CONCEPT DESIGN UPDATE
DESIGN ANALYSIS
DOCUMENT

HALL D COMPLEX
CONVENTIONAL FACILITIES

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY (TJNAF)
NEWPORT NEWS. VA

Prepared for:

SOUTHEASTERN UNIVERSITIES RESEARCH ASSOCIATION (SURA)
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HSMM Commission No. 70095
SURA Contract No. 05-R180

28 February, 2006

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APPENDICES

Appendix A – Architectural Data
Appendix B -Summaries of Conference

I. GENERAL

A. Introduction

Hayes, Seay Mattern and Mattern, Inc. (HSMM) is providing architectural-engineering design services, under contract to Southeastern Universities Research Association (SURA), for the Hall D Complex Conventional facilities to support the 12 GeV Upgrade to the Thomas Jefferson National Accelerator Facility (TJNAF). The project consists of the design and construction of the required new facilities, and tunnels for connection to the existing linear accelerator at the Lab facilities located in Newport News, Virginia.

B. Overall Scope, Criteria and Direction

The project consists of the construction of the following structures and facilities:

- Hall D Experimental Hall and Collimator Enclosure
- Counting House (associated with Hall D)
- Tagger Area and Electron Beam Dump
- Cryogenics Plant and tank pads
- Photon Beam Line from Tagger Area to Collimator/Hall D
- Tunnel Extension from North LINAC to Tagger Area
- Gas Shed
- Service building(s)
- Necessary roads, sidewalks, retaining walls and utilities to support the complex

Hall D is a single story building, approximately 6000 square foot structure constructed of concrete and architectural metal panels, with a silicone coated

polyurethane foam roof. The building will be partially built below grade for radiation protection. Hall D will have stair access from the Counting House, provide access to the Collimator Enclosure, and also have a truck entrance with rollup door. The building will house experimental equipment weighing several hundred tons, and will include a 20-ton bridge crane.

The Collimator Enclosure is attached to Hall D and is constructed of concrete with additional radiation shielding. The Collimator Enclosure will be below grade and will contain several magnets and shielding weighing approximately 92 tons. Access to the Collimator Enclosure will be from Hall D by stairs.

The Counting House will be a single story building at grade and attached to Hall D by stairs and controlled entrance vestibule. The Counting House will be a slab-on-grade, metal-structure building with architectural metal panels. The building will contain office and support space, and a control room for use while running experiments in Hall D.

The Tagger Area will be a concrete structure located below grade which will house 2 magnets weighing approximately 40 tons each and a 13-to-14 meters long vacuum chamber and other equipment and sensors. Off of the Tagger Area will be an Electron Beam Dump, also located below grade and constructed of concrete. Personnel Access will be provided on the north side of the Tagger Area by means of a stair and tunnel.

A Cryogenics Plant Building will be located in close proximity to Hall D and will be a slab-on-grade, steel framed building with insulated architectural metal panels on metal stud framing with an insulated standing seam metal roof system. The building will house owner furnished and installed refrigerators, compressors and controls. Concrete pads will be provided adjacent to the Cryogenics Plant Building for liquid

nitrogen and helium gas storage vessels. Cryogenic lines will be run from the Cryogenic Plant Building to Hall D aboveground on supports.

A Photon Beam Line, consisting of a 10-inch pipe and concrete enclosure approximately 12 feet below grade will extend from the Tagger Area to the Collimator Enclosure.

A Tunnel Extension, constructed of concrete and large enough for personnel access, will extend from the existing North Linear Accelerator Tunnel to the Tagger Area for the purpose of running the beam line from the accelerator.

A Gas Shed Building will be located in close proximity to Hall D and will be a slab-on-grade, steel framed building with insulated architectural metal panels on metal stud framing with an insulated standing seam metal roof system. Concrete pads will be provided for tank storage. Gas storage will consist of both Owner furnished bottle and tank storage of gases such as methane, argon, carbon dioxide, ethane, hydrogen, perfluorbutane (C4F10), and tetrafluormethane (CF4).

