The Proposed Chemistry and Metallurgy Research Replacement Nuclear Facility (CMRR-NF): New Realities Call for New Thinking

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An objective study of alternatives, requiring a break in project momentum, is needed.

The first public reference to the CMRR is an announcement by Senator Bingaman's office in 1999 saying that the proposed CMRR "would not be a Taj Mahal but a scaled-down, streamlined facility that would meet the needs of the lab at a lower cost than they are met now."[1] That was then. The "needs of the lab" have greatly grown.

During the 1999 to 2004 period the Department of Energy (DOE) and the National Nuclear Security Administration (NNSA) persuaded themselves and others that a NF would be relatively quick and inexpensive. In February of 2001 Los Alamos National Laboratory (LANL) was planning a CMRR project priced at $375 million (M) *for two or more buildings* that would be complete in FY2007.[2] In February of 2004, the projected cost for CMRR, including 60,000 sq. ft. of Hazard Category (HazCat) II space and 60,000 sq. ft. of HazCat III space in a 200,000 gross sq. ft. Nuclear Facility and a separate radiological laboratory, utility, and office building (RLUOB), was $600 M, including $100 million (M) in administrative costs.

Today projected total CMRR costs are $363 M for RLUOB and a preliminary (3 years prior to baseline) $3.7 to $5.8 billion (B) for CMRR-NF, at least ten times as much as originally estimated. Gross CMRR-NF area has increased to 406,000 sq. ft. and usable space has contracted to about 38,500 (HazCat II) and zero (HazCat III), i.e. to 32% of before. Using the top estimate, HazCat II unit space cost in the new building has increased by more than a factor of 20 to $151,000/sq. ft. Lab space now costs up to $258,000/sq. ft.

The project is now not expected to be physically complete until at least 2020, a 13-year delay from the 2001 estimate and a decade later than planned in 2004. Full start-up and transition may require four additional years.

By contrast the late Cold War era PF-4 building, with 59,600 sq. ft. of HazCat II space, was completed in 1978 at a then-dollar cost of $75 M, or $251 M in today's dollars, or $4,211/sq. ft. – a factor of 61 less than CMRR-NF.

CMRR-NF maintenance costs are expected to be an order of magnitude greater than CMR, if not more.[3] Program and operating costs will be far higher as well.

In 1997, DOE presciently assessed CMRR-NF as impractical, expensive, and environmentally destructive.

> The construction and operation of a new facility was considered and DOE determined that it was not fiscally prudent…construction of a new facility would not meet DOE's need for…uninterrupted interim and ongoing radioactive chemical and metallurgical research activities at LANL. Planning, design, and construction of a new facility would take a minimum of 10 years [now 24 years] to complete….a new facility is estimated to cost more than twice as much as the proposed upgrades ($348 million vs. $123 million) [i.e. $473 M vs. $167 M in 2010 dollars]. In addition, the existing CMR Building would have to be decommissioned; incurring additional costs and [the] wastes generated would take up space in the LANL low-level radioactive waste landfill or other permitted waste disposal system.
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> A new facility could disturb previously undisturbed land. New construction could potentially have adverse environmental effects upon water and air quality, biological resources, and possibly archeological resources. Because this alternative could potentially cause more environmental effects than the proposed upgrades, is estimated to cost more than twice the proposed upgrades, and would jeopardize DOE's requirement to maintain the uninterrupted operational capability to perform radioactive and chemical research, construction and operation of a new facility were not considered reasonable, and therefore, not analyzed further…[4]

In the years since its inception, CMRR-NF missions and costs have more than crept – they have vaulted. CMRR is not a "replacement" facility at all but rather the key new element in a rapid-response pit production complex that was thought unnecessary a decade ago.

Besides cost, schedule, and mission, many other pertinent circumstances have changed since this project began:

- Pits are now known to age so slowly as to be essentially ageless for current planning purposes. Additional aging data is presumably available, though not reported.
- Warhead retirements have created a long-lived pit/warhead cache with more reusable pits for each delivery system than are present in the deployed stockpile.[5]

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[1] Ian Hoffman, "Bingaman Seeks Funds for Design of Weapons Facility," *Albuquerque Journal North*, 4/15/99, http://www.lasg.org/Pit_Prod.htm.

[2] LANL, *Ten Year Comprehensive Site Plan*, 2/9/01: http://lasg.org/CMRR/Litigation/LANL_Master_Project_List-FY2001.pdf.

[3] "In FY14 [sic – FY2023], the CMRR facility is planned to become operational. The CMRR maintenance budget is projected at approximately 2.5% of RPV [Replacement Plant Value] to sustain its condition. One of the challenges for the Laboratory and NNSA is to provide the funds necessary to meet this new maintenance funding demand." In FY07, total LANL maintenance spending was $88 M, of which $6 M was for the existing CMR building. LANL, *Ten-Year Site Plan, FY2008-FY20017*, LA-CP-07-0039, January 9, 2007, pp. 114-115. Study Group files.

