

Notre Dame Radiation Laboratory Ten Year Site Plan 2009-2018



Prepared 6/26/2007

Ian Carmichael 07/02/07

Ian Carmichael Date

Director, Notre Dame Radiation Laboratory

Richard Baker 7/2/07

Richard Baker Date

NDRL Site Manager for RPAM Functions

A. Executive Summary

The Notre Dame Radiation Research Building, site of the Notre Dame Radiation Laboratory (NDRL), is basically sound and appropriate for the current Office of Science program. The research program is expected to grow over the next five years, but no additional space will be required, inasmuch as we are emerging from a period of contraction.

The primary requirement for producing a first-class environment for the research program is the complete replacement of the HVAC/climate control system within the building. This will be the thrust of our modernization and recapitalization proposal.

B. Overview of Site Facilities and Infrastructure

The Notre Dame Radiation Laboratory (NDRL) is operated by the University of Notre Dame under Cooperative Agreement DE-FC02-04ER15533. The NDRL is located in the Radiation Research Building (RRB), a government-owned building sited on University-owned land on the campus of the University of Notre Dame. It is adjacent to the Stepan Hall of Chemistry and Biochemistry, which houses the University's Chemistry Department, and Malloy Hall, which houses the Theology and Philosophy Departments. These relationships are displayed in the figure in Attachment 2. Administratively, the NDRL is a University Institute and the Director reports to the Provost of the University.

The RRB was constructed in 1962-1963 to house the Radiation Project funded at that time by the Atomic Energy Commission. Underground vaults for accelerator and laser systems were added in 1976, 1985 and 1991. The building size is 68,296 gsf. Present occupancy is 50 persons (scientific faculty, support staff, visiting scientists, students and postdoctoral fellows). The NDRL operating budget for 2007 is \$3,500,000.

The NDRL is 100% funded by the Office of Basic Energy Sciences (SC-BES). There are no non-SC facilities associated with the NDRL.

The Replacement Plant Value (RPV) for the RRB is \$14,347,193 for FY2006. This is the value currently in FIMS; however, a contractor-generated value has been obtained which will be the basis for future estimates. The Facility Condition Index (FCI) is 3.39% which falls within the good range (2% to 5%) specified by FIMS documentation. The corresponding Asset Condition Index (ACI) is 0.961. The Asset Utilization Index (AUI) for the NDRL is also 0.961. The Maintenance Investment Index (MII) for FY06 was 1.38%.

Rehab and Improvement Costs (RIC) are \$440,000 which results in a Total Summary Condition Index (TSCI) of 8.24%.

Laboratory Space Distribution

Usage	GSA Use Code	Square Footage
Chemistry labs and other experimental areas	765	24,227
Office space (programmatic and administrative)	765	8,177
Technical support (Computer Services, Glass Shop, etc.)	765	6,663
Non-technical support (Library, Auditorium, storage areas, etc.)	765	5,148
Public Areas (Lobby, hallways, restrooms,	765	11,967

stairways, elevator)		
Building Infrastructure (Mechanical Room, utility chases, etc.)	765	12,114

C. Current and Future Missions for the Site

NDRL is a single-mission laboratory. The mission is to conduct a program of chemical effects produced by the absorption of energy from ionizing and nonionizing radiation by molecules in condensed phases. This program is supported by the program of Photochemistry and Radiation Research within the Division of Chemical Sciences, Geosciences and Biosciences, Office of Basic Energy Sciences. Radiation chemistry requires the application of ionizing radiation to chemical samples. At NDRL, the radiation is supplied by various electron accelerators and gamma radiation sources. The Radiation Research Building was designed, constructed and subsequently modified to accommodate such radiation sources. A number of short-pulse, high-power lasers are also employed in the program.

It is expected that the NDRL's mission will remain essentially that described above over the next ten years. However, personnel additions and changes in emphasis at BES will produce some shifts in programmatic thrust. Such programmatic redirection may require some building modifications.

