Statement of Mission Need

for the

Oak Ridge National Laboratory
Modernization of Laboratory Facilities, 09-SC-71

Laboratory Infrastructure Division
Office of Science

Non-Major System Acquisition Project

Submitted August 2007

Originator: Johnny O. Moore
Oak Ridge Office
Assistant Manager for Science
865-576-3536

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A. Purpose

This document represents the Statement of Mission Need for Critical Decision 0 (CD-0), Approve Mission Need, for review for the Modernization of Laboratory Facilities (MLF) at Oak Ridge National Laboratory (ORNL). This project is ORNL's highest priority under the proposed Science Laboratories Infrastructure Initiative Ten Year Complex Plan.

B. Background

A previous CD-0, Approve Mission Need, for the FY 2007 Modernization of 4500N, Wing 4, project was signed by the Director of the Office of Science, Dr. Raymond L. Orbach, on March 5, 2002, with a total estimated cost (TEC) of $16.6 million. Modernization of Wing 4 was the first of seven phases necessary to revitalize the entire Building 4500 Complex. Since then there has been no significant change in mission capability need. However, through studies and value engineering, the ORNL strategy has been revised to give priority to delivering new laboratory capacity, on a more cost-effective and accelerated schedule. The replacement research facility will provide fume hood–intensive wet chemistry laboratories and analytical instrumentation laboratories demanding clean electrical power to house chemical and material sciences core capabilities.

In addition to efficiently delivering new laboratory space, the strategy also creates opportunities to further consolidate staff on the main site and vacate aged, inadequate, and inefficient space. The portions of the 4500 Building Complex vacated by research housed in the replacement facility will be rehabilitated into office and support space using the Institutional General Plant Projects and expense funds.

C. Continued Mission Need and Supporting Analysis

ORNL is the Department of Energy's (DOE's) largest science and energy laboratory. Under DOE's Office of Science, ORNL has the primary mission focus of conducting research leading to innovative solutions for neutron science, energy, high-performance computing, systems biology, materials science, and national security complex problems. As an international leader in a range of scientific areas supporting DOE's basic research, energy, national security, and environmental missions, ORNL is actively engaged in a broad range of national and international partnerships with industry and educational institutions. As a DOE steward of critical national research infrastructure, the laboratory provides

access to university, industry, and government researchers on a competitive basis. In total ORNL has 17 research user facilities. The recently constructed Spallation Neutron Source and the upgraded HFIR makes ORNL the world's foremost center for neutron science research. The Laboratory is home to over 4,200 staff; annually it hosts 12,000 extended stay guest researchers and 17,000 short term visitors.

Six core competencies underpin activities at ORNL:

- Neutron science
- Leadership computing and simulation science
- Energy engineering sciences
- Advanced materials and interfacial chemical processes
- Biological and environmental systems
- Science and technology for national security

These six competencies enable ORNL to deliver its mission and customer focus, to perform a complementary role in the DOE laboratory system, and to pursue its vision for scientific excellence and pre-eminence in the areas of

- Delivering and sustaining the world's foremost center for neutron scattering
- Sustaining world leadership in computational science and engineering
- Sustaining world leadership in materials science through discovery, synthesis, and characterization of materials at the nanoscale
- Leading research in microbial biology and proteomics, producing bio-based solutions to energy challenges, and enabling the new field of "ecogenomics"
- Providing international leadership in energy technology through science
- Delivering "first-of-a-kind" science-based security technologies and implementing nuclear nonproliferation programs

For the past six years ORNL has applied substantial resources to modernizing its facilities and infrastructure. Today, many of ORNL's scientific facilities are new or have been recently upgraded. However this is not the case for facilities housing our materials and chemical sciences organizations, the Chemical Sciences and Materials Science and Technology Divisions. ORNL's Chemical Sciences Division conducts both fundamental and applied research in catalysis, surface science and interfacial chemistry, molecular transformations and fuel chemistry, geochemistry, inorganic nanomaterials, polymer and other soft materials, chemical biosciences, mass spectrometry, chemical imaging, nuclear magnetic resonance, separations science, advanced instrumentation, heavy element chemistry and radioactive materials characterization, and neutron science. The Materials Science and Technology Division (MSTD) conducts basic and applied research and technology development of materials for advanced energy applications and other important national priorities. These programs include novel materials synthesis, nanomaterials, materials theory, advanced materials characterization tools (including world-leading electron microscopy and X-ray and neutron scattering research), structural materials and other advanced materials, and composites.