[4] DOE, *Environmental Assessment for the Proposed CMR Building Upgrades at LANL*, 2/4/97: 24, http://lasg.org/CMRR/Litigation/CMR_upgrades_EA_4Feb1997.pdf.

[5] Greg Mello, U.S. Plutonium "Pit" Production: Additional Facilities, Production, Restart are Unnecessary, Costly, and Provocative, http://www.lasg.org/CMRR/Mello_pit_recommendations_2Mar2010.pdf.

- The current "Section 1251" report plans on increasing pit production capacity at PF-4 to 60 pits/year, prior to CMRR-NF.[6] NNSA's TA-55 Reinvestment Project (TRP) is aimed at realizing this. A task force of the former Secretary of Energy Advisory Board (SEAB) estimated efficiency of PF-4 operations at 5% or less.[7] PF-4 devotes perhaps one-third of its HazCat II space to pit production. Small space increases can enable large increases in production capacity, as bottlenecks are removed.
- NNSA is also building ~ $7 B in new plutonium infrastructure at the Savannah River Site (SRS), including a facility at K Area to recycle pits into purified metal, a major portion of the pit production mission. Like the acquisition of pit production capacity, the MOX mission is poorly-justified and has no urgency. If pit production were urgent, portions of the SRS infrastructure could be repurposed, first within K Area (as upgraded), and in a greater emergency within MFFF.
- Pit manufacturing makes and assembles ~ 2 plutonium parts. All other parts, and final assembly, do not require a HazCat II facility. Metal production need not take place at the same site or facility and in the past sometimes has not.
- Replacement warhead proposals were replaced with a policy prejudiced against pit replacement, leaving CMRR-NF without a compelling *raison d'etre*. There is no confident certification path for physics packages with replacement components, in contrast to life extension programs (LEPs) without that replacement. Non-nuclear LEPs can be conducted indefinitely with confidence. Pit production is counter-indicated as well as unnecessary.
- Belatedly-acknowledged requirements for safety-class systems have doubled overall CMRR-NF floor area and increased excavation depth by a factor of 2.5 or more. In 2009 NNSA stated CMRR-NF might be economically infeasible with these new standards.[8] It might be.
- Estimated frequency, magnitude, and acceleration from large earthquakes at LANL have dramatically increased, requiring extensive mitigation, including replacement of a 50-60 ft. geological stratum with concrete with attendant environmental and program impacts, costs, and delays. Seismic upgrades to CMR wings, including buttresses as previously planned, may however still be quite feasible.
- Over 19 years, DOE and then NNSA have never left the Government Accountability Office's (GAO's) Watch List for poor project management. NNSA, seeking to vest Congress in this project prior to the advent of increased fiscal discipline and/or accountability, now proposes to evade DOE's project management orders in multiple ways: by using a design-build process inappropriate to such a unique, high-risk facility; by dividing the project into five "chunks," each of which is proceeding on its own timeline as if it were a separate project; by evading National Environmental Policy Act (NEPA) compliance by proceeding with detailed design without an environmental impact statement (EIS) that objectively considers all non-CMRR-NF alternatives; and by limiting the scope of internal business-case reviews. The threat to seek up-front full project funding is an admission of perceived project instability and management risk.
- Since CMRR-NF was conceived the national security context has dramatically changed, impacting not only its relative national security value but also its likelihood of successful completion and subsequent safe operation. Financial instability, stagnant-to-negative real growth, looming inadequacies and/or high prices in oil supplies, climatic change with attendant impacts on society -- these and other looming crises cast a harsh light on gratuitous nuclear weapons investments. In this austere, even existential situation, DOE and Congress must choose between security investments. For example, ~ $6 B (for CMRR-NF and connected projects), if used as a 20% wind energy subsidy, would build ~ 12 GW of wind generating capacity with an average capacity factor of ~ 0.33 or more. Compared to coal this would save ~ 2 x 10^{10} lbs C emissions/yr and prevent ~ 500 deaths annually from air pollution. About 9,700 direct construction jobs and 1,554 long-term jobs would be created; ~ 6.6 billion gallons of fresh water would be saved annually.[9] Industries and skills would be developed, with long-term security and economic benefits. What marginal security benefit from CMRR-NF, assuming there is any, could ever measure up?
- CMRR-NF has been justified on grounds of maintaining (i.e. improving the low) morale at LANL. It is likely to have the opposite effect, especially as regards science.
- The advent of CMRR-NF halted seismic and most other upgrades at CMR on the theory that replacement was imminent. Since then CMR has been run toward failure, its safety problems insufficiently addressed. CMRR-NF has been and remains a potent cause of safety problems at LANL's nuclear facilities.
- NNSA's managers and advisors must avoid the pitfall of spending money and building huge facilities just for the sake of doing so, or as part of a political deal.