Over the ten-year planning period, it is anticipated that the operating budget will increase by 5% per year through 2010, and at 6% per year thereafter. Our proposed plans call for the addition of up to four new scientific faculty members over the next four years. BES is supportive of this goal. These programmatic additions will require space reallocation and probably modifications in the building. However, we anticipate that these can be accommodated within the existing space. This is possible due to recent departures and pending retirements.

The NDRL building is classified as Mission Critical.

Summary of Expected Program Funding (in \$000) and Staffing

	FY 06	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18
Funding:													
SC - BES	3400	3500	3675	3869	4052	4295	4552	4826	5115	5422	5748	6092	6458
SC - HEP	0	0	0	0	0	0	0	0	0	0	0	0	0
SC - BER	0	0	0	0	0	0	0	0	0	0	0	0	0
SC - NP	0	0	0	0	0	0	0	0	0	0	0	0	0
SC - ASCR	0	0	0	0	0	0	0	0	0	0	0	0	0
SC - Fusion	0	0	0	0	0	0	0	0	0	0	0	0	0
Total SC	3400	3500	3675	3869	4052	4295	4552	4826	5115	5422	5748	6092	6458

Other DOE	0	0	0	0	0	0	0	0	0	0	0	0	0
Work for Others	0	0	0	0	0	0	0	0	0	0	0	0	0
Total \$:	3400	3500	3675	3869	4052	4295	4552	4826	5115	5422	5748	6092	6458
Total Staffing: (FTE's)	34	35	37	38	39	39	39	40	40	40	40	40	40

D. Facilities and Infrastructure

1. Vision, Goals, Strategy

Our vision is to maintain our position as the premier site for radiation chemistry in the United States. The goal of F&I management at NDRL is to provide a building and infrastructure that best supports the radiation chemistry program that is our reason for existence. Our strategy continues to be pursuit of key radiation technologies that will provide us with unique capabilities. The Radiation Research Building was constructed in 1962-1963, so most of our F&I management issues revolve around repair and replacement of aging utility delivery systems. The project proposed as part of the SLI Initiative will help us resolve many of those issues. Additionally, it will enable us to provide the preferred work environment that is the goal of SC facilities.

2. Process for Identifying F&I Needs and Development of Plans to Meet the VGS

Since the NDRL is a single-mission laboratory within a single building, the Laboratory Director makes the final decisions on prioritization of needs and distribution of resources. The Director meets twice yearly with the Assistant Director and the Building Manager to review maintenance issues and resource allocation. This enables us to respond to programmatic shifts and to changes in the condition of our assets.

The building is inspected annually by NDRL maintenance personnel. Local contractors are utilized for special assessments and the associated estimates. Most estimates are based on experience and previous costs for similar work. Deficiency lists are maintained, but there is no CAS database.

3. Land Use Plans

The University of Notre Dame owns and manages the land on which the Radiation Research Building is situated. NDRL does not have or need a Land Use Plan.

4. Utilization and Excess Real Property

The AUI for the NDRL is 0.961, which exceeds the Department's goal for laboratory facilities. The NDRL has no excess real property. There are no expectations that the present facility will be identified as excess during the ten-year planning period.

5. Long Term Stewardship

No LTS activities are underway or planned.

6. Replacement Plant Value (RPV) Estimates

RPV Estimates for the Planning Period

	RPV of existing facilities	Estimated Additions in FY	Total Estimated RPV (sum of columns A & B)	Escalation (2.3%)
FY 04	11,051,136	NA	NA	
FY 05	12,233,607	NA	NA	
FY 06	14,347,193	0	14,347,193	14,677,178
FY 07	20,052,913	0	20,052,913	20,514,130
FY 08	20,514,130	0	20,514,130	20,985,955
FY 09	20,985,955	0	20,985,955	21,468,631
FY 10	21,468,631	0	21,468,631	21,962,410
FY 11	21,962,410	0	21,962,410	22,467,545
FY 12	22,467,545	0	22,467,545	22,984,299
FY 13	22,984,299	0	22,984,299	23,512,938
FY 14	23,512,938	0	23,512,938	24,053,735
FY 15	24,053,735	0	24,053,735	24,606,971
FY 16	24,606,971	0	24,606,971	25,172,932
FY 17	25,172,932	0	25,172,932	25,751,909
FY 18	25,751,909	0	25,751,909	26,344,203

The discontinuity in RPV beginning in FY 2007 arises from a change in the method of computing RPV. The older data are based on CPV. The newer data are based on a Costworks analysis prepared by an outside contractor. They will be incorporated into FIMS at the next updating.

