Pre design Study for:

Radiochemistry Lab Remodel

Renovation to the Center for Magnetic Resonance Research, Bldg. #180
2021 6th Street SE, Minneapolis MN

Department of Radiology

University of Minnesota, Minneapolis Campus
UM Project: 01-180-11-2336

May 2012
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## UNIVERSITY OF MINNESOTA

### Program Representatives
- Charles Dietz, Radiology
- Kamil Ugurbil, Radiology
- Jerry Froelich, Radiology
- Bruce Hammer, Radiology
- Kathleen Dockter, Radiology
- Jeramy Kulesa, Radiology
- Wynne Schiffer, Neurology
- Melanie Kiihn, Neurology
- Kelvin Lim, Psychiatry
- Cyd Gillett, RAR

### Academic Health Center
- Lorelee Wederstrom
- Brenda Trebesch

### Capital Planning & Project Management
- Kevin Ross

### Energy Management
- Jay Denny

### Environmental Health and Safety
- David Paulu

## CONSULTANTS

### Architect - RSP Architects, Ltd
- Judd Brash
- Dustin Bennis

### Mechanical and Electrical Engineers - Sebesta Blomberg
- Doug Lucht
- Harold Bowie

### Construction Budgeting - Mortenson Construction
- Barry Morgan

### PET NET Solutions, Siemens Medical Solutions
- Jim Townsend
STATEMENT OF NEED

INTRODUCTION

The University of Minnesota has recently recruited a scientist whose research using addiction models requires a radioactive isotope, called C-11 raclopride. The University is in a unique position of being capable of producing this short-lived isotope due to the on site cyclotron housed at the Center for Magnetic Resonance Research ("CMRR") and Center for Clinical Imaging Research ("CCIR"). In order to produce this and other similar complex radioactive compounds, the University is proposing to remodel existing laboratory space within CMRR into a specialized radiochemistry laboratory.

MISSION & OBJECTIVES

The objective of building a radiochemistry lab at the University of Minnesota is to support the expansion of radioactive isotopes in pre-clinical and clinical research. At the onset, this lab will support creation of only the C-11 raclopride isotopes for pre-clinical purpose. However, lab equipment and infrastructure will be built to support the expansion into other C-11 compounds, such as C-11 acetate and C-11 choline, for both preclinical and clinical research. The research will enhance the University’s capability for nuclear imaging using positron emission tomography ("PET"), as imaging will utilize the state-of-the-art microPET and PET/CT scanners purchased in 2010 as part of the CMRR expansion project. Various medical fields could benefit from the isotopes produced by this laboratory, including psychiatry, neurology, oncology and cardiology.
INTRODUCTION

The build-out of this proposed Radiochemistry Laboratory is the second phase in developing a thriving molecular imaging with PET research program at the University of Minnesota. The first phase involved constructing a 4,051 sq. ft. space within CMRR to house a cyclotron. This space is leased to PETNET, a subsidiary of Siemens Medical Solutions, USA, as the company’s Twin Cities location to manufacture medical radioisotopes for University of Minnesota researchers and local hospitals and clinics. The PETNET-provided cyclotron is capable of producing a variety of radioisotopes. Since PETNET provides equipment and personnel, this unique partnership provides researchers with access to radioactive isotopes and the short lived isotopes.

The first phase of developing molecular imaging with PET also included major investments in preclinical and clinical PET cameras housed at CCIR. This investment was made by the State of Minnesota and the University of Minnesota as part of the CMRR Expansion project. Currently, these PET cameras are used with FDA approved radioisotopes which limits the University’s molecular research capabilities.

This proposed project is the second phase of developing a molecular imaging PET research program: the build-out of a specialized radiochemistry laboratory to produce novel radiochemical synthesis and labeling (“radioligands”). These radioligands will be used to enhance visualization of pathological targets and disease processes that will be crucial for more accurate early diagnosis, monitoring of disease progression and treatment efficacy. This laboratory was envisioned in 2008 when the building was designed as underground conduits were installed during construction to deliver radioisotopes directly from the cyclotron to this lab space. The recent recruiting of Dr. Wynne Schiffer accelerated the expected timetable for constructing this lab due to her need for C-11 raclopride. With a 20 minute half-life, this compound must be synthesized close to the cyclotron and close to the PET imaging equipment. The proposed location for this lab is ideally situated within the building to provide these capabilities.

As a final note, researchers currently using the existing lab space will be relocated to under utilized spaces within the CMRR building. Some minimal costs to retrofit these existing lab spaces are included in this project budget.
SPACE TYPES

Radiochemistry Lab 1-169
- Remodeled, shared space.
- Utilize 1523 SF of the existing Chemistry Lab and remodel as necessary for installation of the delivery tubes from the cyclotron, two hot cells and four mini-cells.

Behavioral Rooms (2) 1-169A, 1-169B
- Remodeled, dedicated space.
- Make existing Tissue 1-169A a Behavioral Room. Relocated existing entrance to the east side, add a point of source scavenging exhaust to create Behavior Room 1-169.
- Make existing Tissue 1-169B a Behavioral Room. Relocated existing entrance into the east side, remove existing benches at north wall, and add a point of source scavenging exhaust to create Behavior Room 1-169B.

Equipment Room 1-166A
- Remodeled, dedicated space.
- Convert private office 1-166A into a passage way to 1-169B and an equipment room.

Tissue Lab 1-224
- Remodeled, dedicated space.
- Remodel existing lab space for relocation of existing Tissue 1-169A

Private Office 1-166B
- Existing, dedicated Space.
- Utilize office for Dr. Schiffer.

Procedure Room (Various locations)
- Existing, shared space.
- Utilize existing Procedure Rooms throughout CMRR.

Micro PET Suite 1-164
- Existing, shared space.
- Utilize existing suite as is, animal holding, imaging and dosing. Utilize existing Atomlab 100 Dose Calibrator and a Capintec Drawing Station.

