

**WBS Dictionary
for
The BNL Center for Functional Nanomaterials**

At
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Upton, New York 11973

February 20, 2004

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WBS 1.1 - Project Support:

WBS 1.1.1 – Project Management - includes all work to manage the project in accordance with this Preliminary Project Execution Plan and compliance with DOE Manual 413.3-1, “Project Management for the Acquisition of Capital Assets”. This WBS also includes the implementation of the BNL Project Management Control System (PMCS); procedures and application of control systems to include oversight and evaluation of the project. It includes the control of project baselines, contingency and Earned Value Management in accordance with ANSI standard EIA-748 which will be used for performance management throughout the life of the project.

WBS 1.1.1.1 – Project Management - Design Phase includes all work to manage the project during the design phase in accordance the approved Preliminary Project Execution Plan and the DOE Manual 413.3-1, “Project Management for the Acquisition of Capital Assets”. The Project Manager has the overall responsibility for the project’s performance, cost, and schedule and leads a team of individuals who contribute to the overall project objectives. Included are day-to-day project management, team meetings, authorizations, project estimates, analysis and control, change control, risk management, management plans and revisions, and reporting and documentation.

WBS 1.1.1.1.1 – Project Management - Conventional Design includes the management effort to support the design phase of the project, including overseeing the A/E Title I and Title II design, developing RFQ documents, and project controls.

WBS 1.1.1.1.2 – Design Management – Conventional Design involves reviewing the building design by the BNL Plant Engineering design staff, coordinating with the A/E project team, and interacting with the customer and consultants. This includes design team meetings.

WBS 1.1.1.1.3 – Project Management - Technical Design includes the management effort to support the technical design phase of the project including managing the preparation of specifications for the technical equipment. It also includes technical management support during the design phase of the building.

WBS 1.1.1.2 – Project Management - Construction Phase includes all work to manage the project during the construction phase in accordance with BNL's Preliminary Project Execution Plan, DOE Manual 413.3-1 and includes implementation of the BNL Construction Safety Program.

WBS 1.1.1.2.1 – Project Management - Conventional Construction includes all the project management effort to support the conventional construction phase of the project including earned value management and project controls.

WBS 1.1.1.2.2 – Project Management - Technical Equipment includes all the project management effort to support the technical construction phase of the project including overseeing the installation of technical equipment.

WBS 1.1.2 – Project Engineering - includes Title I & II engineering, value engineering, shop drawing review, and Title III construction inspection services, and includes implementation of the BNL Construction Safety Program.

WBS 1.1.2.1 – Project Engineering - Design Phase includes all work to design the CFN building including Title I, and Title II engineering.

WBS 1.1.2.1.1 – Project Engineering – A/E Title I Design is the preliminary design development phase, which usually consists of 30 to 40 percent of the design effort. During this phase schematic design is done for all building systems, and typical elevations and sections are developed. Very little work is performed on details,

sections, and schedules or materials. The intent of Title I is to design the project at a level of detail that can be presented to the customer base to confirm that the project is on the proper course for performance, cost, and schedule.

WBS 1.1.2.1.2 – Project Engineering – A/E Title II design is the final design development phase. All plans, sections, details, and specifications are completed during this phase. A final cost estimate is completed. A customer review of the completed design is also performed. The deliverable from this phase is the bid document package.

WBS 1.1.2.1.3 – Project Engineering - Technical Design includes all the project design effort to support the technical engineering phase of the project. This includes development of instrument specifications and procurement packages.

WBS 1.1.2.2 – Project Engineering - Construction Phase includes the engineering effort to support the construction phase of the project.

WBS 1.1.2.2.1 – Project Engineering - Conventional Construction includes the project engineering effort to support the conventional construction activity. This includes shop drawing review, construction inspection, change orders, and quality assurance.

WBS 1.1.2.2.2 – Project Engineering - Technical Equipment includes all the engineering effort by the scientific staff to support laboratory and clean construction during the construction phase of the project.

WBS 1.2 – Technical Equipment - Consists of competitively bid (where possible), lump sum contracts, as well as in-house fabrication, assembly, installation and testing. The tasks within each WBS element are broken down as follows:

WBS 1.2.1 – Nanopatterning

New state-of-the-art electron beam, ion beam, and deep ultraviolet patterning; plasma deposition, gas vapor deposition, and vacuum deposition; plasma, wet-chemical etching and appropriate packaging methods to fabricate nanomaterials with nanoscale precision.

WBS 1.2.2 – Ultrafast Optical Sources

These laboratories will utilize standard and customized laser sources for the following applications: (1) ultrafast laser probes for examining issues in nanostructures, (2) new sources such as femto-second pulses and X-ray generation from laser-electron beam interactions, and (3) surface non-linear optical probes including second harmonic generation.

WBS 1.2.3 – Electron Microscopy

Planned for acquisition are two transmission electron microscopes including a 200kV instrument with a field emission gun. An ultra-high resolution scanning electron microscope will be available for examination of specimens and quantitative measurements. A sophisticated sample preparation lab will also be installed.

WBS 1.2.4 – Materials Synthesis

This suite of laboratories is designed to provide a range of thin film, bulk, and soft material synthesis capabilities. Preparation equipment included in these laboratories are a thin film deposition system and an electron beam evaporator. Analytical and characterization facilities constitute a major portion of the investment. Equipment includes x-ray diffraction, a magnetometer, thermal properties measurement apparatus, and a nuclear magnetic resonance (NMR) installation.