7. Maintenance

Site Maintenance Funding Plan

	RPV	SC Goal (2% of RPV)	Planned Site Maintenance Direct Funding	Explanation if Funding Plan does not meet goal or results in deferred maintenance
FY 07	11,051,136	221,023	153,000	See text following table
FY 08	12,233,607	244,672	161,000	
FY 09	14,347,193	286,944	169,000	
FY 10	20,052,913	293,544	177,000	
FY 11	20,514,130	401,058	188,000	
FY 12	20,985,955	410,283	199,000	
FY 13	21,468,631	419,719	211,000	
FY 14	21,962,410	429,373	224,000	

FY 15	22,467,545	439,248	237,000	
FY 16	22,984,299	449,351	251,000	
FY 17	23,512,938	459,686	266,000	
FY 18	24,053,735	470,259	282,000	

The Site Maintenance Funding Plan shown above incorporates the anticipated programmatic funding from BES. The Plan accurately reflects the maintenance needs of the Radiation Research Building. We would find it difficult to absorb and spend the additional money called for by the SC Goal, both because we lack the manpower to manage too many projects, and because the disruption to programmatic activities increases substantially in the presence of multiple maintenance projects. Deferred Maintenance will not result from this Plan unless funding from SC drops below that anticipated in B, above.

Major projects for 2008 and 2009 involve a complete overhaul of the auditorium and the provision of handicapped access in some restrooms. These and other minor projects, along with their DM components, are indicated in Attachment 4.

8. *Deferred Maintenance Reduction (DMR)*

Estimated DM and ACI Based on Site DMR and Other Funding

	DM	SC DMR Funding Target	Planned DMR Funding	Expected DM at the end of the Year	DM Escalation	Estimated RPV	Estimated ACI
FY 07	471,000	NA	70,000	436,833	481,833	11,051,136	0.961
FY 08	481,833	NA	133,000	338,880	446,880	11,305,312	0.976
FY 09	446,880	NA	66,000	305,674	346,674	14,347,193	0.979
FY 10	346,674	NA	51,000	286,705	312,705	20,052,913	0.985
FY 11	312,705	NA	9,000	309,299	293,299	20,514,130	0.986
FY 12	293,299	NA	81,000	260,413	316,413	20,985,955	0.985
FY 13	316,413	NA	75,000	216,403	266,403	21,468,631	0.988
FY 14	266,403	NA	75,000	171,380	221,380	21,962,410	0.990
FY 15	221,380	NA	75,000	125,321	175,321	22,467,545	0.992
FY 16	175,321	NA	75,000	78,204	128,204	22,984,299	0.995
FY 17	128,204	NA	50,000	55,003	80,003	23,512,938	0.997
FY 18	80,003	NA	50,000	31,268	56,268	24,053,735	0.998

The NDRL does not receive funding from the SC DMR project. DM is based on items listed in Attachment 4, plus projected future deficiencies of \$25,000 per year.

ACI at the NDRL is 0.96, in the "good" range. Planned maintenance activities will bring us into the "excellent" range within three years. Projects which reduce DM are listed in Attachment 4.