These organizations have made ORNL a leading national laboratory in Basic Energy Sciences (BES) materials and chemical sciences research, sustaining world leadership in materials and chemical science through discovery, synthesis,

and characterization of materials at the nanoscale. Much of their capabilities are housed in the 4500 Building Complex, including

- Catalysis
- Soft and bio-mimetic materials
- Advanced separations and mass spectrometry
- Chemical imaging and electron microscopy
- Geochemistry
- Nanomaterials and nanoscience
- Materials design and synthesis
- Chemical materials theory
- Structural materials
- Condensed matter physics
- X-ray and neutron scattering

The building space is aged and difficult to maintain. Many building systems have exceeded their design life expectancy. Air handlers and ductwork in heating, ventilation, and air-conditioning (HVAC) systems are corroded and vibrate excessively, resulting in particulate contamination of lab spaces. Exhaust systems are worn and corroded and in some cases shut down because of insufficient exhaust capability. In general, HVAC systems do not meet current energy standards. Fume hoods are out of date and pose a challenge with respect to safety. Laboratory furniture and casework are deteriorated and no longer functional for the types of science housed there. Floor, wall, and ceiling finishes have also exceeded normal life expectancy and in some cases will require lead and asbestos abatement. Plumbing systems are original to the facility and in some areas contain legacy contamination that presents an environmental liability.

The science operations of these research groups are already being affected by the functionality of the old, deteriorating building facilities. The condition of the buildings threatens the viability of several research programs and no longer adequately supports DOE mission accomplishment. Frequent failures of the utility systems that support the labs result in lost time and inefficiencies during research experiments. It is a deterrent in attracting and retaining scientific staff. Immediate action to house programs in modern, reliable laboratory space is required.

DOE needs to maintain these capabilities. Current conditions at ORNL do not allow the most efficient or cost effective approach in meeting the mission need.

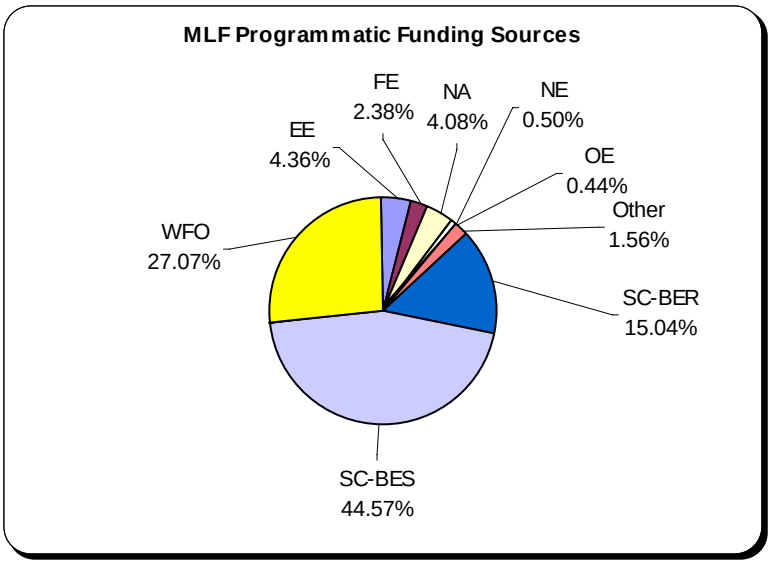

Figure 1 – Programmatic Funding Sources for MLF Occupants

It is proposed that ORNL construct a new laboratory replacement building of modern, 21st-century laboratories, with associated lab equipment and space for support functions, for materials and chemical research and development use. The facility is planned on a site currently used for parking (Flagpole Parking Lot, see Figure 2).