A Service Building will be located in close proximity to the Tagger Area and Tunnel Extension. It will be a slab-on-grade, steel framed building with insulated architectural metal panels on metal stud framing with an insulated standing seam metal roof system. The building will be used to house electronic control racks for the Tagger Area and Tunnel Extension, the HVAC chillers and the LCW filtration system.

C. Documents

The following documents, as applicable, provide the overall scope and direction for the design of the project:

1. Criteria Developed Specifically for Hall D Complex Conventional Facilities

   a. Part I – Section C – Statement of Work (Final 12 January 2006)
   b. Part I - Section F – Period of Performance (Final 12 January 2006)
   c. Part I – Section H – Special Subcontract Requirements (Final 12 January 2006)
   d. Attachments:
      A – Criteria for Design and Computer Generated Drawings (Final 12 January 2006)
      B – Criteria for Developing Specifications (Final 12 January 2006)
      C – Criteria for Project cost Estimates (Final 12 January 2006)

2. Department of Energy (DOE) Directives.

   a. DOE Manual 420.1-1, Nonreactor Nuclear Safety Design Criteria and Explosives Safety Guide
   c. DOE STD-1021, Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components
   d. DOE STD-1066, Fire Protection Design Criteria
   e. DOE STD- 1098, Radiological Control
   f. DOE STD 3020-97, Specifications for HEPA Filters Used by DOE Contractors
   g. DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards

h. DOE Order 5480.7A, Fire Protection

i. DOE Order 5480.28, Natural Phenomena Hazards Mitigation

j. DOE Manual 5632.1C-1, Manual for Protection and Control of Safeguards and Security Interests

k. DOE/EH-0256T, Radiological Control Manual

l. DOE Order 6430.1A, General Design Criteria, April 6, 1989

m. Energy Policy Act of 1992

n. Executive Order 13123

3. Code of Federal Regulations (CFR)

a. 10 CFR 435, Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings

b. 10 CFR 830, Nuclear Safety Management

c. 10 CFR 835, Occupational Radiation Protection

d. 29 CFR Part 1910, Occupational Safety & Health Standards

e. 29 CFR Part 1926, Safety & Health Regulations for Construction

5. State of Virginia

a. Virginia Uniform Statewide Building Code, 2003 Edition, incorporating the International Code series, 2003 Editions.

6. SURA Documents

The Architect-Engineer has been provided with the following:

a. Jefferson Lab Title Block Drawing in AutoCAD 2000.

b. Division 1 Guide Specifications for Jefferson Lab – The Architect-Engineer will be responsible for editing these guide specifications for project specific information.

c. Subsurface Exploration and Geotechnical Engineering Analysis for Hall D dated July 13, 1999

d. Geotechnical Report for Beam Accelerator Facility (CEBAF) dated December 1987

e. Concept Drawings dated July 2005 including the Site Survey in AutoCAD

f. Hall D Complex Foundation Type Analysis prepared by DJG, Inc. dated July 2005.

g. Environmental Site Assessment (ESA), Phase I and II dated October 2005 – This ESA is for the SURA land that will be transferred to Department of Energy (DOE) in support of this project.

h. Record drawings of the Northeast end of the Accelerator Tunnel

i. Drawing of Beam Switchyard – 1st Section

7. American Conference of Governmental Industrial Hygienist (ACGIH)

ACGIH 2092, Industrial Ventilation: A Manual of Recommended Practices, 24th Edition

8. American Concrete Institute (ACI)

ACI-318, Building Code Requirements for Reinforced Concrete with Commentary

9. American National Standards Institute

   a. Accessible and Useable Buildings and Facilities, ICC/ANSI A117.1, 2003 Edition.
   b. ANSI/TIA/EIA-569-B, Commercial Building Standards for Telecommunications Pathways and Spaces, 2003.
   c. ANSI/TIA/EIA-606-A, Administration Standard for commercial Telecommunications Infrastructure, 2002.
   d. ANSI J-STD-607-A, Commercial building Grounding (Earthing) and Bonding requirements for Telecommunications, 2002.