WBS 1.2.5 – Proximal Probes

These laboratories are to be equipped for optical characterization of samples using IR, UV and Raman spectroscopy and confocal microscopy, and near-field scanning optical microscopy (NSOM). A development laboratory for spectroscopic near-field microscopy using IR and UV Raman techniques as well as a low energy electron microscope. General purpose chemistry laboratory for sample preparation. A wet chemical laboratory for sample preparation and analysis.

WBS 1.2.6 – Theory & Computation

This laboratory cluster provides state-of-the-art software and computational equipment, i.e., a Linux cluster computer, with approximately 200 processors.

WBS 1.2.7 – CFN Endstations at NSLS

A small-angle x-ray scattering end station will be constructed by the BNL CFN. The major components of the end station are an area detector, position sensitive detector, scattering system, optics and microscopes.

WBS 1.3 – Conventional Construction - Consists of competitively bid, lump sum contracts. The tasks within each WBS element are broken down as follows:

WBS 1.3.1 – Improvements to Land - includes all costs associated with clearing and grubbing, site work, landscaping, sidewalks. It also includes curbing, paving, and vehicle access to the building. Compusult section B. Site Work.

WBS 1.3.2 – Building – Typically, construction includes the overall building structure, main mechanical and electrical equipment located in equipment rooms and penthouses, primary building distribution mechanical and electrical systems, the lightning protection system, elevator, emergency lighting system, exterior finish, roof, windows, secondary systems, and interior spaces as required by the specific building occupants.

WBS 1.3.2.1 – Building Architectural - Construction includes the overall building structure, elevator, exterior finishes, windows, and interior spaces as required by the specific building occupants. The following sections from the Compusult detailed construction cost estimate make up this WBS. 1. Substructure, 2. Superstructure, 3. Exterior Closure, 4. Roofing, 5. Interior Construction, 6. Interior Finishes, 7. Building Specialties, 8. Equipment, 9. Furnishings, 10. Special Construction, and 11. Conveying Systems.

WBS 1.3.2.2 – Building Mechanical - Construction includes the main mechanical equipment located in equipment rooms and penthouses, and primary building distribution mechanical systems and its controls. Compusult Section 15. HVAC & Controls.

WBS 1.3.2.3 – Plumbing - Construction includes the installation of the plumbing distribution systems. Compusult Section 12. Plumbing & Waste Water Systems & Section 13. Process Systems.

WBS 1.3.2.4 – Fire Protection - Construction includes the installation and controls of the fire protection equipment and distribution systems. Compusult Section 14. Fire Protection.

WBS 1.3.2.5 – Electrical - Construction includes the power and lighting distribution of these electrical systems. Compusult Section 16. Electrical/Life Safety/Telecom.

WBS 1.3.3 – Utilities - includes providing services such as water, steam, sanitary waste, voice communication and data, chilled water, compressed air, and electrical to the building.

WBS 1.3.3.1 – Mechanical - Construction includes the site mechanical equipment and distribution systems. Compusult Section B. Site Work & Section 15. HVAC & Controls.

WBS 1.3.3.2 – Electrical - Construction includes the site electrical equipment and power distribution to building. Compusult Section B. Site Work.

WBS 1.3.4 – Other Construction Costs – includes demolition or relocation of the existing Teachers Federal Credit Union (TFCU), Building 193 and contribution to a new satellite chiller plant to be located in Building 555. The satellite chiller plant will consist of 2 – 650 ton chillers, cooling tower and associated piping and controls. The satellite chiller plant will add capacity to the Central Chilled Water Plant and provide chilled water to the CFN.

WBS 1.3.4.1 – Demolition/Relocation of the TFCU - Construction includes the demolition/relocation of the building.

WBS 1.3.4.2 –Satellite Chiller Plant - Construction includes the installation of chillers and its associate distribution systems in a remote location.

WBS 1.4 – Standard Equipment includes office furniture, personal computers, blinds and equipment that are off the shelf or only require nominal engineering.

WBS 1.5 – Other Project Costs – major support activities are charged to OPC, these include Conceptual Design Costs, NEPA final hook-up and testing, and commissioning activities.

WBS 1.5.1 – Conceptual Design Report (CDR) – the CDR summarizes investigations to establish baseline scope, schedule, and cost information. Approval of the CDR is required before the CFN project can compete for congressionally approved Capital funds and receive Critical Decision 1 (CD-1), Approval of Preliminary Baseline.

WBS 1.5.2 – National Environmental Policy Act (NEPA) – includes tasks for preparation and documentation needed for the NEPA process to determine if further NEPA documentation is required or a categorical exclusion (CX) will be issued.

WBS 1.5.3 – Hazards Analysis – preparation of hazards analysis document for the CFN project.

WBS 1.5.4 – Building/LEED Commissioning – includes Plant Engineering (EP) Construction Support and EP Operations and Maintenance during commissioning activities along with a Commissioning Agent.

WBS 1.5.5 – Final Hook-up and Testing – includes activities needed to ready the facility and equipment to operate safely and effectively.

WBS 1.5.6 – Other Project Related Costs – includes minor project management to coordinate efforts through completion for turnover to the facility owner. Project management will coordinate with the contractor and the designer for support needed during this phase. It also includes any ESH&Q support needed to bring the facility to safe operations.

Center for Functional Nanomaterials (CFN) Work Breakdown Structure (WBS)

