluded that the CNMS is determined to be an "Other Industrial" facility, which will not contain any radiological material, except for calibration standards. The ORNL Research and Development Work Control Process will be used to evaluate and develop controls for the research activities.

H. Energy Conservation and Sustainable Design

The CNMS will be designed and constructed to comply with 10 CFR 435. The project will prepare a compliance analysis report at the completion of final design. Sustainable building design principles are being applied to the design and construction of the CNMS. Standard practices will include using recycled content products, purchasing energy efficient and water efficient equipment and substituting less hazardous construction materials. The Systems Requirements Document includes these requirements for the design of the CNMS. Project waste disposal and recycle requirements will be incorporated into the CNMS procurement documents.

Submitted by:

David K. Arakawa
DOE Federal Project Manager
ORNL Site Office

8/29/02
Date

George J. Malosh
Site Manager
ORNL Site Office

8/29/02
Date

Jeff Hoy, CNMS Program Manager
Materials Sciences and Engineering Division
Office of Basic Energy Sciences
Office of Science

9/4/02
Date

Iran L. Thomas
Director, Materials Sciences and Engineering Division
Office of Basic Energy Sciences
Office of Science

9-5-02
Date

Recommendations

The undersigned "Do Recommend" (Yes) or "Do Not Recommend" (No) approval of CD-2, Approval of Performance Baseline, for the Center for Nanophase Materials Sciences at ORNL as noted below.

ESAAB Secretariat, Construction Mgmt Support Division	Sept 5, 2002 Date	Yes ✓	No____
Representative, Non-Proponent SC Program Office	5 Sept 02 Date	Yes ✓	No____
Representative, Financial Mgmt. Division	9/5/02 Date	Yes ✓	No____
Representative, Environmental, Safety and Health Division	9/5/02 Date	Yes ✓	No____
Representative, Security Mgmt. Team	9/5/02 Date	Yes ✓	No____
Representative, Laboratory Infrastructure Division	9/5/02 Date	Yes ✓	No____
Representative, Grants and Contracts Division	Date	Yes____	No____

Approval

Based on the information presented above and at this review, Critical Decision-2, Approve Performance Baseline, is approved. Therefore, the Oak Ridge Operations Office is authorized to continue with expenditure of Project Engineering & Design funds for the design of the Center for Nanophase Materials Sciences, a Nanoscale Science Research Center and to request construction funding.

Patricia M. Dehmer — 9/5/2002 Date

Patricia M. Dehmer
Associate Director of the Office of Science
for Basic Energy Sciences

ORNL Document X-OE-933

CORRECTIVE ACTION PLAN

FOR THE

EXTERNAL INDEPENDENT PROJECT REVIEW

OF THE

CENTER FOR NANOPHASE MATERIALS SCIENCES PROJECT

August 29, 2002

8/29/02

David K. Arakawa
Federal Project Manager

08/28/02

Linda L. Horton
Project Director

Jack L. Stellern
Conventional Facilities Project Manager

ID No.	Section Ref	Pg Ref	Recommendation	Required Action (Discussion)	Action by	Scheduled Completion date	Current Status	Actual Completion Date
1	3.1.1 - Cost Estimate/ Project Funding	9	Use the latest DOE escalation rates.	Per discussions with BES, the escalation rates used in the FY03 data sheet will be used for the life of the project unless there is a major increase in the escalation rates.	Stellern	09/05/02	Completed	08/26/02
			Use Primavera to apply escalation to a spending pattern based on a resource loaded and costed schedule, taking care not to apply escalation where it has already been included in the base numbers.	Per discussions with BES, escalation will be applied through the midpoint of construction/equipment acquisition, as was used in the CDR for this project.				
			Illustrate how escalation was applied to the Construction Manager Furnished Equipment and Materials (CMFE) items in the estimate.	Escalation will be applied only once to all elements of the cost estimate, including personnel costs.				
2		10	Prepare an LCC estimate to cover all acquisition costs, operating and maintenance costs, assumed future rehab or expansion costs (if any), and decommissioning costs. Update the LCC as necessary to reflect significant changes, e.g., addition/deletion of major technical equipment, building size changes, and significant changes in recurring operating costs such as utilities, security, etc.	An LCC estimate will be prepared and issued as a project document	Horton	09/05/02	Completed	08/28/02

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3		10	Further refine the current construction WBS (currently one element) to at least two additional levels. Include those levels in the WBS dictionary.	NO ACTION REQUIRED The lowest level of the WBS is currently at the building level. This is the lowest level of tracking necessary for adequate management of the project. The schedule of values prepared by the construction contractor will be used to determine earned value. This approach parallels that used by the SNS project. Technical equipment earned value will be tracked by piece of equipment through the use of separate accounts rather than additional WBS detail.		NA		
4	3.1.2 - Cost Risk Analysis	11	Include language to the PEP and/or the Risk Mitigation Assessment and Plan documents to provide regular, periodic review of risk elements including their relationship to remaining contingency and the status of the risks and management activities.	ORNL plans to perform periodic reviews of the risk elements. This will be documented in the PEP. The next review will be at the completion of design.	Stellern	09/05/02	Completed	08/29/02
5	3.2.1 – Project Schedule	12	Develop a fully integrated resource and cost loaded Critical Path Method Schedule from design through commissioning including technical equipment, construction, design, design support, project management, Title III, OPC activities, demobilization, etc. **The revised schedule should be independently reviewed.**	The project schedule will be cost loaded prior to CD-2. The suggested level of effort activities will be added to the schedule. The scheduled IPR will provide independent review of the schedule.	Stellern/ Horton	09/05/02	In progress	

