

# **Chemistry and Metallurgy Research Building Replacement Project May 2007**

## **Preface and Executive Summary:**

In the Senate Report (109-274, page 155) to accompany the FY 2007 Energy and Water Appropriations Bill, the Senate Appropriations Committee Subcommittee for Energy and Water Development stated:

"The Committee has reviewed the Department's Complex 2030 proposal and noted several assumptions regarding mission scope of the CMRR facility that don't seem to match current planned activities. The Committee directs the Administrator to deliver a report by June 1, 2007, clarifying the cost and mission requirements this facility will be expected to address."

This report replies to that request.

The NNSA is closely coordinating the Chemistry and Metallurgy Research Building Replacement Project (CMRR) with its Complex 2030 Vision. The NNSA is committed to proceeding with construction of the CMRR Radiological Laboratory and to completing the design of the CMRR Nuclear Facility. However, the NNSA will defer any decision on whether to construct the nuclear facility until the Complex 2030 Record of Decision (ROD) in the fall of 2008. NNSA's plan is prudent risk management to maintain the nuclear facility's schedule while awaiting strategic decisions.

While the cost performance baseline for the nuclear facility has not been established, NNSA expects that the cost to deliver the CMRR would be greater than estimated at the project's Critical Decision-1 in May 2005. NNSA takes its responsibility seriously with respect to taxpayer dollars and will release validated financial figures when they are available.

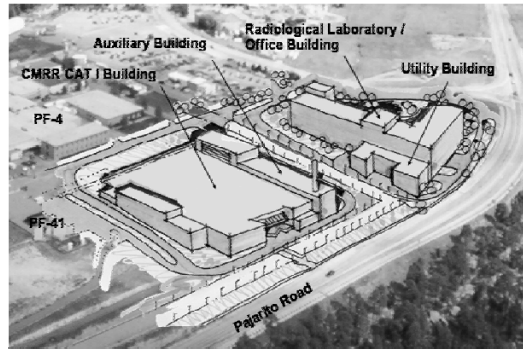
## CMR and CMRR Representations



CMR Construction,  
Circa 1949



Existing CMR Building



Artist's rendition of the CMRR at Technical Area-55 at Los Alamos National Laboratory, including the Radiological Laboratory and the Nuclear Facility (CAT I Building). PF-4 is the existing Plutonium Facility.

## **Background and Purpose:**

In 1999, the Department of Energy (DOE) approved the Chemistry and Metallurgy Research Building (CMR) Risk Management Strategy that determined the existing CMR could not safely operate at a Security Category I level and that the DOE should plan for an end of life of the CMR around 2010. The existing CMR has been in operation since 1952, is technically obsolete, and is practically incapable of being upgraded to meet modern health, safety, and security requirements. The existing facility houses analytical chemistry, materials characterization, and actinide research and development (R&D) that are required for all nuclear programs at the Los Alamos National Laboratory (LANL). These programs include defense pit certification, pit surveillance, and pit production consistent with meeting current national security requirements, and also include non-defense materials disposition, nuclear fuels development, environmental stewardship, and waste management.

In fiscal year (FY) 2000, the draft Defense Programs plutonium strategy assumed two separate facilities would be required to support long-term mission needs. One facility would support plutonium R&D and surveillance and a second would support pit manufacturing. A proposed Chemistry and Metallurgy Research Replacement (CMRR) facility and other buildings in the LANL Technical Area 55 (TA-55) complex were to serve as the long-term focus for plutonium R&D. A Modern Pit Facility, at a site to be determined, was to manufacture pits in sufficient quantities to support warhead quantities projected at the time. The mission need (Critical Decision 0 or CD-0) for a Modern Pit Facility was approved in May 2002. The Modern Pit Facility project, which never achieved CD-1, was suspended in 2005 and officially terminated in October 2006.

The mission need (CD-0) for the CMRR project was signed in July 2002 and initiated the evaluation of conceptual design alternatives for replacing the CMR. The CMRR project was determined necessary to support the enduring plutonium mission at LANL because many of the functions currently performed in the CMR are unique and essential.

In February 2004, the Department approved a Record of Decision for the CMRR. It stated that the CMRR would be built and located at TA-55. The CMRR was analyzed for environmental impacts associated with a pit production rate of up to 80 pits per year. The CMRR Record of Decision tiered from the 1996 Stockpile Stewardship Management Programmatic Environmental Impact Statement (EIS) that assigned an interim pit production mission to LANL. The CMRR Record of Decision, supported by a 1996 LANL Site-Wide EIS, established the pit production target rate at 20 pits per year. In May 2005, NNSA authorized the preliminary design (Critical Decision 1 or CD-1) for the CMRR project. As approved by the NNSA in May 2005, the CMRR project comprised two structures: a low cost, simple radiological facility (Rad Lab), or light laboratory, which would not host experiments on Category I or Category II special nuclear materials, and a larger, more complex (Security Category I/Hazard Category 2) Nuclear Facility (NF). A third component of the project is the long-lead specialized process equipment that goes into two structures. In all contemplated alternatives for complex transformation, the Rad Lab, which received Critical Decisions 2 and 3 in October 2005, and its associated equipment, will be needed and its use in the Complex of the future is

clear. This report assumes that the Rad Lab, currently under construction, will be completed as planned. The future of the NF is the focus of this report.