Cyclotron Vault
- Existing, dedicated space.
- Utilize on-site cyclotron equipment; the origin of the isotopes used to create C-11 raclopride.
## SUMMARY

### Remodeled Space
- Radiochemistry Lab 1,523 SF
- Behavioral Room 1 210 SF
- Behavioral Room 2 189 SF
- Equipment Room 122 SF
- Tissue Lab 1-224 406 SF

**2,450 SF Total**

### Existing Space Utilized
- MicroPET Suite 387 SF
- Procedure Rooms 300 SF (Average)
- Private Office 1-166B 117 SF

**804 SF Total**

### Combined Radiochemistry Space Summary
- Total Remodeled Space 2,450 SF
- Total Existing Space 804 SF

**3,254 SF Total**
FINANCIAL ANALYSIS

SYSTEMS

Funding for the initial investment in construction and equipment is from non-sponsored funds committed by the following organizations:

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Bud Grossman Center for Memory Research and Care School</td>
<td>$800,000</td>
</tr>
<tr>
<td>Karen Ashe, MD, PhD nonsponsored funds</td>
<td>$164,200</td>
</tr>
<tr>
<td>Department of Neurology</td>
<td>$125,000</td>
</tr>
<tr>
<td>Institute for Translational Neuroscience (ITN)</td>
<td>$100,000</td>
</tr>
<tr>
<td>Jerry Froelich, MD chair funds</td>
<td>$29,399</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,536,599</strong></td>
</tr>
</tbody>
</table>

Ongoing Operating Costs

PETNET Solutions will provide a trained radiochemist to synthesize C-11 compounds via a contract for services between the Department of Radiology and PETNET Solutions. Additional costs for compliance administration, equipment service agreements, operations and maintenance and oversight will be paid for by the Department of Radiology and recovered from all users via Internal Service Organization (ISO) user fees.
ENVIRONMENTAL/CODE/HAZARDOUS MATERIALS ANALYSIS

CONDITIONS
The existing building was constructed in 1997 and added onto in 2003, 2009 and then most recently in 2010. To date, no suspect materials have tested positive of asbestos.

ISSUES
- The building currently contains 9 High Field MRI Systems. Safety training is required for access around or in these systems. Furniture and equipment supporting the systems within the high fields are required to be non-ferrous.
- The cryostats for each high field magnet contain a large volume of liquid helium which is required to be vented directly to the outside of the building. A potential safety hazard exists of depleting the oxygen level within the suite if a catastrophic cryostat event should occur.
- The Minnesota Department of Health (MDH) and the U.S. Nuclear Regulatory Commission (NRC) have issued licenses to the University of Minnesota for the use of radioactive materials in research, teaching and medical applications. All personnel who wish to use radioactive materials in any University facility must work under an existing permit or submit an application for a permit which will be reviewed by the appropriate University committee.

Note: The CMRR has been built in several phases. The proposed remodel is isolated to five existing rooms within CMRR.

CODE HIGHLIGHTS

Applicable Codes
For the design and construction of the Radiochemistry Lab, the University of Minnesota’s Building Department enforces the following codes:
- 2007 Minnesota State Building Code
- 2006 International Building Code
- 2003 Minnesota Building Conversation Code – Chapter 1311
- 2007 Minnesota Accessibility Code
- 2007 Minnesota Energy Code
- 2007 Minnesota State Fire Code
- 2006 International Fire Code
- 2008 National Electric Code
- 2009 Minnesota State Plumbing Code
- 2009 Minnesota State Mechanical Code
- 2006 International Mechanical Code
- 2006 International Mechanical and Fuel Gas Codes

Occupancy Classifications
The proposed use for each of the options is consistent with the existing occupancies.
• B – Research, Education above 12th Grade
• B – Labs – Chemical use below Table 307.1(1) & 307.1(2).
• A – Seminar (Accessory)

Proposed
• B – Research, Education above 12th Grade
• B – Labs – Chemical use below Table 307.1(1) & 307.1(2).

Type of Construction
The CMRR has been built in several phases. The existing structure is technically several buildings built adjacent to each other with separation walls. The proposed area of remodel does fall within the allowable area of either of the existing buildings.
• The original 42,000 square foot one story building structure was built in 1998. The area is divided into 36,000 SF type V-B construction type and 7,000 SF of type II-B.
• The newest 61,000 square foot two story addition was built in 2010 as a type IIA construction type.

Height and Number of Stories
The existing buildings height and stories will not change.
• The original 42,000 square foot building is one story structure.
• The newest 61,000 square foot building is a two story structure.

Allowable Floor Area
The existing structure is technically several buildings built adjacent to each other with separation walls. The proposed remodel will not increase the floor area of either building type.

Building Approach
The main entrance would remain as exists today.

Fire Safety
The existing building has a complete automatic fire protection system.
• The fire safety systems (sprinklers, alarms) would be modified as necessary for the remodeled areas.
**Occupant Loads and Egress**  
Occupant loads and egress will remain unchanged.

**Plumbing Fixtures**  
The number of plumbing fixtures appears to be adequate for the additional occupancy.

**Radiation**  
The University of Minnesota DEHS will review project for radiation safety requirements.
COST ANALYSIS

CONSTRUCTION COST

Construction Costs include: demolition and general, mechanical, electrical, structural, and civil construction work, contractor provided furnishings and equipment, miscellaneous site work, hazardous material abatement, building permit, sewer availability charges, utility outages, temporary facilities, signage & graphics, BSAC, networking & telecommunications, keys & keying, and construction contingency. Cost Figures below are in 2012 dollars.