10. American Society of Civil Engineers (ASCE)

   a. ASCE 7, Minimum Design Loads for Buildings and Other Structures

11. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

   a. 2003 HVAC Applications Handbook
   b. 2005 Fundamentals Handbook
   c. ASHRAE Standard 90.1-2004

12. American Society of Mechanical Engineers (ASME)

   a. ASME B31.3, Process Piping

13. American Society for Testing and Materials (ASTM)

   a. ASTM E84, Standard Test for Surface Burning Characteristics of

Building Materials

14. American Water Works Association (AWWA)

AWWA D100, Welded Steel Tanks for Water Storage

15. Factory Mutual (FM)

a. FM Data Sheet (DS) 5-4, Transformer
b. FM Data Sheet 1-22, Criteria for Maximum Foreseeable Loss Firewalls and Space Separation

16. Illuminating Engineers Society (IES) of North America

IES Lighting Handbook

17. International Code Council

a. International Building Code (IBC), 2003 Edition.
b. International Mechanical Code (IMC), 2003 Edition.
c. International Plumbing Code (IPC), 2003 Edition.
d. International Electrical Code (IEC), 2003 Edition – incorporating the National Electrical Code, 2002 Edition.
e. International Fire Code (IFC), 2003 Edition.

18. National Association of Corrosion Engineers (NACE)

a. NACE Standard RP-0169, Recommended Practice, Control of External Corrosion of Underground or Submerged Metallic Piping

Systems

b. NACE Standard RP-0285, R Recommended Practice, Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems

19. National Fire Protection Association (NFPA)

a. National Fire Protection Association (NFPA), as applicable, including the following:

b. NFPA 10, Portable Fire Extinguishers

c. NFPA 13, Sprinkler Systems

d. NFPA 15, Water Spray Fixed Systems

e. NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances

f. NFPA 30, Flammable and Combustible Liquids Code

g. NFPA 70, National Electric Code, 2002 Edition

h. NFPA 75, Protective of Electronic Computer/Data Processing Equipment

i. NFPA 77, Static Electricity

j. NFPA 72, National Fire Alarm Code

k. NFPA 80, Fire Doors and Windows

l. NFPA 90A, Installation of Air Conditioning and Ventilating Systems

m. NFPA 101, Life Safety Code

n. NFPA 221, Fire Walls and Fire Barrier Walls

o. NFPA 780, Lightning Protection Code

p. NFPA 801, Facilities Handling Radioactive Materials

s. NFPA 1141, Planned Building Groups

20. Sheetmetal and Air Conditioning Contractor's National Association (SMACNA)

SMACNA, HVAC Duct Design

21. Steel Tank Institute (STI)

a. STI -P3, Specifications and Manual for External Corrosion Protection of Steel Storage Tanks
b. STI RP-892, Recommended Practice for Corrosion of Underground Piping Networks Associated with Liquid Storage and Dispensing Systems

22. Underwriters Laboratories, Inc. (UL)

a. UL 96, Lightning Protection Components
b. UL 586, High Efficiency Particulate Air Filter (HEPA) Units
c. UL 900, Air Filter Units
d. UL 1746, Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks, Part 1

D. Updated Concept Design Submission

The Updated Concept Design submission documents and deliverables include the following:

1. Drawings
2. Outline Specifications
3. Design Analysis Document

4. Building Code Analysis Data Sheet
5. Estimate of Probable Construction Cost
6. Sustainable Design Report

E. Site Investigations

A site investigation was performed on 2 and 3 February 2006. A summary of conference is included in Appendix B.

F. Sustainability

The Department of Energy was a signer to a January, 2006 "Memorandum Of Understanding" (MOU) as result of the White House Summit on Federal Sustainable Buildings. The summit was to establish guiding principles of sustainability. The MOU's principles are five fold:

- Employ integrated design and commissioning.
- Cut energy costs by 30% versus ASHRAE 90.1-2004 and provide measurement and verification.
- Protect and conserve water (20% less than the Energy Policy Act of 1992.
- Enhance indoor environmental quality (thermal comfort, moisture control, daylighting, and low-emitting materials).
- Reduce environmental impact of materials (10% post-consumer recycled content, bio-based content, reduce construction waste at least 50%, and eliminate ozone-depleting compounds.