Please write or call for further information, or see http://www.lasg.org/CMRR/open_page.htm.

[6] NNSA, *FY2011 Biennial Plan and Budget Assessment on the Modernization and Refurbishment of the Nuclear Security Complex Annex D*, Table D-2.

[7] SEAB Nuclear Weapons Complex Infrastructure Task Force, *Recommendations for the Nuclear Weapons Complex of the Future*, July 2005, pp. H-5,6

[8] "The [NNSA's] CMRR Nuclear Safety Design Strategy…states that it may not be economically feasible to seismically design and qualify some components of the active confinement ventilation system or its support system to PC-3 seismic design requirements." DNFSB, letter to NNSA, 1/16/09. (CMRR certification), http://www.hss.energy.gov/deprep/2009/FB09J16A.pdf.

[9] DOE, "Economic Benefits, Carbon Dioxide (CO2) Emissions Reductions, and Water Conservation Benefits from 1,000 Megawatts (MW) of New Wind Power in New Mexico," at http://www.windpoweringamerica.gov/astate_template.asp?stateab=nm.

Table 1: All but one mission proposed for CMRR-NF could be done in multiple ways by renovating existing facilities. That mission – prompt large-scale pit production – is very costly, would erode stockpile confidence, is unsupported by current policy, and may be impossible.

(The suggested reasonable mission assignments below create *primary* CMRR-NF alternatives. *Secondary* alternatives would build a *different* CMRR-NF, e.g. smaller. *Tertiary* alternatives would build a CMRR-NF *in different ways.* Up-front and contingent assignments are both shown.)

CMRR-NF Mission Elements Most of these are far from clarified at present. Some are of very dubious value (e.g. larger pit production capacity). This list includes waste disposal, including disposal of demilitarized pits.	**Site and Facility** (■ signifies possible use, without necessarily an endorsement; ■? signifies possible use with greater uncertainty as to reasonableness; for ◊, □, and * see notes below)																
	LANL								**SRS**		**LLNL Super-block**	**Pantex**	**INL**	**NTS**	**Industry**	**DoD**	**WIPP**
	PF-4	**RLUOB**	**Upgraded CMR, 1 to 4 wings:**				**Sigma**	**Other**	**K Area**	**MFFF**							
			9	**7**	**5**	**3**											
1. Pit production capacity 50 - 200 pits/year Inherent single-shift capacity of one pit production line – all that is needed – is assumed to be ~ 50 pits/year or ~ 80 pits/year with two shifts. Larger capacities require relatively modest additional space. More facilities may be needed under some alternatives. See "primary alternatives" in notes for more on contingent new production capacity in existing facilities, delayed acquisition of new capacity, enhancements of existing facilities, and clearer pit and stockpile policies.																	
a. Receive, inspect, assay, and store old pits	■		■	■	■				■	◊	□		■?				
b. Disassemble old pits	■		■	■	■				■	◊	□		■?				
c. Recover, process, and prepare metal	■			■	■				■	◊	□		■?				
d. Cast and machine new plutonium pit	■									◊	□		*				
e. Fabricate other pit components							■	■?					■		■		
f. Measure and certify components	■			■	■	■	■	■?		◊	□		*		■		
g. Assemble new pit	■			■	■	■	■	■?		◊	□		*				
h. Ship or store new pit				■	■	■	■	■?	■	◊	□		*				
i. Recover scrap and residues	■			■	■	■			■	◊	□		*				
2. Pu storage																	
a. (Additional) working storage for pit production	■								■		□						
b. (Additional) long-term storage (see also 9a.)	■								■			■	■	■		■	
3. "Analytical chemistry" (will be moved to RLUOB)		■				■		■	■?	◊							
4. "Materials characterization" (already moved to PF-4)	■	■	■	■	■				■?	◊	□						
5. Hot cell activities (not proposed for CMRR-NF)			■														
6. Large vessel preparation and cleanout (now in Wing 9)			■	■	■									■			
a. Purification of Pu-242 or other materials if necessary	■			■	■												
7. Pit production technology development if necessary	■									■	■		■				
8. Other HazCat II plutonium missions	■		■	■	■				■	■	■		■				
9. Nuclear waste disposal																	
a. Pits (as demilitarized, vitrified Pu, or via MOX)			■	■	■				■	◊		■		■			■
b. Other Pu (TRU, LLW) waste disposal								■	■				■?	■	■		■