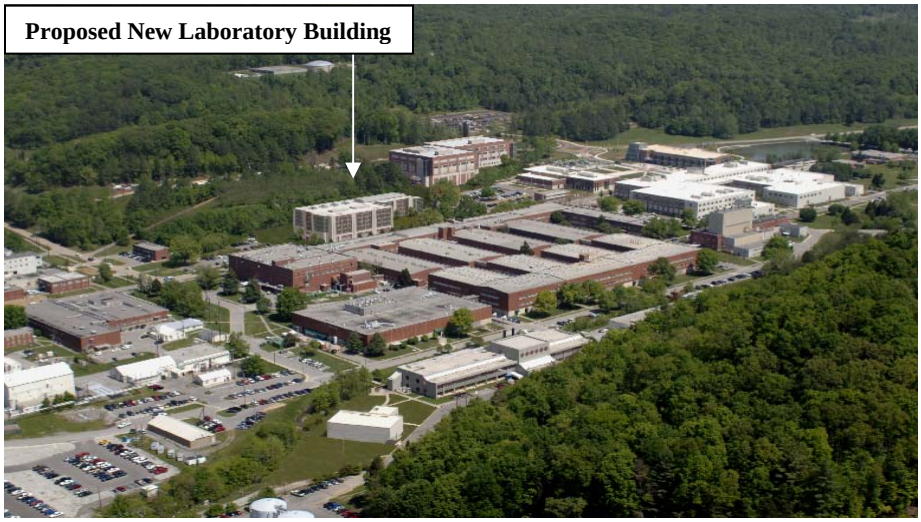

Figure 2. Flagpole Lot —New Laboratory Building

The design will use modern, efficient lab planning benchmarks as the basis for determining the size and configuration of space types.

D. Importance of Mission Need and Impact if Not Approved

The Building 4500 Complex, housing the primary and largest chemical and materials sciences facility at ORNL, simply does not meet the needs of modern science. The complex is unreasonably expensive to operate and poses undesirable operational risks. The complex has facilitated the mission at ORNL for over 50 years, but now its condition, configuration, and functionality limit the Laboratory's ability to perform certain aspects of the DOE mission, to conduct research operations safely and efficiently, and to attract and retain top scientists. The complex accounts for one-third of deferred maintenance at ORNL. It houses approximately one-fourth of the staff at ORNL; and it is the hub or a major pass-through point for site-wide services such as telephone, computing network, and emergency notification systems. The sporadic, unforeseen failures of building systems and inefficient laboratory configurations are limiting the productivity of the complex's laboratories and staff.

As ORNL is one of DOE Office of Science's largest "user laboratories," the success of many users depends on productive interaction with ORNL research programs. It is imperative that the site infrastructure provide workplace facilities that attract staff and users and facilitate their research with modern laboratory configurations and equipment, controllable environments, robust utility and service systems (e.g., computational capability, clean reliable electricity), appropriate space allocation, and state-of-the-art safety systems. This strategy focuses required line item investments on the materials and chemical science space. Failure to renovate or replace the fume hood–intensive wet chemistry laboratories and analytical instrumentation laboratories that demand clean, reliable power supplies will further inhibit scientific output and threaten those missions supported by materials and chemical sciences, core capabilities at ORNL. Failure to provide modern laboratory space for staff and users jeopardizes ORNL's missions to foster a large, productive user program and perform exceptional science for DOE programs in a safe, secure, and environmentally sound manner.

The following project alternatives will be analyzed in the conceptual design phase to ensure the proposed strategy is the most cost-effective method of meeting the identified mission need:

- Alternate 1: Do nothing. (i.e., continue to operate the building complex under current conditions and procedures)
- Alternative 2: Modernize and renovate existing laboratories and offices in Buildings 4500 North and South.
- Alternative 3: Acquire a new laboratory building and supporting infrastructure at ORNL.
- Alternative 4: Other alternatives - revitalizing other existing space at ORNL and use of a "noncapital alternative,", to provide new lab space.
- Alternative 5: Perform work at this laboratory instead of other laboratories. The existing laboratories areas are used to perform chemical and material science research and development work by approximately 200 principal investigators and associated staff. Materials and chemical science are primary underpinnings of the core research programs at ORNL (i.e. neutron science, life science, computational sciences, and energy). Historically

breakthroughs in chemical and materials science has led to a large number of the 134 R&D 100 awards received at the laboratory. If this work was transferred to another laboratory, it could diminish effectiveness in several of the ORNL core capabilities (neutron scattering, biological and environmental sciences, etc. Relocation of staff to another laboratory would be difficult and costly and there is not a common method for transfer of equitable benefits that allows staff to maintain their service time. In addition, the researchers have cutting edge instruments and laboratory equipment that are fragile and expensive to relocate. Therefore we believe relocation of this work to another site would not be in the best interest of the Office of Science.