NON-CONSTRUCTION COST

Non Construction Costs include: consultants (architects, engineers, special inspections, material testing, hazardous abatement, special consultants); University review fees; project management fee; advertisements; surveys: geotechnical, site, hazardous materials; owner provided furnishings & equipment; University provided building investigation; moving; miscellaneous (swing space accommodations, travel expenses, art, incidental expenses).

| Construction Cost:       | $629,541 |
| Non-Construction Cost:   | $907,058 |
| Total Project Cost:      | $1,536,599 |
PROJECT SCHEDULE

Design Development Phase 2 weeks
Design Development Review 2 weeks
Construction Document Phase 3 weeks
Construction Document Review 2 weeks
Construction Award 2 weeks
Earliest Construction Start **August 13, 2012**
Construction Phase 9 weeks
Equipment Validation 2 weeks
Total project Duration Approximately 6 months

Complete planning schedule in appendix.
CONCEPT PLANS

INTRODUCTION
Following are plan images indicating the extents of the remodeled spaces within CMRR.

PLANS/NARRATIVES
- Building Location Map
- A0 - Building Space Type Plan
- A1 – Demolition Plan
- A2 – Radiochemistry Lab Plan
- A3 – Behavioral Rooms Plan
- A4 – MicroPET Suite Plan
- A5 – Tissue Lab Plan
- A6 – Radiochemistry Lab Ceiling Plan
- A7 – Mechanical Penthouse Plan
- Key – Plan Keynotes
- Mechanical / Electrical Design Narrative
### CMRR Radiocchemistry Lab Remodel

1. Disconnect overhead services and remove 4 ft. mobile lab benches. Save for relocation.
2. Disconnect vent and remove flammable storage cabinet. Save for relocation.
3. Remove door and frame. Save for relocation. Patch wall opening, floor and base as necessary to match adjacent.
4. Disconnect and remove 6’-0” fume hood. Save for relocation.
5. Remove floor finish, save for owner.
6. Remove concrete floor from location of buried pvc conduit. Trench floor west to new transfer pit location.
7. Remove existing base cabinet & work surface. Save for owner.
8. Remove door and frame. Patch wall opening, floor and base as necessary to match adjacent.
9. New transfer pit with lead shielded cover and auto opener.
10. Connect 2’-0” pvc conduits to existing conduits and extend to new transfer pit. Provide 2’ of concrete cover above new conduits to location of transfer pit. Patch and repair carpet and epoxy flooring as necessary.
11. Extend 2’ PVC conduits from transfer pit to hot cell, minicell locations. Provide 2’ of concrete cover above new conduits. Repair epoxy flooring as required.
12. Existing flammable storage cabinet to remain.
13. Relocated 6’ foot lab bench, one half. Provide air valves, power and data outlets from overhead. Provide service connections in new aluminum ceiling panel above.
14. Owner Provided laminate flow hood - provide dedicated outlet.
15. Vent gas cylinder cabinet.
16. Widen old door opening and finish with gypsum board.
18. Not used.
19. Provide film at existing windows.
22. New 4’-0” fume hood.
23. New overhead source capture exhaust arm.
24. New epoxy floor & base to match existing corridor finish.
25. 36” x 30” heavy duty stainless steel table w/ shelf below.
26. Relocated 6’-0” fume hood from chem lab. Provide power and services.
27. Provide new dedicated emergency power outlets for relocated refrigerator.
28. Relocated flammable storage cabinet - provide exhaust connection.
29. 2’ PVC conduits, route above the ceiling - turn down and extend 6’ below ceiling. Attach small diameter stainless steel hose to each PVC conduit for fluorine gas delivery.
30. Location for new charcoal filter box and lead shielded cabinet enclosure. Verify new exhaust duct location with existing conditions.

### Key Notes

#### Predisgn Study: CMRR - Radiocchemistry Lab Remodel

- **U of M Project Number:** 01-180-11-2336
- **University of Minnesota | CMRR Radiochemistry Predisgn Study**

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**KEY**

- **Project No.:** 0208-0012
- **Client:** 01-186-11-2286
- **Date:** 03/14/2012

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**RSP Architects Ltd.**

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Minneapolis, MN 55413

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University of Minnesota
CMRR – Radiochemistry Lab Remodel
UMN Project No. 01-180-11-2336

MECHANICAL / ELECTRICAL
DESIGN INTENT NARRATIVE

Prepared by:
Sebesta Blomberg & Associates, Inc.

April 3, 2012
Mechanical

Overview

A. Design Intent Document

This document is intended to represent the design intent and schematic design level description of mechanical systems for the CMRR Remodel Suite 1-169 project at the East Bank campus of the University of Minnesota.

B. General

The following building systems are described in this document:

- HVAC Systems
- Fire Protection Systems
- Laboratory/Medical Gases
- Domestic Water Systems
- Plumbing Systems

C. Code Compliance

The mechanical design of this facility will be in compliance with the current NFPA, IBC, IMC, IFC, MN Plumbing Code, and approved Minnesota amendments, Minnesota Codes and local code officials as of the date indicated in the construction documents. Construction methods shall adhere to the latest edition of the University standards, SMANCA and ASHRAE guidelines.

- Minnesota State Building Code (SBC) 2007
- International Building Code (IBC) 2006
- Minnesota State Fire Code (SFC) 2006
- International Fire Code (IFC) 2006
- Minnesota State Mechanical Code 2007 (MN Rules Chapter 1346)
- International Mechanical Code (IMC) 2006
- International Fuel Gas Code (IFGC) 2006
- Minnesota Plumbing Code 2009 (MN Rules Chapter 4715)

D. General Building

The 103,622 square foot Center for Magnetic Resonance Research facility on the East Bank campus of the University of Minnesota. This project will renovate an existing chemistry lab area into a Radiochemistry Lab to support additional research at the CMRR.
HVAC Systems

A. Design Conditions

Outdoor Temperatures and Humidity

The following table lists the outdoor dry bulb and wet bulb temperatures that will be used to calculate the building envelope cooling load for each month. The monthly data is based on the 1.0% values from Chapter 27, Table 4B in the 2001 ASHRAE Fundamentals Handbook for Minneapolis-St. Paul. The building cooling loads will be evaluated for each of the twelve months to determine the peak building load for all possible incident solar angles.