The TJNAF Solicitation, Offer and Award states that: "Energy conservation, green building principles, and sustainable design are included in the design requirements. The project will not be a LEED registered or certified project but shall incorporate the principles to the maximum extent possible within the project budget."

HSMM's design will carefully evaluate all systems of the project for compliance and cost implications. Construction waste management will be specified and required of the civil phase construction contractors in order to reduce waste and recycle materials. All construction materials will be evaluated for their performance, local availability, and recycle-ability. In the next design phases, HSMM will consider a variety of HVAC systems. Hour-by-hour computer simulations analysis will aid in the selection of practical options to establish minimal energy usage. Life-cycle cost analysis will be performed to validate the selections. Flow meters may be installed on utility lines to help monitor and validate design criteria if the construction budget permits. The project will require commissioning to validate performance of the building's systems and ensure proper operations. The commissioning team will be comprised of contractor and applicable subcontractors, the Resident Contracting Officer, and representatives of SURA. A preliminary LEED Version 2.2 Project Checklist is provided in the Architectural Appendices. A further narrative of LEED criteria follows:

Sustainable Sites

Construction Activity Pollution Prevention (Prerequisite 1)

Our design will meet all requirements of the prerequisite. Erosion and sedimentation control plans and pollution control plans will be prepared and implemented.

Site Selection (Credit 1)

The site does not encroach into prohibited areas. However, the retention pond is to be constructed under a separate contract. The credit may be questionable.

Alternative Transportation (Credit 4.1)

Access to public transportation is not directly available to the site since it is a secured site.

Alternative Transportation (Credit 4.2)

Since this is a secured location, bicycle facilities and showers are not planned to be incorporated. This credit may not be applicable to this Project.

Alternative Transportation (Credit 4.3)

Preferred parking for low emitting and fuel-efficient vehicles will be provided in the parking lot. A parking space can be so identified.

Alternative Transportation (Credit 4.4)

A parking space can be designated for car pool parking as a practical alternative for this Project.

Heat Island Effect, Non-Roof (Credit 7.1)

The provision of planting extensive landscaping and trees is not conducive to this Project. Therefore, the credit may not be applicable.

Heat Island Effect, Roof (Credit 7.2)

The roofing will be light reflective type.

Light Pollution Reduction (Credit 8)

Site lighting fixtures

Water Efficiency

Water Efficient Landscaping; Reduce by 50% (Credit 1.1)

Water efficient plantings will be used.

Water Efficient Landscaping, No Potable Use or No Irrigation (Credit 1.2)

No irrigation is anticipated. Therefore, the credit may be applicable. .

Water Use Reduction, 20% Reduction (Credit 3.1)

It is intended to reduce the potable water use in the building by 20% compared to the baseline model. This will be done by providing waterless urinals, low flow fixtures, and infrared faucets.

Energy & Atmosphere

Fundamental Commissioning of the Building Energy Systems (Prerequisite 1.1)

Commissioning will be required. TJNAF has anticipated this process. The credit will be applicable.

Minimum Energy Performance (Prerequisite 2)

The project will be designed in accordance with ASHRAE 90.1-2004.

Fundamental Refrigerant Management (Prerequisite 3)

It is intended that the selected and installed HVAC&R equipment for the building will not use CFC refrigerants.

Enhanced Commissioning (Credit 3)

It is the intent of TJNAF to conduct commissioning. However, the extent of commissioning has not been fully developed.

Enhanced Refrigerant Management (Credit 4)

It is intended to select and install HVAC equipment that will meet the requirements for this credit. The sum of [(LCGWP + LCODP x 10^5) x Qunit] / Qtotal will be less than or equal to 100 for the base building level HVAC equipment.

Materials and Resources

Storage & Collection of Recyclables (Prerequisite 1)

It is proposed that an area will be established by the Couinting House's Copy Area to store recyclables as necessary to satisfy Prerequisite 1.

Construction Waste Management, Divert 50% (Credit 2.1)

It is intended that 50% of construction waste will be diverted from landfills. This will be done by implementing salvaging techniques, recycling packing materials, and reusing construction materials when possible. The contractor shall record and document the amount of construction waste that is diverted from the landfills.