- Alternative 6: Perform this work at universities instead of this laboratory: Work that is performed in these labs benefits many of the research programs at ORNL. Although chemical and materials science research is prevalent at universities, the opportunity to perform multi-functional and multi-disciplinary research is not always apparent at universities. Many university programs are in narrow fundamental research areas and do not involve multi-organizational teams. For example, at ORNL materials research can benefit ORNL research programs in energy (automotive and superconducting technologies and neutron user facilities (HFIR and SNS). Having this capability and enhancing material property knowledge in complex environments (including radiological environments) is not typically possible at universities. The national laboratories also have large, expensive and complex one -of -a-kind tools that are not generally available at most universities

E. Constraints and Assumptions

This Line Item project will comprise a new laboratory building. For the purpose of establishing a funding profile, the cost range of $90M to $95M will be used as the basis for the resource requirements and schedule.

F. Significant Factors

1. Project Requirements

   No unusual project requirements have been identified that could adversely affect this project. State-of-the-art, code-compliant, and energy-efficient laboratory facilities that meet the needs of world-leading scientific research conducted at ORNL are required.

2. Technical Considerations

   All equipment and work in the project involve technology based on conventional, industrial standards and construction practices. No unusual technical or research and development requirements or constraints are known to exist that would hinder the design of a new research facility.

3. Facility Operational Considerations

   Unique facility operational considerations are not expected.

4. Special Considerations

   The assessments performed on this project did not identify any significant issues, special needs, or special requirements. Testing, and commissioning activities will be coordinated and managed with the support of the integrated project schedule to ensure operability of this facility.

5. Operational Constraints

   No unusual operational constraints or limitations in terms of capacity, technology, or configuration have been identified that could adversely affect this project.

6. Environmental and Regulatory

   No environmental issues have been identified to date that would significantly impact this project. The environmental risk is low for this project. The project will comply with all requirements of the National Environmental Policy Act (NEPA) and its implementing regulations. A NEPA determination will be made during early conceptual design stage, well prior to CD-1 approval. No action will be taken on the proposed project that could have adverse environmental effects or that would limit the choice of reasonable alternatives prior to NEPA determination. It is expected to result in a recommendation for Categorical Exclusion (CX).

7. Pollution Prevention Plans
   A Pollution Prevention Plan will be prepared for the project.

8. Integrated Safety and Health Management

   ES&H issues during construction of proposed facilities are typical of standard industrial building construction. No unusual demolition and decontamination activities are anticipated. An assessment of the hazards associated with the wet chemistry and analytical instrumentation laboratory research will be undertaken during the conceptual design phase to ensure that adequate yet flexible hazard control areas are incorporated for a safe and code-compliant operation in the future laboratory plan.

9. Safeguards and Security
   There are no special safeguard and security issues anticipated with this project other than those that will be encountered in a typical construction project.

10. Risk Management

    The risks anticipated during implementation of the proposed facilities are typical of standard industrial building design and construction. Facility

design technology and construction methods for this type of facility exist and will be utilized. An essential part of the early project planning will be to ensure all potential risks associated with this project have been identified, analyzed, and mitigated via an effective project risk management plan. An adequate contingency reserve will be provided for these risks.

The probability of success of the Modernization of Laboratory Facilities is considered high based on comparisons to similar facilities on site and worldwide.

11. Technology Research and Development

No unusual technology, engineering, or research and development equipment issues have been identified that could adversely affect this project. No research or development is required to carry out this project.

12. Location and Site Conditions

Thee are no special site conditions, e.g., seismic, flood plain, expected with this project.

13. Standardization and Standards Requirements

The project will be designed and constructed in accordance with applicable Public Laws, Executive Orders, OMB Circulars, Federal Property Management Regulations, and DOE Orders. In addition, it will be designed and constructed to promote the goals of the Energy Policy Act of 2005 and Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management." All systems will be designed to applicable ASHRAE standards.

14. Sustainability Considerations

Planning, acquisition, siting, designing, building, operating, and maintenance decisions for this proposed facility will use Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. The building will be consistent with DOE policy regarding LEED certification. New equipment and systems will be selected to maximize energy efficiencies and “green” building technologies.

15. Value Engineering

A significant amount of study has been conducted over the last 18 months that has established a deep understanding of the laboratory needs of the critical lab users. The program of need has been carefully value-engineered to maximize benefit while minimizing construction needs. In addition to a clear understanding of “who” needs new space, the team has also studied “how” that space would be equipped and would perform. By creating models for generic and flexible labs that can accommodate a higher density of personnel using them, we believe we are on a path to the greatest value with the available construction dollars. We must create space that can respond to unpredictable changes in the research mission without substantial

cost for facility modifications. This study has provided great benefit in enabling the team to add value long before the design begins in earnest, rather than struggle to do so later in the process.