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6		12	Add all appropriate project activities to the summary level project schedule. – Display the technical equipment schedule by activities that comprise the Level II WBS 2.1, i.e., Equipment, Procurement, Installation, Test and Checkout, Technical Design Support and Project Management. – Display the conventional facilities schedule by activities that comprise the Level II WBS 2.2, i.e., Design, Construction, Project Management, Design Support, Construction Management Construction Support, and Title III services. – Add OPC elements such as CDR/VE Study, Scientific Scope Development, ES&H Documentation and Engineering Support. – Add key events and milestones as appropriate to a summary level project schedule. Add key events and milestones, such as dry-in, foundations, clean room, mechanical, steel, foundations, and integrate equipment delivery/installation to the existing construction schedule. Add key events for individual equipment items, such as procurement, inspection, installation, test and acceptance to the preliminary technical equipment schedule.	The project schedule will be cost loaded prior to CD-2. The suggested level of effort activities will be added to the schedule.	Stellern/ Horton	09/05/02	In progress	
7	3.3.2 – Solution Requirements	13	The SNS AE/CM's ES&H Plan should be formally adopted as the ES&H plan for the CNMS Project by UT-Battelle.	A formal CNMS ES&H plan will be in place prior to CD-2. This plan will formalize the adoption of the existing SNS ESH plan for the CNMS.	Kornegay	09/05/02	Draft in Review	

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8	3.3.3 – Solution Design	14	Review project technical decisions and provide supporting documentation for all major issues used in the design decision-making process. At a minimum, this should include all analyses performed by external consultants. These analyses must detail all primary methods, assumptions, data sources, lessons learned, and key experience based knowledge and show how the parameters impact the equipment and building requirements, as well as major sources of risk and error.	The consultant has already provided reports on EVA design; a site survey report for vibration, EMI, and acoustics measurements; and an analysis of the impact of the thickness of the concrete slab. Note that the consultant has been part of the design team since the initial conceptual design meetings and has participated in design reviews. Additional documentation that outlines his credentials and the basis of his design recommendations will be obtained.	Horton	09/30/02	Requested additional documentation from consultant	
9	3.3.4 – Solutions Preparation for Next Phase	15	Implement a commissioning plan for the CNMS and establish a Commissioning Authority. Include the cost of commissioning in the cost estimate.	We will comply with the 413.3 requirement for transition to operations planning, including a readiness assessment. This planning will be initiated prior to CD-2.	Horton	09/05/02	Completed	08/28/02
10	3.4.2 –Team/ Managemen t Issues	16	A RAM for the CNMS Project should be developed and included in the PEP.	The project team organization and responsibilities are described in section 3.0 of the PEP. This section will be strengthened when the PEP is reissued. The project team charter will be appended to the PEP.	Stellern/ Horton	09/05/02	Completed	08/29/02
11		16	It would be good practice to start planning for that event now by growing one or more candidates for the Technical Equipment Project Managers position.	NO ACTION REQUIRED If a new Technical Equipment Project Manager is needed, he/she will be selected from the existing science/technical team.		NA		
12	3.4.3 – Documents / Requiremen ts	17	Secure approval of the PEP prior to CD-2, but after incorporating EIR Team suggestions discussed in the following observation.	PEP will be reissued prior to CD-2. The EIR team suggestions will be included in the revision, as appropriate.	Stellern/ Horton	09/05/02	Completed	08/29/02

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13		17	Increase the level of detail included in the PEP.	PEP will be reissued prior to CD-2. The EIR team suggestions will be included in the revision, as appropriate.	Stellern/ Horton	09/05/02	Completed	08/29/02
14	3.4.4 – Project Risk Analysis / Mitigation	17	An overarching QA Plan at the UT-Battelle level, that encompasses the SNS AE/CM's QA Plan and the technical equipment QA plan should be formalized for the CNMS Project by UT-Battelle. Within this plan, the independence of the QA organizations should be clearly delineated.	A formal CNMS QA plan will be in place prior to CD-2. This plan will formalize the adoption of the existing SNS QA plan for the CNMS and will clearly delineate the independence of the QA organization.	Horton/ Stellern/ Vance	09/05/02	Completed	08/28/02
15		18	Revise the Risk Assessment/ Plan to incorporate more detail and specificity on the afore-mentioned risks and on any other risks that the project team may identify.	The Risk Assessment/Plan will be reviewed and updated at the completion of design.	Stellern/ Horton	1/30/03		
16		18	Implement a Constructibility Review Process starting at this preliminary stage of the project and continuing throughout project development.	NO ACTION REQUIRED The process of an independent constructability review is currently planned for CNMS. The AE has assigned an independent QA team, including architectural, structural, industrial, mechanical, and electrical reviewers. These reviewers are experienced people independent of the project team. This QA team will review the drawings for accuracy, constructability, completeness and interfaces. This review will occur at 30%, 60% and 90% design complete stages.		NA		

Red = Essential Finding
Yellow = Finding
Green = Observation