The Winter Design dry bulb temperature represents the Minnesota Energy Code Heating Design Condition and corresponds to the 0.4% winter design condition in Chapter 27, Table 1A in the 2001 ASHRAE Fundamentals Handbook for Minneapolis-St. Paul. This will be used to calculate the maximum heating envelope load for the building.

<table>
<thead>
<tr>
<th>Month</th>
<th>Dry Bulb (°F&lt;sub&gt;db&lt;/sub&gt;)</th>
<th>Mean Coincident Wet Bulb (°F&lt;sub&gt;wb&lt;/sub&gt;)</th>
<th>Humidity Ratio (Grains/Lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>39.6</td>
<td>34.9</td>
<td>23.2</td>
</tr>
<tr>
<td>February</td>
<td>45.4</td>
<td>39.4</td>
<td>27.1</td>
</tr>
<tr>
<td>March</td>
<td>61.8</td>
<td>51.6</td>
<td>42.2</td>
</tr>
<tr>
<td>April</td>
<td>77.6</td>
<td>59.9</td>
<td>51.0</td>
</tr>
<tr>
<td>May</td>
<td>85.7</td>
<td>66.0</td>
<td>66.9</td>
</tr>
<tr>
<td>June</td>
<td>91.0</td>
<td>72.3</td>
<td>92.7</td>
</tr>
<tr>
<td>July</td>
<td>93.7</td>
<td>74.5</td>
<td>101.6</td>
</tr>
<tr>
<td>August</td>
<td>91.3</td>
<td>73.9</td>
<td>101.8</td>
</tr>
<tr>
<td>September</td>
<td>85.7</td>
<td>70.6</td>
<td>91.6</td>
</tr>
<tr>
<td>October</td>
<td>76.2</td>
<td>62.2</td>
<td>63.7</td>
</tr>
<tr>
<td>November</td>
<td>60.4</td>
<td>52.8</td>
<td>49.0</td>
</tr>
<tr>
<td>December</td>
<td>43.0</td>
<td>38.2</td>
<td>27.3</td>
</tr>
</tbody>
</table>

Instantaneous winter outside air loads such as air handling unit pre heat coils will be calculated using a winter design dry bulb temperature of -20°F. Instantaneous summer outside air loads such as AHU coils and energy recovery coils will be calculated using extreme design conditions of 92°F dry bulb and 75°F wet bulb.

Indoor Temperature, Humidity, and Ventilation Design Criteria

Summer and winter interior space conditions listed in the following table are based upon the Minnesota Energy Code, University of Minnesota construction standards, and information gathered from equipment manufacturers. Outside air ventilation rates and exhaust rates are based on ASHRAE standard 62.2001 Addendum N Table 2.
<table>
<thead>
<tr>
<th>Space Type</th>
<th>Summer Indoor Conditions</th>
<th>Winter Indoor Conditions</th>
<th>Outside Air Ventilation Rate</th>
<th>Exhaust Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max. Temp (F)</td>
<td>Max. RH (%)</td>
<td>Min. Temp (F)</td>
<td>Min. RH (%)</td>
</tr>
<tr>
<td>Laminar</td>
<td>74</td>
<td>50</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>74</td>
<td>50</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Laboratory</td>
<td>74</td>
<td>50</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Mechanical</td>
<td>85</td>
<td>-</td>
<td>55</td>
<td>-</td>
</tr>
</tbody>
</table>

**General Notes:** Building summer humidity levels will be indirectly controlled at the AHU cooling coil. Blank cells indicate the parameter is not applicable to that type of space.

**Specific Notes**
1. Space will be ventilated by transfer air from adjacent ventilated spaces.
2. Mechanical cooling will not be provided. Space temperature will be maintained by mechanical ventilation.
3. Must comply with Appendix L of University Construction Standards with 2 pascal negative pressure with respect to public spaces.

### Internal Heat Gains

Internal loads due to people, lights, and equipment were determined based on the schematic plans and correspondence with RSP Architects. The internal cooling loads were calculated using the equipment heat release data listed table below. These values are subject to change upon review of equipment submittals from the owner and equipment plans provide by RSP Architects.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Heat Gain (Watts)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop Laser Printer</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Desktop PC and Monitor</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>Facsimile Machine</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Flat Screen Monitor (17&quot;)</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Flat Screen Monitor (40&quot;)</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Laptop PC</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Refrigerator / Freezer (18 ft3)</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>Transformer – 3- phase 75 KVA</td>
<td>1890</td>
<td></td>
</tr>
<tr>
<td>Transformer – 3-phase 45 KVA</td>
<td>1280</td>
<td></td>
</tr>
<tr>
<td>Video Projector</td>
<td>800</td>
<td></td>
</tr>
</tbody>
</table>

The heat release from occupants is determined based on an average sensible load of 250 Btu/hr per person and an average latent load of 200 Btu/hr per person. Lighting load estimates are based on AHSRAE Standard 90.1-1999 Table 9.3.1.2.

### Noise Criteria

The HVAC related background sound levels will be designed to meet the following noise criteria in the spaces listed. The following guidelines are based on the design guidelines listed in the 2007 ASHRAE Applications Handbook, Chapter 47, Table 42.

<table>
<thead>
<tr>
<th>Space</th>
<th>Sound Criteria Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratories</td>
<td>NC 45 or less</td>
</tr>
</tbody>
</table>

**Notes:** 1. Diffusers shall be selected for 10dB lower than the room NC rating at rated flow to account for field installation.
The ambient noise levels from the mechanical systems will be designed to meet the following noise standards as specified in the Minnesota Rules part 7030.0040 for residential areas.