Planning, designing, procurement, and building decisions will be based on considerations of value engineering principles. A formal value engineering evaluation will be performed as an integral part of preliminary design engineering. Value engineering principles will be applied throughout the life of the project.

16. Legal and Regulatory Constraints or Requirements

The project will be designed and executed in accordance with current applicable public laws, codes, standards, DOE Orders, and best management practices.

17. Stakeholder Considerations

All stakeholders will be closely involved with the integrated project team in the planning and implementation of this project to ensure the project goals and user requirements are met.

G. Applicable Conditions and Interfaces

1. Interfaces and Integration Requirements

Interface and integration requirements will depend on the alternative selected.

H. Resource Requirements and Schedule

1. Schedule

For the purpose of the mission need analysis, the following preliminary schedule is based on a government-funded project to upgrade the current facilities. It is proposed that the new laboratory building be executed as a fast-track project commensurate with the available funding. Critical decision 3 will be phased as shown in Table 1 (Critical decisions schedule). The funding line used in Table 2 is the TEC high end range.

Table 1. Critical decisions schedule

Critical decision point	Completion
LEVEL 1	
CD-0 Approve Mission Need	4QFY07
CD-1 Approve Alternative Selection and Cost Range	1QFY08
CD-2 Approve Performance Baseline and CD-3A Approve Start of Construction (Early Construction & Long Lead Procurement)	1QFY10 2QFY10
CD-3B Approve Start of Construction—New Lab Building	1QFY11
CD-4 Approve Start of Full Operations	1QFY13

2. Funding

The line item funding requirements to accomplish the tasks listed in Table 1 are estimated as follows: TEC is between $90 million and $95 million. The TEC high end range including escalation is $95 million, refer to Table 2 for a funding profile.

Table 2. Financial schedule

Design/construction by fiscal year	Appropriations	Obligations	Costs
	(Dollars in thousands)		
Design			
2009	8,700	8,700	4,000
2010	0	0	4,700
Total, Design (PED)	8,700	8,700	8,700
Construction			
2010	35,000	35,000	19,000
2011	32,378	32,378	34,000
2012	18,922	18,922	30,300
2013	0	0	3,000
Total, Construction	86,300	86,300	86,300
Total, TEC	95,000	95,000	95,000

The funding range will be supported by a project estimate including contingency developed during the conceptual design process. The estimate will be based on detailed bills of materials and standard industrial estimating techniques; therefore, the actual project cost is expected to be within the range. A risk-based contingency will be determined to provide funding for risks identified in the risk assessment. No other funding issues have been defined at this time. The levels in the profile in Table 2 are proposed in order to achieve the proposed schedule. However, if funding were spread out or delayed by a continuing resolution or rescission, that would affect the schedule and a baseline change proposal would be issued to document the changes.

I. Development Plan

Project Structure and Organization

DOE SC-31 will serve as the acquisition executive after the acquisition strategy is signed by S-4 (Undersecretary for Science) and will approve remaining critical decisions and level 1 baseline changes. The Federal Project Director, with the support of the DOE-ORO Office of the AMS, will provide overall project management oversight, approve key project documents, and provide necessary funds via approved financial plans. UT-Battelle will furnish engineering support, including the design-bid-build procurement documentation, management support services, administer all fixed-price construction subcontracts and construction inspection.

The project team will include those listed in Table 3; membership will be revised as necessary as the project matures. The stakeholders (users and researchers) and building managers will be part of the integrated project team.