Table 1 (continued). Notes (1): Primary alternatives to CMRR-NF include but are not limited to the following, with variations:

1. **Upgrade and use from one to three CMR wings**, with Wing 9 and supporting systems remaining in any case; combine with appropriate other facility use and underlying policy decisions as appropriate; several options are possible. Structural upgrades, including buttresses, as augmented from previous plans may be feasible and if so be economic, rapid, and incur less program impact, risk, and CMR D&D.
2. **Delay decision** on CMRR-NF, possibly pursue later if needed, thus deferring high maintenance expenses (~2.5% of capital cost per annum, i.e. ~$145 M/yr) and other operating expenses and thus saving net present value even if design re-start costs are considered, while at the same time minimizing risk of unneeded capital investment.
3. **Contingent pit production** centered at LANL but possibly also involving other sites for higher production rates; establishes priorities for redirecting existing Pu HazCat II/III space (as renovated independently) and otherwise-planned capacity under specified conditions. Many variations are possible.
4. **Internal physical and/or programmatic modifications at PF-4, possibly including moving Pu-238 work to existing and new facilities at INL**, liberating PF-4 space. Indirect INL enhancement of PF-4 capability is indicated by * above.
5. **Enhance facilities at other sites for pit production mission elements**, e.g. the K **Area** Complex at SRS, or INL, for pit recycling, metal production, (steps a. – c. above), and for Pu and pit storage.
6. **RLUOB modifications**, e.g. to HazCat III or higher for specific uses, or possibly for transient or sporadic uses, or as an element of contingency plans.
7. **Use LLNL Superblock as a HazCat II facility as part of contingency plans,** indicated by □ above.
8. **Planned contingent redirection of parts of MFFF** for pit production elements or to take missions from PF-4 as indicated by ◊ above.
9. **Clarify pit policies**, e.g. establish policies of a) **LEPs without pit production**, with non-intrusive cross-type pit reuse (Pantex) as back-up in selected cases; **(b) keep a retired warhead and/or pit bank**; **(c) abjure attempted certification of new-design pits or replacement warheads**; **(d) limit required pit production rate**; **(e) require only one production line**; **(f) retire some pit types** (e.g. W88); and **others**.

Evaluate alternatives for: effectiveness in maintaining *the existing* stockpile; cost; management risk; implementation speed; environmental impact; morale; and diplomacy.

Prompt, large-quantity pit production without commandeering non-pit space at PF-4 and elsewhere should be evaluated separately given its uniquely large, dominating infrastructure demands and lack of justification in current policy.

Notes (2): The assumptions used for all the primary alternatives at left, which include any "no action" under NEPA, are roughly:

1. RLUOB is completed as planned; The TA-55 Reinvestment Project (TRP) proceeds as described in DOE's FY2011 Budget Request.
2. All outstanding safety and seismic issues are promptly and successfully addressed at PF-4 and supporting facilities. This may not be easy, raising systemic safety and efficiency questions affecting CMRR-NF.
3. Successful interim safety upgrades and safety-related interim operational changes are made in all operating CMR wings under all circumstances, even if CMR is to be torn down in the 2023-2026 timeframe. These upgrades can be done faster, with more confidence, and far more cheaply than CMRR-NF construction.
4. CMR wings 1, 2, and 4, which lie on and near an active earthquake fault, and which are not needed now, will not ever be used, and will be maintained in "safe standby" pending disposition, which can proceed.
5. The LANL RLWTF is upgraded as needed; adequate solid radioactive waste management facilities are provided; and other supporting infrastructure needs at LANL are met.
6. A fully-functional production pit line is set up, staffed, and operated at PF-4, with provision for contingent expansion at critical bottlenecks. This does not require stockpile production. Right-size the program.
7. Under sufficient need to prioritize production and improve management, and with needed renovations and time for re-tooling in proportion to need, PF-4 could produce up to 125 pits/yr, single shift, or 200 pits/yr with two shifts. Front-end work (a. – c. above) could be done at K Area, SRS.
8. MOX fuel PuO2 production at PF-4, if (uselessly) begun, is concluded prior to any large-scale production, liberating space.
9. Existing facilities (specifically PF-4 and needed CMR wings) can be fully upgraded for at least 20 more years of life, which provides 5-10 years of decision time to evaluate any future CMRR-NF need. Quite likely upgrades can be planned (as previously) to last for 30-40 years with appropriate maintenance. Solid safety investments with near-term benefits are valued highly. Projects with contingent need which can be built within a warning horizon should be deferred.
10. Relative life-cycle present-value costs of alternatives matter, and should be minimized where possible.
11. Stockpile pit surveillance and pit longevity studies are continued and enhanced as necessary.