<table>
<thead>
<tr>
<th>Daytime</th>
<th>Nighttime</th>
</tr>
</thead>
<tbody>
<tr>
<td>L50 (1)</td>
<td>L10 (2)</td>
</tr>
<tr>
<td>60 dbA</td>
<td>65 dbA</td>
</tr>
<tr>
<td>L50 (1)</td>
<td>L10 (2)</td>
</tr>
<tr>
<td>50 dbA</td>
<td>55 dbA</td>
</tr>
</tbody>
</table>

**Notes:**
1. Maximum sound pressure allowed at the nearest point of human activity for a sound source operating 50% of the time.
2. Maximum sound pressure allowed at the nearest point of human activity for a sound source operating 10% of the time.

**B. Central Heating and Cooling Systems**

No modifications to the central heating and cooling systems are anticipated as part of this project.

**C. Energy Recovery Systems**

The new general exhaust system will be provided with an energy recovery coil which will be connected to the existing pumped coil energy recovery system. The existing pumps will be replaced to increase the capacity of the energy recovery system.

**D. Humidification Systems**

No modifications to the building humidification systems are anticipated as part of this project.

**E. Air Handling Equipment**

The areas within the scope of this project will be supplied from SUP-004 located in the mechanical penthouse. SUP-004 was originally designed for future capacity to serve a new magnet addition to the north of the addition. Serving the radiochemistry lab from this unit will reduce the reserve capacity that was originally intended for a new magnet addition.

The minimum outside airflow setpoint for SUP-004 will be adjusted to compensate for the additional outside air required for this space.

All existing supply and exhaust diffusers serving existing Chem Lab 169, Tissue 1-169A, and Tissue 1-169B will removed.

The existing supply air VAV terminal units (VAV-401, VAV-402, VAV-403, VAV-404 and VAV-405) and associated reheat piping will be removed and capped at the nearest main. The existing supply air ductwork serving these existing VAV terminal units in Chem Lab 169 will be removed back to and capped at the mains. The existing exhaust ductwork serving existing Chem lab 169 will be removed back to the West wall of room 1-169A and capped.

The existing fan coil units (FNCL-017 and FNCL-018) will be demolished and associated chilled water piping will be removed back to the nearest main and capped.

The intent will be to reuse the existing supply and exhaust duct mains currently serving Chem Lab 169 to serve the newly remodel spaces.
F. HVAC Terminal Units and GRDs

1. Variable Air Volume Terminal Units (VAV Boxes)

Five new supply air VAV terminal units with reheat coils will be provided to serve each of the new laboratory and support spaces. Each VAV box shall have its own wall mounted DDC space temperature sensor to control its supply air damper and two-way hot water reheat valve.

The existing supply VAV terminal units currently serving rooms 1-224 and 1-226 will be reused and rebalanced to accommodate the renovated spaces.

2. Grilles, Registers and Diffusers

Laboratory spaces will be supplied with lay-in ceiling style diffusers. Volume dampers will be provided to allow airflow balancing. Ceiling grilles will be used to return or exhaust air from the laboratories.

The laminar flow area will be supplied with a fan powered HEPA filter diffuser located in the ceiling of the space.

3. Fan Coil Units

In order to accommodate the relocated Tissue Culture Lab and the associated equipment to rooms 1-224 and 1-225 supplemental cooling will be required. Two new 2,000 cfm chilled water fan coil units will be provided to serve room 1-224 and 1-226. The units will be similar to Enviro-Tec model HPP. These units will be ducted in a similar manner as currently installed in rooms 1-169A/B. Chilled water piping will be connected to existing 3” chilled water mains located in the corridor.

4. Miscellaneous Heating Units

Existing finned tube radiation currently serving the North wall will be removed. Linear supply diffusers will be provided to and new finned tube radiation will be provided at the existing windows zoned to control space temperature in the new areas.

5. General Exhaust

The intent will be to reconfigure the general exhaust system currently serving Chem Lab 169 to serve as dedicated general exhaust systems for the Laminar Hood Space, Manufacturing, Laboratory as well as providing exhaust for the relocated Chem Lab and the existing Tissue Culture rooms. Each space will have a dedicated exhaust air valve installed that will modulate to maintain the exhaust airflow setpoint.

A new general exhaust fan will replace the existing EXH-034 located on the roof of the mechanical penthouse to draw exhaust air from these spaces. The fan will be retrofitted with a variable frequency drive and duct static pressure sensor to allow the system to vary the exhaust air flow rate as needed to satisfy the exhaust air valve airflow setpoints.

All new general exhaust ductwork will be G90 coated galvanized steel.
6. Hazardous Exhaust

A 750 cfm dedicated exhaust system will be provided to exhaust from the hydrogen storage cabinet, hot cells, and mini cells. Each of the exhaust inlets will be provided with a constant volume air regulator for control of airflow. The air from the hot cells and mini cells will be drawn through a carbon adsorption air filter box for removal of radioactive isotopes. This filtration system will be provided with a dedicated booster exhaust fan with a variable frequency drive and a high plume dilution blower with a bypass damper that will discharge on the roof. The hydrogen storage cabinet will be connected to the exhaust air system downstream of the carbon filters but upstream of the high plume dilution blower. An air monitoring system will be provided on the common exhaust duct immediately upstream of the high plume dilution exhaust fan.

The booster fan and VFD will be located in the mechanical penthouse closet. The high plume dilution blower will be located on the roof of the PETNET space over 100 ft from the AHU outdoor intakes. The exhaust ductwork will be routed on the roof from the mechanical room to the new fan location.

7. Ductwork

All supply and outdoor air ductwork shall be externally insulated. All ductwork shall be concealed. Flexible duct runs shall not exceed 4 feet. All new ductwork serving the renovated spaces shall be G90 galvanized steel.