9. *Recapitalization and Modernization*

a) *IGPP*

Not applicable.

b) *Line Items*

The NDRL proposes a line item project of \$10,000,000 to be spread over the years 2012-2015. This project is meant to accomplish the complete redesign and replacement of the Radiation Research Building's HVAC and climate control systems, together with modifications to the laboratory rooms within the RRB to render them preferred workplaces for chemical research. The modifications will include replacement of the building's single-pane windows with energy-efficient windows. The need for this project arises from several sources: (1) energy conservation requirements, as explained in more detail in D.12 (Energy and "Sustainability" Management) below; (2) programmatic impact, manifested most immediately in our inability to control temperature and humidity sufficiently well to allow routine operation of high-power, short-pulse lasers, (3) safety conditions, in that some of the chemical fume hoods are still connected to room exhaust ducts, creating the potential for exposure to people in the building. The project is covered in more detail in Attachment 5.

c) *GPP*

Attachment 4 identifies all RIC projects and the recapitalization funding to accomplish these projects. For FY07 through FY13 the planned GPP funds total \$760,000 which represents \$638,000 for recapitalization and \$122,000 for DM reduction.

10. *Space Bank Analysis*

Not applicable.

11. *Performance Indicators and Measures*

Normally formal performance indicators or measures are not included in Cooperative Agreements. There are none in the NDRL Cooperative Agreement. The DOE MII, ACI, and AUI metrics are discussed above.

12. *Energy and "Sustainability" Management*

The Radiation Research Building is integrated into the utilities distribution network of the University of Notre Dame, and all utilities (electrical power, steam and chilled water) are received from the University at direct cost. The NDRL has no options for alternate suppliers or distribution methods.

Energy costs in the three-year rolling timeline (TYRT) format are shown below. Because the building was *designed for a complete turnover of building air every four minutes (i.e., single pass)*, it is profligate in its energy usage. For the same reason, the building HVAC system acts as an amplifier of the external weather, and year-to-year fluctuations

of up to 50% in energy usage have been observed. Over the past 20 years, NDRL management has made a number of modifications in attempts to mitigate this situation, but we are obviously limited by the original design of the system.

The data in this table require some comment. The baseline year (FY 2003) was the lowest year for energy consumption in the 7-year period 2000-2006, 20.4% below the average for that period. Examination of NDRL’s energy consumption indicates that it is dominated by chilled water used for dehumidification and cooling. In the baseline year (FY 2003) chilled water accounted for 40.8% of all energy usage. In FY 2006 it was 58.7%. The average over the period was 50.5%, indicating the extent to which weather variability dictates our usage.

It is clear that we can neither forecast nor substantially reduce energy usage at NDRL with the present building configuration. This factor is the main driver in our proposed recapitalization project. The date for achieving the target is 2015, the proposed date of completion of our recapitalization project.

Performance Measures	Baseline	Actual	Target				Achieve Target
	FY 2003	FY 2006	FY 2007	FY 2008	FY 2009	Long Term	
Operating Costs - Energy Consumption (BTU/SF). 2005 Energy Policy Act. 20% reduction from 2003 baseline by 2015.	325,230	526,654	400,000	400,000	400,000	260,000	2015
Operating Costs - Energy Consumption (BTU/SF). EO 13423 3% annual reduction or 30% reduction by 2015.	325,230	526,654	400,000	400,000	400,000	227,660	2015

13. Leasing & Third Party / Non-Federal Funded Construction of New Buildings

NDRL leases no additional space outside the government-owned Radiation Research Building. No construction of new buildings is planned for this site.

14. *Operating Costs for Sustainment and Operations*

The operating costs are presented below in TYRT format. The drop in operations costs between FY 2005 and FY 2006 reflects a reduction in the size of the (programmatically funded) support staff.