Recycled Content, 10% (post consumer + ½ pre consumer) (Credit 4.1)

It is the intended that selected building products incorporate recycled content materials, reducing impacts resulting from extraction and processing of virgin materials. Items include: Steel, Gypsum Board, Acoustic Ceiling Tiles, Masonry, Metals, and Ceramic Tile.

Recycled Content, 20% (post consumer + ½ pre consumer) (Credit 4.2)

It is the intent of this section "to increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials." Items to incorporate may include: steel, gypsum board, acoustic ceiling panels, masonry, metals, and ceramic tile. This goal may or may not be achievable for this Project.

Regional Materials, 10% Extracted, Processed & Manufactured Regionally (Credit 5.1)

It is intended that there will be an "increased demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation." It is intended that the steel structural frame as well as the steel roofing, doors etc. will be extracted, recovered and manufactured within a 500 mile radius of the project. Other items that we will explore will be, concrete, gypsum board, acoustic ceiling panels, ceramic tiles, insulated wall panels, etc.

Regional Materials, 20% Extracted, Processed & Manufactured Regionally Credit 5.2)

It is intended that there will be an "increased demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation." It is intended that the steel structural frame as well as the steel roofing, doors etc. will be extracted, recovered and manufactured within a 500 mile radius of the project. Other items that we will explore will be, concrete, gypsum board, acoustic ceiling tiles, ceramic tiles, insulated wall panels, etc.

Certified Wood, (Credit 7)

"Use a minimum of 50% of wood-based materials and products which are certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria, for wood building components". It is proposed that the wood blocking necessary for many locations in this project be so specified, but there is not an abundant amount that will be required..

Indoor Environmental Quality

Minimum IAQ Performance (Prerequisite 1)

The proposal will be designed in accordance with ASHRAE 62.1.

Environmental Tobacco Smoke (ETS) Control (Prerequisite 2)

Smoking will not be permitted in the building. Any designated smoking areas outside of the building will be located away from any building entrances or air intake systems.

Construction IAQ Management Plan, During Construction (Credit 3.1)

An Indoor Air Quality (IAQ) Management Plan will be developed and implemented during the construction and pre-occupancy phases of the building. If air handlers are used during construction, a filter with a Minimum Efficiency Reporting Valve (MERV) of 8 must be installed on all return grilles. Prior to occupancy, all filters must be replaced with MERV 13 filters. All absorptive materials either installed during construction or stored on-site will be protected from moisture damage.

Construction IAQ Management Plan, Before Occupancy (Credit 3.2)

An IAQ Management Plan may be developed and implemented for the pre-occupancy phase of the building that includes a two-week building flush-out period using 100% outside air and new MERV 13 filters. After the flush-out, the filters will be replaced with MERV 13 filters. This has not been included in this Project thus far

Low-Emitting Materials, Adhesives and Sealants (Credit 4.1)

The intent is to "reduce the quantity of indoor air contaminants that are odorous,

irritating and/or harmful to the comfort and well-being of installers and occupants". Items to explore will be: rubber or vinyl composition floor adhesive, ceramic tile adhesive, drywall and panel adhesive, cove base adhesive, multipurpose construction adhesives, plastic cement welding, abs welding, cpvc welding, pvc welding, metal to metal adhesives, plastic foams, porous materials, fiberglass, architectural non porous sealants, architectural porous sealants, etc.

Low-Emitting Materials, Paints and Coatings, (Credit 4.2)

It is intended to "reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants." Investigated items will include: paints, coatings and primers applied to interior walls and ceilings; anti-corrosive and anti-rust paints applied to interior ferrous metal substrates; floor coatings, sealers, etc. applied to interior elements.

Low-Emitting Materials, Carpet Systems (Credit 4.3)

Carpet systems of the Counting House will be specified to comply with these requirements.

Low-Emitting Materials, Composite Wood & Agrifiber Products (Credit 4.4)

Millwork and casework for thsiProject will be specified to comply with these requirements.

Indoor Chemical & Pollutant Source Control, (Credit 5)

It is intended to "minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants" We will "explore the use of permanent entryway systems at least 6 feet long in the primary direction of travel to capture dirt and particulates from entering the building at all entryways that are directly connected to the outdoors."