All radioactive exhaust ductwork will be type 304 welded stainless steel. Roof mounted exhaust ductwork will be externally insulated with 2” fiberglass and clad with an aluminum jacket.

All HVAC systems will be tested and balanced by a NEBB certified contractor. All new supply, return, and outside air ductwork shall be pressure tested to be less than 5% of the supply volume at twice the normal operation static. A minimum of two signed balance reports will be required.

G. Control Systems

The existing Johnson Controls DDC system serving the existing facility will be expanded to control the new equipment installed as part of this project.

The following table is an abbreviated list of the equipment intended to be controlled in the remodeled area.

<table>
<thead>
<tr>
<th>System</th>
<th>Tag</th>
<th>Qty</th>
<th>AI</th>
<th>DI</th>
<th>AO</th>
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<th>Total</th>
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<td>SAV-X</td>
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<td>3</td>
<td>2</td>
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<tr>
<td>Exhaust Air VAVs</td>
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<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
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<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td>5</td>
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<tr>
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<td>1</td>
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<td>Filter Box DP Monitor</td>
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<td></td>
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<td>72</td>
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H. Duct and Pipe Sizing Criteria

1. Duct Sizing Criteria:

Ducts shall be sized with either the following maximum air velocities or pressure drops, whichever results in the larger duct. Maximum velocities are based on Chapter 47, Table 3 in the 2003 ASHRAE Applications Handbook for rectangular ductwork in spaces with an RC of 35 (NC of 35) or less.

(1) Supply Air
   (a) Mechanical rooms
      (i) Maximum velocity = 1800 FPM
      (ii) Maximum pressure loss = 0.10"/100 ft
   (b) Vertical mains (within shaft enclosure)
      (i) Maximum velocity = 1800 FPM
      (ii) Maximum pressure loss = 0.10"/100 ft
   (c) Horizontal branch ducts (upstream of terminal units)
      (i) Maximum velocity = 1600 FPM
      (ii) Maximum pressure loss = 0.10"/100 ft
   (d) Runouts (downstream of terminal units, above acoustical ceiling)
      (i) Maximum velocity = 1400 FPM
      (ii) Maximum pressure loss = 0.08"/100 ft

(2) Return and exhaust air
   (a) Mechanical rooms
      (i) Maximum velocity = 1800 FPM
      (ii) Maximum pressure loss = 0.08"/100 ft
   (b) Vertical mains (within shaft enclosure)
      (i) Maximum velocity = 1800 FPM
      (ii) Maximum pressure loss = 0.08"/100 ft
   (c) Horizontal branch ducts
      (i) Maximum velocity = 1600 FPM
      (ii) Maximum pressure loss = 0.08"/100 ft
   (d) Runouts to individual rooms
      (i) Maximum velocity = 800 FPM
      (ii) Maximum pressure loss = 0.08"/100 ft

(3) NC 30 Spaces (supply, exhaust, and return)
   (a) Horizontal branch ducts
      (i) Maximum velocity = 1160 FPM
      (ii) Maximum pressure loss = 0.08"/100 ft
   (b) Runouts to individual grilles and diffusers shall be the same size as the diffuser inlet or a maximum as follows:
(i) Maximum velocity = 750 FPM
(ii) Maximum pressure loss = 0.08”/100 ft
(4) Maximum velocity through sound attenuators is 1600 FPM

2. Pipe Sizing Criteria:

Hydronic piping for building heating and cooling systems shall be sized based on the following criteria:

(1) Smaller than or equal to 2”
   (a) Maximum velocity = 7fps
(2) Larger than 2”
   (a) Maximum pressure drop = 4 ft w.g./100 ft pipe
   (b) Design pressure drop = 3 ft w.g./100 ft pipe

Fire Protection Systems

A. Classification

The existing wet system serving the renovated area will be re-used to serve the newly remodeled lab spaces. The space will be fully sprinklered in accordance with NFPA Chapter 13. Hazard classification will be Ordinary Hazard Group 2 for all spaces in this renovated area.

B. Fire Protection System

Sprinkler heads will be quick response type. Sprinklers in areas with finished ceilings will be concealed head type with flush, white painted escutcheons. Sprinklers in unfinished spaces will be exposed upright head with rough brass finish.

Laboratory/Medical Distribution Systems

A. Medical Air Compressor System

No modifications to the existing medical compressed air infrastructure are anticipated as part of this project.

B. Lab Air Compressor System

No modifications to the existing lab compressed air infrastructure are anticipated as part of this project.

C. Lab/Medical Vacuum Pump System

No modifications to the existing lab/medical vacuum infrastructure are anticipated as part of this project.
Laboratory/Medical Gases

A. Configuration

New laboratory gases (lab vacuum, lab air, medical vacuum, medical air, oxygen, nitrous oxide and carbon dioxide) will be connected to existing piping mains located in the corridor. Lab/medical gas wall and/or benchtop outlets in accordance with NFPA 99, standards for health care facilities will be located as shown on the floor plans.

Med Gas area alarm modules will not be provided in the laboratory spaces as it our understanding that lab gases will not be administered to humans or research subjects in this area.

B. Lab Gases and Services:

1. De-ionized (Purified) Laboratory Water System:

De-ionized water piping systems shall be sized at 3 psi pressure loss per hundred feet of pipe on a flush tank system curve.