Performance Measures	Baseline	Actual	Target				Achieve Target
	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	Long Term	
Operating Costs-Sustainment and DM Reduction (\$/SF)	\$2.52	\$2.24	\$2.24	\$2.30	\$2.35	\$3.00	2012
Operating Costs - Operations (\$/SF)	\$1.46	\$0.95	\$1.30	\$1.35	\$1.35	\$1.35	2007

E. Site's Alternative Investment Plan

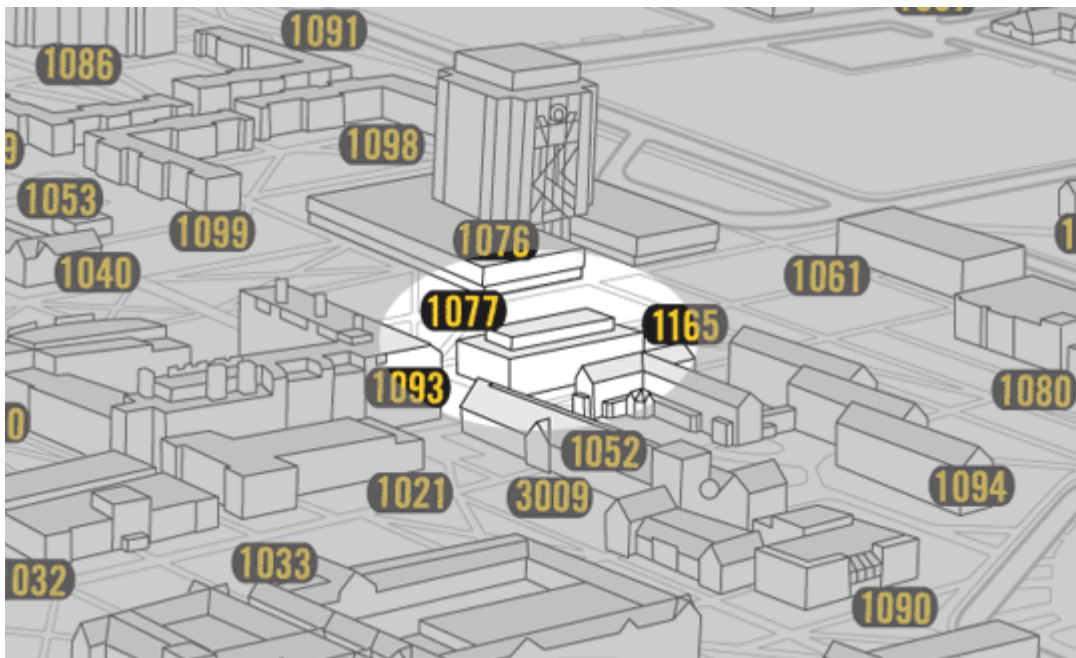
Not applicable.

E. Appendices

Only three of the eight Appendices are applicable for the NDRL. There is no Land Use Plan (App. 1), no maps of Infrastructure/Site Utility Systems (App. 3), no Facilities to be Formally Declared Excess (App. 6), no Excess Facility Projects (App. 7), and no GPP Information provided to Headquarters (App. 8).

Attachment 2. Inventory and Map of Buildings.

The image below is taken from the Campus Map of the University of Notre Dame and shows the placement of the Radiation Research Building (1077) adjacent to the Hesburgh Library (1076), Stepan Hall of Chemistry and Biochemistry (1093) and Malloy Hall (1165).



Attachment 4. Integrated Facilities & Infrastructure Budget

The title document appears on the next three pages.

Attachment 5. Prioritized List of Line Item Projects

There is only one line item project. A description of it appears following the IFI.



Laboratory Infrastructure



Notre Dame Radiation Laboratory

SLI Initiative

June 7, 2007



1. Future Mission Impact on Infrastructure



- Advancing our understanding of radiation-induced chemistry will require increasingly precise experimental probes
 - Shorter time and finer spatial resolution
 - Closer control of radiation energy deposition
 - Advanced methods for detecting transients and products
- NDRL currently has the physical space to accommodate the necessary instrumentation
- We critically require a stable interior environment to allow this instrumentation to perform reliably
- Need substantial refurbishment of experimental stations to provide a truly modernized laboratory



2. State of General Support Infrastructure



- NDRL building constructed in 1962
 - Well maintained physical plant
 - Currently used for original purpose
Study of chemical effects of radiation on matter
- Building as designed is profligate in energy usage
 - Complete air turnover every 4 minutes
- Building additions and energy conservation efforts addressed by piecemeal modifications to the HVAC
 - Every modification further compromises satisfactory air handling