Table 3. Proposed Integrated Project Team

IPT TEAM MEMBERS			
POSITION	**NAME**	**TELEPHONE**	**ORGANIZATION**
Federal Acquisition Executive	**Marcus E. Jones**	**(301) 903-4097**	**DOE-SC(SC-31)**
Federal SLI Program Manager (FPM)	**Caryle Miller**	**(301) 903-8434**	**DOE-SC-SLI**
DOE-ORO Federal Contracting Officer (FCO)	Mark Million	(865) 576-7814	DOE-ORO
DOE-ORO Office of the Assistant Manager for Science (AMS) Manager	Johnny O. Moore	(865) 576-0710	DOE-ORO
DOE-ORO Federal Project Director (FPD)	Les Ginn	(865) 576-7317	DOE-ORO
DOE-ORO ES&H Representative	Bobby J. Davis	(865) 576-9597	DOE-ORO
M&O Project Manager (PM)	Jack Stellern	(865) 574-6434	UT-Battelle
M&O Facilities Strategic Planner	Karla Gaither	(865) 241-2183	UT-Battelle
M&O Project Principal Engineer (PE)	Debbie McCarter	(865) 241-3030	UT-Battelle
M&O Project Planning and Analysis	Gerald Scott	(865) 576-0514	UT-Battelle
M&O Project Procurement Representative	Joel Poteat	(865) 576-6826	UT-Battelle
M&O Construction Field Representative	Gerry Palau	(865) 574-6747	UT-Battelle
M&O Safety & Health Team Member	W. Underwood	(865) 576-8799	UT-Battelle

The acquisition and all other project execution processes will be effectively managed using a tailored approach commensurate with the risk, complexity, cost, and schedule factors of this project and consistent with DOE O 413.3A. The Acquisition Executive will be delegated, when deemed appropriate, to the field office for this project. Independent project reviews will be conducted to validate the performance baseline for this project. A detailed acquisition strategy and project execution plan will be developed as part of the conceptual design process.

The undersigned have reviewed the mission need for this project and believe it is consistent with ORNL's Ten Year Site Plan of May 2006. The undersigned concur that this project is needed to better accomplish the DOE's missions being performed by the laboratory in cost-effective, reliable, safe, and productive manner.

Concurrences:

F. Lester Ginn — August 23, 2007
Date

F. Lester Ginn,
Federal Project Director
Office of the Assistant Manger for Science
Oak Ridge Office

8/23/07
Date

Johnny O. Moore,
Assistant Manger for Science
Oak Ridge Office

Recommend for approval

Caryle B. Miller — 28 August 2007
Date

Caryle B. Miller, HQ SLI Program Manager
Laboratory Infrastructure Division
Office of Safety, Security and Infrastructure
Office of Science (SC-31.2)

Caryle B. Miller — 28 August 2007
Date

John G. Yates, Director
Laboratory Infrastructure Division
Office of Safety, Security and Infrastructure
Office of Science (SC-31.2)

8/28/07
Date

Daniel R. Lehman, SC-1.3
Director
Office of Project Assessment

Patricia M. Dehmer — 8/31/2007
Date

Patricia M. Dehmer,
Director
Office of Basic Energy Science
Office of Science (SC-22)

Marcus E. Jones — 9/11/2007
Date

Marcus E. Jones
Director
Office of Safety, Security and Infrastructure
Office of Science (SC-31)

Approval:

After reviewing the project justification material, including the positive recommendation from the Office of Project Assessment (SC-1.3), I find the Statement of Mission Need for the Modernization of Laboratory Facilities project satisfactory and authorize DOE–ORO AMS to proceed with CD-0.

Raymond L. Orbach

Raymond L. Orbach, S-4
Under Secretary for Science

Sept. 18, 2007
Date

CD-0 Review—ORNL Modernization of Laboratory Facilities

Recommendations

The undersigned "Do Recommend" (Yes) or "Do Not Recommend" (No) approval of CD-0, Approval Mission Need Statement, for this project.

Ken K. Chao 9/18/07 Yes ✓ No ____
ESAAB Secretariat, Office of Project Assessment / Date

David Goodwin 9/18/07 Yes ✓ No ____
Representative, Non-Proponent SC Program Office/ Date

9-18-07 Yes ✓ No ____
Representative, Environmental Safety and Health Division/ Date

9/18/07 Yes ✓ No ____
Representative, Office of Budget and Planning / Date

9/18/07 Yes ✓ No ____
Representative, Security Management Team / Date

Yes ____ No ____
Representative, Grants and Contracts Division / Date

Carole B Miller 18 Sept 07 Yes ✓ No ____
Representative, Laboratory Infrastructure Division/ Date

CD-0 Review—ORNL Modernization of Laboratory Facilities

Approval

Based on the material presented above and this review, Critical Decision 0, Approve Mission Need, is approval.

Raymond L. Orbach

Raymond L. Orbach, S-4
Under Secretary for Science

Sept. 18, 2007
Date