2. Laboratory Vacuum System:

All new laboratory vacuum piping shall be designed, specified, installed and tested in accordance with NFPA 99, Standard for Health Care Facilities. Vacuum shall be provided at a minimum of 21 in Hg at the furthest inlet. Design based on one (1) scfm per inlet. Diversity factors shall be applied based on the maximum number of inlets. Diversity factors are as follows:

<table>
<thead>
<tr>
<th>LABORATORY VACUUM SYSTEM DIVERSITY FACTORS</th>
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</thead>
<tbody>
<tr>
<td>Number of Outlets</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>1-5</td>
</tr>
<tr>
<td>6-12</td>
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<td>13-33</td>
</tr>
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<td>34-80</td>
</tr>
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<td>81-150</td>
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<tr>
<td>151-315</td>
</tr>
<tr>
<td>316-565</td>
</tr>
</tbody>
</table>

3. Natural Gas System:

Size any main for 2psig with a 1psi pressure drop per 100 ft. Size any run-out after the pressure regulator for as 7” with a .30psi pressure drop per 100 ft. Capacity for the piping system shall be based on actual equipment demand, plus 7 ccfh per laboratory outlet with diversity factors applied based on the number of outlets. An emergency gas solenoid shut-off valve shall be provided at each lab module activated by an EPO switch. Valves shall not be located above any ceiling spaces. Diversity factors are as follows:

<table>
<thead>
<tr>
<th>NATURAL GAS SYSTEM DIVERSITY FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Outlets</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>1-8</td>
</tr>
<tr>
<td>9-16</td>
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<td>17-29</td>
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<td>30-79</td>
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<tr>
<td>80-162</td>
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</table>
NATURAL GAS SYSTEM DIVERSITY FACTORS

<table>
<thead>
<tr>
<th>Number of Outlets</th>
<th>Use Factor – Percent</th>
<th>Minimum Outlets</th>
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</thead>
<tbody>
<tr>
<td>163-325</td>
<td>40</td>
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<tr>
<td>326-742</td>
<td>35</td>
<td>131</td>
</tr>
<tr>
<td>743-1570</td>
<td>30</td>
<td>260</td>
</tr>
</tbody>
</table>

4. Laboratory Compressed Air System:

All new laboratory compressed air piping shall be designed, specified, installed and tested in accordance with NFPA 99, Standards for Health Care Facilities. Branches to pipe gallery floors will be provided with pressure regulators to reduce system pressure as required. A maximum pressure of 15 psig will be supplied to laboratory outlets. The distribution system shall be based on one (1) scfm per outlet, with diversity factors applied based on the number of outlets, plus actual demands of any equipment requiring this service. Diversity factors are as follows:

COMPRESSED AIR SYSTEM DIVERSITY FACTORS

<table>
<thead>
<tr>
<th>Number of Outlets</th>
<th>Use Factor – Percent</th>
<th>Minimum Outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>100</td>
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<tr>
<td>3-12</td>
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<td>13-38</td>
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<td>39-115</td>
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<td>116-316</td>
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<td>50</td>
</tr>
<tr>
<td>317-700</td>
<td>20</td>
<td>95</td>
</tr>
</tbody>
</table>

A dedicated 1 HP air compressor providing 100 psi compressed air will be located in the mechanical closet adjacent to the lab to serve the hot cells. The air compressor will be provided with an oil filter and refrigerated air air dryer to condition the compressed air.

Domestic Water Systems

A. Service

No modifications to the existing building water service are anticipated as part of this project.

B. Domestic Cold Water

Domestic cold water will be piped to serve the laboratory sinks and emergency eyewash equipment as shown on the floor plans.

C. Domestic Hot Water

Domestic hot water will be piped to serve the laboratory sinks and emergency eyewash equipment as shown on the floor plans.

Plumbing Systems

A. Sanitary Sewer and Vent

All plumbing fixtures will be routed by gravity to the existing sanitary sewer system. All above ground sanitary and vent piping will be CPVC.
B. Storm Drainage

No modifications to the storm drainage system are anticipated as part of this project.

C. Plumbing Fixtures

The plumbing fixtures will be based on the standard manufactures as defined in the University design standards. Any deviation from these manufactures will be submitted and approved by the engineer prior to inclusion into the systems design.

1. Faucets

All faucets are to be provided with integral flow restricting devices to limit water flow to 0.5 gpm. Public lavatories will be equipped with single lever faucets. Faucets are to be constructed of lead-free waterways.

2. Eyewash and Emergency Showers.

Emergency eyewash and showers will be provided at all fume hoods and a minimum of one eyewash station in wet labs. Floor drains will not be provided at emergency eyewash and shower locations.
ELECTRICAL

Overview

A. Design Intent Document

This document is intended to represent the design intent and schematic design level description of electrical systems for the CMRR Remodel Suite 1-169 project at the East Bank campus of the University of Minnesota.

B. General

The following building systems are described in this document:

- Power Distribution System
- Lighting Systems
- Fire Alarm System
- Voice/Data Systems
- Security Monitoring

C. Code Compliance

The electrical design of this facility shall comply with the current NFPA, IBC, National Electric Code (NEC), approved Minnesota amendments, Minnesota Codes and local code officials as of the date indicated in the construction documents.

- Minnesota State Building Code (SBC) 2003
- Minnesota Accessibility Code 1999 (MN Rules Chapter 1341)
- International Building Code (IBC) 2000
- Minnesota State Fire Code (SFC) 2003
- International Fire Code (IFC) 2000
- National Electrical Code (NEC)
- 1999 Minnesota State Energy Code (Chapters 7676 + 7678)

D. General Building

This project will renovate an existing Chemistry Lab into a Radiochemistry Lab to support additional research at the existing Center for Magnetic Resonance Research facility.

E. Scope of Work

1. Work under this contract includes complete electrical systems for the remodeled areas, including (but not limited to):
   a. Coordinate phasing of all work with all other construction trades
   b. Providing a new 200 ampere, 277/480V, 3-phase, 4-wire panelboard and feeder to serve the new laboratory equipment. Existing 120/208V, 3-
phase, 4-wire panelboards will be utilized for general purpose
convenience receptacles and 120 volt loads.

c. Electrical renovations including new lighting, power, and systems in
remodeled areas.
d. Provide all required connections to HVAC equipment and Owner
furnished equipment
e. Provide raceway system for voice/data cabling and Local Area Network
(LAN) systems
f. Provide fire alarm devices for the remodeled areas. Devices shall be
connected to the existing addressable system.