3. Vision of a Modernized Laboratory



- Replace current HVAC system with a system that provides superior climate control and is appropriate for the needs of the scientific program that will be in place ten years out
- In conjunction with this, rehabilitate laboratory space (fume hoods, plumbing, cabinetry, ...) to provide a truly modern laboratory environment that will help to attract world-class scientists



4. Ten Year Prioritized Project Plan



UNIVERSITY OF
NOTRE DAME

Single project encompasses

- redesign and rebuild HVAC/climate control
- replace single-pane windows with energy-efficient windows
- replace aging plumbing with new
- refurbish laboratory space to provide “preferred” environment
- integrate HVAC replacement with fume hoods to decouple from building air

Spread over four years to minimize dislocations to scientific program.



5. Project NDRL-1



Laboratory:

Notre Dame Radiation Laboratory

Project Title:

Mechanical, Electrical, Plumbing upgrades

Project Number*:

NDRL-1

Estimated Cost

10,000,000

Near, Mid or Far-term:

Mid

Project Description/Justification:

Project Description: This project consists of a three-year 6-phase renovation to the HVAC, electrical and plumbing systems of the laboratory. The project includes the main supply and return ducting, air handlers, exhaust ducts and fans, remaining fume hoods and HVAC controls. NDRL also plans to refurbish the building's original restrooms and existing plumbing and laboratory waste lines. Due to the nature of the demolition in the areas of work and the need to limit the present and future impact to the Program, which involves moving personnel and work around, the laboratory furniture, lighting, ceilings and existing badly etched single-pane windows need to be replaced at this time.

Project Justification: The existing HVAC system is the original system and was designed for a complete air change every 4 minutes. Over 45 years numerous modifications have been made to the HVAC to reduce operating costs, but these have compromised ability to provide a stable internal environment. This has affected the performance of accelerators, lasers, and other instrumentation. By changing the HVAC system we will make a more efficient design and reduce the heating and cooling loads on the building, which will reduce the size of the equipment and the energy usage. The plumbing in the existing bathrooms and labs is old and starting to deteriorate, and should be replaced. To minimize impact to the program (temporary relocation of personnel and experiments) it is suggested to phase the project into six rolling phases. While portions of the NDRL building will be out of operational condition due to the HVAC construction, we will replace the inefficient single-pane windows, laboratory furniture, bathroom fixtures, inefficient lighting fixtures and ceiling, most of which need to be demolished to accomplish the work.

Funding Profile:

	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19
Expenditure (\$K)				2,000	3,000	2,500	2,500				

Gross Sq Ft

Added:

0

Removed:

0

Rehabed :

68296

Def. Maint. Reduc.

422

CAMP Score

62

Principal Driver:

MI-AC



6. Proposed Lab Contribution



- Expenditures for deferred maintenance reduction are being committed on an ongoing basis from BES operating funds.
- NDRL has no indirect funded overhead pool. The university assesses a 25% charge on NDRL direct costs, but none of this is available for programmatic or maintenance expenses.
- The following GPP projects (in \$000) are generally improvements to conventional rather than programmatic infrastructure, and demonstrate our commitment to recapitalization and DM reduction. (Even the fume hood projects have a nonprogrammatic aspect, namely, they remove old units from the air circulation system.)
 - replace entrance doors, electronic locks, handicapped access (2009, \$50)
 - rehab auditorium (2008, \$140)
 - upgrade one fume hood, add one new one (2008-9, \$85)
 - upgrade some restrooms for handicapped access (2009, \$50)
- BES has provided excellent GPP support in the past and the same can be expected in the future.



Project Funding Plan



Lab	Project	TEC	FY07	FY08	FY09	FY 10	FY11	FY12	FY13	FY14	FY15	FY 16	FY 17	FY 18	Mortgage
NDRL	Project 1	\$10,000						\$2,000	\$3,000	\$2,500	\$2,500				
	Total	\$10,000						\$2,000	\$3,000	\$2,500	\$2,500				