"Where hazardous gases or chemicals may be present or used, exhaust each space sufficiently to create negative pressure with respect to adjacent spaces with the doors to the room closed."

"In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media prior to occupancy that provides a Minimum Efficiency Reporting Value of 13 or better."

Controllability of Systems, Lighting (Credit 6.1)

Individual lighting controls will be provided for 90% of the building occupants.

Controllability of Systems, Thermal Comfort, (Credit 7.1)

The Project will be designed to comply with ASHRAE 55-1992. The design room temperatures for regularly occupied spaces will be kept within the temperature range for optimal thermal comfort.

Thermal Comfort, Verification (Credit 7.2)

A thermal comfort survey will be taken of the building occupants within six-18 months after occupancy. If more than 20% of the occupants are dissatisfied with

the thermal comfort of the building, a plan will be developed to solve the problem. This issue has not been directed by TJNAF as yet.

Daylight and Views, Views for 90% of Spaces (Credit 8.2)

"Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building." The Counting House as the only normally occupied space will be designed to provide a view to the outside from 90 % of the spaces within it.

Innovation & Design Process

Innovation in Design (Credit 1.1)

The Project has the potential to have such a system. This will need to be developed.

Innovation in Design (Credit 1.2)

The Project has the potential to have such a system. This will need to be developed.

LEED Accredited Professional, (Credit 2)

"At least one principal participant of the project team shall be a LEED Accredited Professional (AP)." HSMM has personnel meeting this qualification. Therefore, the credit will be applicable.

II ARCHITECTURAL

A. Criteria: General criteria for project design are listed in Section I, General. The following criteria are specifically applicable to the Architectural design.

1. Virginia Uniform Statewide Building Code (VUSBC), incorporating the International Building Code (IBC), 2003 Edition.

2. American National Standard, Accessible and Useable Buildings and Facilities, ICC/ANSI A117.1-2003.

3. National Fire Protection Association (NFPA):
   a. NFPA 10, Portable Fire Extinguishers.
   b. NFPA 30, Flammable and Combustible Liquids Code.
   c. NFPA 80, Fire Doors and Windows.
   d. NFPA 101, Life Safety Code.
   e. NFPA 221, Standard for Fire Walls and Fire Barrier Walls.

B. Architectural Design and Space Planning

1. General

The Hall D Complex will be comprised of four above ground buildings and tunnels system of approximately 18, 300 square feet. The purpose of the Hall D Complex is to provide a research facility for the testing and analysis of photons. The design will feature secure construction and is designed architecturally to meet the existing campus context and enhance functional operations and flexibility. The design approach is to accommodate equipment, processes, and functions. The Hall D Complex will be designed

to provide a modern and efficient environment.

2. Areas

Space	Net Area	Gross Area
Operational Areas:		
Counting House	3,300	3,793
Hall D	6,298	7,239
Tagger Area & Tunnel Extension	4,531	5,208
Support Areas:		
Cryo Plant & Gas Shed	900	1,066
Service Building	3,300	3,528
Total	18,329	20,834

3. Staffing

Production personnel of TJNAF will staff the Hall D Complex. They will conduct experimental research on photon light beams. Occupancy for the facility is projected at full-time staff of 10 people, working 24-hour, 7-day shifts while the experiment is in operation, to be housed in the Counting House. Support personnel will access the Cryo Plant and Service Building on an as needed basis. The Counting Room of the Counting House will be staffed on a 24/7 basis during the experiments with approximately 4 people therein. The office areas are designed for six student workers to perform data management activities in a semi-private format, office provisions for 2 visiting researchers in a semi-private format, and a meeting area in the same semi-private format. These spaces are equipped with open office type furniture. Other spaces are unoccupied, e.g. there are no assigned

workstations in them.

During non-experiment times, the Tagger Area and Extension Tunnel, and Hall D will be occupied with technicians who will make the necessary equipment modifications and set ups for the next experiment series. It is anticipated that 15 or fewer technicians will be present. However, during the initial equipment set-up and commissioning, approximately 50 technicians may be present.