F. University Standards

The electrical design of this facility is to be in compliance with University of Minnesota Division
16 Construction Standards, 2002 (Revised 2006).

Power Distribution Systems

A. Utility Power Distribution

The existing university 13,800V medium voltage service and substation are existing to remain
and will not be modified under this project.

B. Emergency Generator

The existing building has an existing Caterpillar 277/480V, 3-phase, 4-wire diesel standby
generator and emergency distribution system that is existing to remain and will not be modified
under this project.

The existing life safety system will be expanded to the remodeled spaces as required for
emergency egress lighting in the remodeled spaces.

There is no equipment branch emergency power required for this project.

C. Building Power Distribution

The existing pair of 3000 amp, 277/480V, 3-phase, 4-wire, switchboards (main-tie-main) are
existing to remain and will not be modified under this project.

Provide a new 277/480V, 3-phase, 4-wire panelboard and feeder in the mechanical penthouse to
serve the new lab equipment required under this project. Provide a new 200 amp breaker in the
existing space in distribution panelboard HD-9 and a new 200 amp feeder to serve the new
panelboard.

All panelboard busses shall be copper. Panelboards shall utilize bolt-on breakers. All distribution
equipment shall use circuit breakers.

All new conductors required for this project shall be copper. Wires 4/0 AWG and larger can be
copper or aluminum. Aluminum conduit shall be used in all specified non-ferrous construction
areas. Raceways in other areas of the building shall be rigid metal conduit, intermediate metal
conduit, electrical metallic tubing, or electrical non-metallic tubing (PVC), as indicated.
At a minimum, provide the following receptacles for each space specified below:

- 4 duplex receptacles (2 normal, 2 isolated ground) per new lab areas.
- Convenience duplex receptacles on 50’ centers for all corridor/connecting link/skyway spaces

Provide power connections to the following estimated pieces of equipment (estimated total load of 90 KVA):

1. (3) Stack exhaust fans ((2) 5 HP VFD, (1) 10 HP FVNR)
2. (4) (1) Fan power diffuser (1/3 HP)
3. (5) (1) Air Compressor (1 HP)
4. (6) (2) Upgraded Energy Recovery Unit Pumps (currently 3 HP, upgraded to 5 HP)
5. (7) Miscellaneous lab and manufacturing equipment provided by owner

D. Grounding
The existing grounding system is to remain and will not be modified under this project.

E. Lightning Protection
Expand the existing lightning protection system to include all new roof mounted mechanical equipment.

Lighting Systems

A. Interior Lighting
All fluorescent fixtures shall have electronic ballasts and utilize T-8 lamps, unless otherwise noted.

Remove the existing 2’-0” x 4’-0,” direct/indirect, metal, perforated center-basket, fluorescent light fixtures from the remodeled areas and turn over to the owner.

Provide chain-hung, 2-lamp, premium Industrial light fixtures in the following areas:

1. Mechanical Rooms

Provide 2’-0” x 4’-0”, recessed prismatic 3 lamp fixtures in the following areas:

1. Laboratory
2. Manufacturing
3. Laminar

Emergency egress lighting shall be through standard light fixtures connected to dedicated circuits from life safety panels. Egress levels will comply with code standards.

B. Lighting Controls
Provide new local line voltage wall switches for all remodeled spaces under this project.
Fire Alarm System

A. General

Provide new fire alarm initiating devices and notification appliances for the remodeled areas. Expand the existing Notifier AFP-400 addressable system to accommodate the new devices as required. Comply with University standards, NFPA, and the American’s with Disabilities Act Accessibility Guidelines (ADAAG).

Voice/Data Systems

A. General

Provide rough in only for new voice/data/telephone devices required. All cabling and equipment to be provided by owner.

Security Monitoring

A. General

Provide rough in only for new card readers at entrance to lab/manufacturing suite and mechanical room. All cabling and equipment to be provided by owner.

END OF NARRATIVE
DESIGN GUIDELINES

DISTRICT PLAN GUIDELINES  
Image/Architectural Character  
This remodel occurs within the existing building and do not affect the exterior of the building.

SITE GUIDELINES  
Access/Circulation  
The CMRR is a secure facility, both for the security of the research, as well as the safety of visitors and patients. Though it requires a controlled access, it will maintain an architectural dialogue with the campus.

Utilities  
The existing utilities will continue to service the building. No new services are proposed for this remodel.

ARCHITECTURAL DESIGN GUIDELINES  
Interior Elements  
The interior elements which occur in the existing CMRR would be incorporated in the remodeled spaces.

INFRASTRUCTURE  
The existing CMRR site is now served by university steam and electrical power. Each of the remodeled spaces will be supported by the infrastructure supporting the building.
Appendix

Preliminary Cost Estimate
Radiochemistry Lab Equipment Summary
Planning Schedule
## 065 RADIOCHEMISTRY LAB REMODEL

### MINNEAPOLIS, MN

**April 19, 2012**

### BUDGET ESTIMATE

**Estimate Report**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>TOTAL $'s</th>
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<tr>
<td><strong>FOUNDATIONS</strong></td>
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<tr>
<td>MASS EXCAVATION, BACKFILL &amp; COMPACTION</td>
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### 065 RADIOCHEMISTRY LAB REMODEL

#### MINNEAPOLIS, MN

April 19, 2012

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**BUDGET ESTIMATE**

**Estimate Report**

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065 RADIOCHEMISTRY LAB REMODEL
MINNEAPOLIS, MN

April 19, 2012

BUDGET ESTIMATE
Estimate Report

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