In April 2006, approximately a year after authorizing the preliminary design of the CMRR, NNSA presented its Complex 2030 planning scenario to Congress. The scenario identified four over-arching, long term strategies. The events of September 11, 2001, evolving information on plutonium aging, current stockpile projections, and development of Reliable Replacement Warhead (RRW) concepts caused NNSA to revise its FY 2000 plutonium strategy. Increasing physical security costs for special nuclear materials (SNM) are driving NNSA to maintain fewer sites with Category I/II quantities of SNM and to increase its reliance on hardened, engineered-security facilities for physical protection. Accordingly, Complex 2030 planning scenarios assume that NNSA will have production and R&D involving Category I/II quantities of plutonium at only one site in the long-term. A consolidated plutonium center is being considered at one of five NNSA sites, and would become the single location for all plutonium R&D, certification support, surveillance, and manufacturing required to support weapons activities.<sup>1</sup>

The first two Complex 2030 strategies, transforming the Nation's nuclear weapons stockpile and transforming the physical infrastructure of the nuclear weapons complex, specifically involve the CMRR. The CMRR would contribute to the first strategy by supporting the interim production of pits for Reliable Replacement Weapons should the Nuclear Weapons Council and Congress continue to support this concept beyond Phase 2A (which consists of developing RRW's costs, scope, and schedule). The CMRR would support the second strategy by contributing to a modernized nuclear weapons complex.

### **Relationship of the CMRR to Current Plutonium Missions and Operations**

Essentially all nuclear missions at LANL (both defense and non-defense related programs) require the following capabilities: analytical chemistry, materials characterization, and actinide R&D. The existing CMR provides these capabilities; however, the existing facility has a planned end of life around 2010. Until Complex 2030 was articulated, NNSA understood that the CMRR would house the CMR capabilities as soon after 2010 as practical. Beyond replacing the CMR, the CMRR would have also provided essential SNM storage and handling capabilities that are required at Technical Area-55 to complement existing plutonium operations already there. The newly installed capabilities of the CMRR would include storage and other support functions that would have enabled the existing Plutonium Facility (known as PF-4), the CMRR, and the collocated infrastructure at TA-55 to operate as a comprehensive, integrated plutonium enterprise.

The missions contemplated for the CMRR at CD-1 included:

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<sup>1</sup> The Consolidated Plutonium Center could also be implemented in conjunction with the consolidation of uranium operations as well to become a Consolidated Nuclear Production Center. Since this report is specific to plutonium only, distinguishing between the two centers is unnecessary for this purpose.

- Maintaining mission-critical analytical chemistry, materials characterization, and actinide R&D capabilities for currently assigned pit production, certification, surveillance and other nuclear missions.
- Supporting consolidation of nuclear materials currently at LLNL.
- Providing SNM storage capability.

**Future Plutonium Missions:**

The need for future plutonium capabilities is well established and includes:

- Meeting national security requirements for pit production for life extension programs and/or RRWs.
- Continuing to provide pit surveillance and pit certification capabilities.
- Providing ongoing plutonium research, development, and experimental capabilities.

The decisions regarding the plutonium facility are:

- Where will it be located?
- What capabilities and capacities will be required to support future stockpiles and when are they required?

The first decision is central to infrastructure transformation; the second, to stockpile transformation. The second decision includes whether to transform the existing stockpile based on RRW concepts or to continue refurbishment of legacy weapons. The two decisions are interdependent.

**Infrastructure Transformation:**

The NNSA is currently examining plutonium facility alternatives in its ongoing National Environmental Policy Act (NEPA) process for Complex 2030. The process was initiated in fall 2006 with a Notice of Intent to prepare a Complex 2030 Supplement to the Stockpile Stewardship and Management Programmatic EIS for transforming the existing weapons complex. The scope of the transformation effort includes plutonium operations in addition to other weapons functions. A Record of Decision on the future complex is anticipated in the fall of 2008. For the near-term, plutonium operations will continue at both LANL and LLNL. By the 2014 timeframe, NNSA plans to eliminate the need for security Category I/II quantities of plutonium at LLNL. The long-term options for plutonium facilities alternatives are bounded by the following:

Option I: Use existing LANL plutonium facilities only and defer all new plutonium facilities, including the NF. This option does not satisfy NNSA’s mission needs because it provides limited pit production capability, does not address plutonium storage needs, and offers limited ability to absorb the transfer of missions currently conducted at LLNL.