4. Description of Spaces

a. Counting House

1) Open Office Area

Open Office Area will provide workstations for 6 students, two visiting researchers' workstations, and a Coffee/ Copy Alcove:

- Student Workstations (16 SF each).
- Researcher Workstations (64 SF each).
- Coffee Alcove with space for double sink and garbage grinder, refrigerator, microwave oven, coffee brewer and storage of supplies.
- Meeting space for 10 to 12 people.

2) Counting Room & Rack Room

Counting Room will provide space for control consoles and monitors. Rack Room will provide room for 12 racks. The entire area will have an accessible floor system.

The Counting Room will have 3 to 4 people on a 24 hour/ 7 day a week basis during operation of experiments in Hall D.

3) Support facilities

Support facilities of the Counting House will include a unisex toilet room, telephone/communications room, and mechanical/electrical room.

b. Hall D

1) Hall D:

Hall D will house the Glue X Machine and the photon beam path. A 20-ton bridge crane will be provided above. The hall will allow emergency and maintenance egress directly to the exterior at the southeast corner through TJNAF provided shielding and a stair access with a dumbwaiter to the Counting House. A coil-up access door in the southeast corner of the hall is also provided to facilitate equipment installation and reconfigurations.

2) Collimator:

The Collimator Room will encapsulate the photon beam and will contain various shielding materials. Access to the Collimator will be from a stair and landing, with a labyrinth shielded tunnel and a wire mesh access door.

c. Tunnel Extension & Tagger Area

1) Tagger Area:

The Tagger Area will house the Tagger which separates the electrons from the photons in the beam. An electron beam dump is provided with shielding to be provided by TJNAF. The hall will allow emergency and maintenance egress directly to the exterior at the southwest corner through TJNAF provided shielding and a stair access with a dumbwaiter to grade above. A coil-up access door is also provided to facilitate equipment installation and reconfigurations.

2) Tunnel Extension:

The Tunnel Extension will connect the Tagger Area to the existing Accelerator Tunnel. It will contain the beam and bending magnets which will realign the beam through the Hall D Complex. The Tunnel Extension cannot have direct line of sight to the existing Accelerator Tunnel system for shielding reasons. Therefore, the Tunnel Extension floor will

slope up at an approximate 10% incline starting in the existing Accelerator Tunnel Extension to a point in the new Tunnel Extension. The new Tunnel Extension floor is raised higher than the adjacent Tagger Area floor to accomplish this visual shielding separation.

d. Cryo Plant

1) Cryo Plant

The Cryo Plant will house the cryogenics plant and equipment. The building will generally be unoccupied except for maintenance. The equipment will generate excessive noise. A coil-up access door will provide access to install and maintain the equipment.

2) Gas Shed

A separate Gas Shed building will house bottled and cylinder gases and piping manifolds. The building will generally be unoccupied except for maintenance. There will also be concrete pads for exterior located hydrogen and perfluorbutane C4F10 tanks.

c. Service Building

1) LCW System:

The Low Conductivity Water (LCW), Chilled Water (CHW),

and Condenser Water (CW) systems will be housed in the Service Building. The LCW system will cool, filter, polish and circulate the LCW water used in the Hall D Complex. A coil-up access door will provide access to install and maintain the equipment. The room is not normally occupied.

2) Beam Diagnostics, Computer Racks, Trim Magnets & PSS:

This room will house a variety of components relative to the Tagger Area and Tunnel Extension. It will provide the power and communications feeds to these areas. A coil-up access door is also provided to facilitate equipment installation, maintenance and reconfigurations. The room is not normally occupied.

C. Project Classifications

The Hall D Complex is classified as Group B, Business, occupancy per the VUSBC, International Building Code (IBC), and NFPA 101, Life Safety Code. The Service Building and Cryo Plant are classified as Use Group F-1, Factory, occupancy per VUSBC, IBC and NFPA 101.

D. Safety Controls

Access to the Tagger Area and Hall D coil-up doors will be considered as restricted access. Access through the man-doors adjacent to the coil-up doors and through the stair access in the Tagger Area and Hall D will be considered as controlled access with proximity readers and electro-magnetic locks.