Option II: Use existing LANL facilities, supplemented by the NF to achieve a higher pit production capability and to support transfer of LLNL plutonium mission and material to LANL.

Option IIA: Rely on the current NF design approach, which has not been optimized for pit manufacturing capacity. This option has been NNSA's plan since its CMRR Record of Decision in February 2004 and through the CMRR's CD-1 in May 2005.

Option IIB: Expand the NF's capabilities to achieve a somewhat higher pit production capacity.

Option III: Use existing LANL plutonium facilities as interim assets until a new consolidated plutonium facility is operational.<sup>2</sup>

Option IV: Combine Options II and III. Option II would allow for a delay in implementing Option III, or would serve as prudent risk management by assuring national security capabilities are retained while Option III is implemented.

Thus, the CMRR has a significant role in Complex 2030 planning in either Option II or Option IV. Although decisions about future plutonium facilities will be made in the Complex 2030 Record of Decision in 2008, NNSA recognizes that progress on certain aspects of the CMRR project is needed in the interim. The existing CMR is at the end of its life and cannot be relied upon for extended performance of vital national security activities. Consistent with prudent risk management, NNSA has chosen to continue design efforts for the NF to assure continued progress if an alternative calling for this facility is selected. The choice enables key design issues to be addressed, many of which would be applicable to any future plutonium facility regardless of its location. In addition, the choice enables the most rapid execution of the NF project, should this be part of the alternative selected. No activities relating to NF beyond design would be pursued until, and unless, a Record of Decision locating this facility at LANL is issued.

### **Stockpile Transformation and its Relationship to the CMRR:**

A pit production capability will be required at LANL for the next decade at a minimum, independent of stockpile transformation. Without the CMRR, the long-term pit production capacity at LANL is limited to approximately 10 to 15 pits per year, based on limited vault space and multiple mission requirements. The actual throughput that would be achieved likely would be lower owing to the inherent unreliability of the CMR. LANL provides the Nation's sole pit production capability until a new consolidated

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<sup>2</sup> The consolidated plutonium capability could be included within an overall consolidation of all nuclear (uranium and plutonium) operations in the Complex. In particular, based on comments made during the 90-day public scoping period which ended on January 17, 2007, NNSA decided to include the Consolidated Nuclear Production Center as an alternative in the Supplement to the Stockpile Stewardship and Management Programmatic EIS.

plutonium center is available. Although the limited LANL capability does sustain a certain level of production capability, the 10 pits per year rate would not support meaningful stockpile transformation, or provide a capability to respond to a significant technical issue in the current stockpile. If the NF were constructed, and if the existing plutonium facilities at LANL were dedicated to pit manufacturing, a pit production rate of approximately 50-80 pits per year might be sustainable for some duration.

Pit production rates are dictated by national security requirements for our strategic nuclear deterrent. The sustainability of the current approach without NF would presumably be limited by the availability of PF-4, which will be fifty years old in the mid-2020s, and is already experiencing safety and operational challenges due to its age.

**Cost:**

When the Department authorized the project to proceed into preliminary design for the CMRR project (both the Rad Lab and NF) at CD-1, the target cost and the upper boundary cost for the project were estimated to be \$850M and \$975M respectively. The FY 2007 Future-Year National Security Plan budgeted \$838M for the CMRR project. The Rad Lab portion of the project has been baselined at a cost of \$164M (not including its specialty equipment) and is being executed as planned. The cost and schedule baseline for the NF has yet to be established. The performance baseline for the NF would be established and validated after the Complex 2030 Record of Decision is issued, should a decision to proceed be made.

In 2006, the new management and operating contractor at Los Alamos conducted a management and technical review of the CMRR project and found that conditions had changed since development of the cost range at CD-1. Various factors such as more stringent design requirements, increased commodity prices, revised escalation rates, and increased project contingency to address schedule changes will impact the NF costs and may result in total project costs greater than \$975M. A better understanding of these factors will be available after the preliminary design is delivered late in FY 2007. Future NNSA decisions about the NF will rely on higher fidelity cost data than exist today. NNSA requires establishing a fully validated cost baseline before undertaking major construction, and NNSA is scheduled to perform a Technical Independent Project Review this summer that will review the project's safety and security parameters, the technical basis of the project's scope, cost and schedule.

**Summary:**

The future role of the CMRR project in the defense plutonium infrastructure continues to be assessed. Its role will be determined in the Complex 2030 Record of Decision in late 2008. Pending those decisions, NNSA intends to manage program risks by:  
(1) completing the CMRR Rad Lab; (2) continuing with the design of the CMRR NF, and  
(3) deferring a decision on whether to construct the NF until the Record of Decision.

NNSA will seek to develop more reliable cost data for the CMRR in order to better inform its Complex 2030 decisions. NNSA will not make a decision on whether to construct the NF without a budget-quality, validated cost baseline and until it completes the Complex 2030 NEPA process.