E. Demolition

The existing cast-in-place concrete cap over a portion of the existing accelerator tunnel extension will be removed for connection of the new Tunnel Extension.

F. Fire Safety

It is intended that all buildings and spaces will be equipped with fire sprinkler protection. See Fire Protection under Mechanical.

Doors and ducts penetrating fire-rated separations will be fire-rated accordingly, ¾-hour in 1-hour partitions.

All penetration fire seals within the Hall D Complex will be Fire and Temperature rated fire seals.

G. Future Expansion

Future expansion is not anticipated.

H. Accessibility

The facility is designed for accessibility for the disabled in the Counting House only. All other buildings are considered as process areas and therefore are not intended for accessibility by the disabled.

I. Architectural Systems

1. Building Envelope

The building envelope is reinforced concrete up to specific heights as indicated on the drawings with architectural metal panels on sheathing on metal stud back-up walls on steel framing at Hall D. All other above ground buildings will be architectural metal panels on sheathing on metal stud back-up walls on steel framing. Service entries and emergency exits will have heavy-duty hollow metal doors and frames, painted. Insulated steel coil-up doors, painted, will be provided for access to Hall D and the Tagger Area. The exterior drive-up concrete ramps will have exterior concrete caps above the coil-up access doors and man doors to provide a radiation shield over the TJNAF installed shielding blocks.

The exposed exterior wall finish for above ground buildings is an architectural metal wall panel system with batt insulation in the metal stud back-up , U-value = 0.124, minimum. The major roofs will be silicone coated, spray foamed, U-value = 0.065, minimum, on metal decks and steel framing. Minor roofs will be either silicone coated spray foam roofing or insulated metal roof systems on metal framing.

Those portions of the construction that are below grade will be encapsulated in waterproofing. This will include the tunnel extension, Tagger Area, and Hall D. The water table is approximately 5 feet below current grade or at approximately elevation 25 foot above sea level. It is intended to use a sheet applied elastomer. Over a mud-slab, the sheet membrane will be laid out, and then the structural floor slab will be placed. When the concrete walls and top concrete slabs are placed and cured, the same sheet membrane will be

applied, lapped and sealed with the initial sheet membrane. The system will be tested for leakage. A protection board layer will be placed over the membrane before backfilling. It will be imperative that the new system be compatible with the existing system for tie-in at the existing tunnel extension.

2. Interior Systems

All interior walls and partitions in the Counting House and Service Building will be gypsum board on metal studs with acoustical insulation in the stud space. Ceilings in the Counting House will be acoustic lay-in panels on a suspended metal grid system. Typical ceiling height in the Counting Room will be 10' – 0" while in the remainder for the Counting House it will be 9'-0". As required by DOE Orders 420.1 and 6430.1A, finishes in each process bay, decontamination areas, and support areas will be of such design and application as to readily be decontaminated in the event of radioactive material being deposited on these surfaces in the event of an accidental release. The walls and ceilings will be two-part epoxy enamel paint system, and the floors will be seamless urethane making it possible to wash down any contamination. New urethane flooring will match existing seamless flooring. Doors and frames within the Hall D Complex will be hollow metal, painted with the epoxy enamel.

Doors to the Counting House's Vestibule will be storefront aluminum and glass. All other exterior man doors will be insulated hollow metal doors in hollow metal frames. Remote Access Panels (RAP) will be provided at these doors. All exterior doors will be provided with exit device panic hardware with exterior locking lever handles, hinges, closers, weather-stripping and electro-magnetic locks.

All interior doors, except the interior Counting House's Vestibule doors, will be hollow metal door and frames, fire rated where required at stairs and dumbwaiters. Remote Access Panels (RAP), electro-magnet locks, panic hardware exit devices and closers will be provided at stair and vestibule doors. All doors will have ADA compliant lever handles, hinges and closers. Doors and frames at dumbwaiters will be interlocked with the dumbwaiter operation.

Architectural casework will be plastic laminate covered counter tops, wall and base units. Casework will be provided in the Counting House at the Coffee/Copy Area, window sills, and toilet room vanity.

Open office furniture will be modular systems furniture.

Dumbwaiters with a capacity of at least 200 pounds will be provided at the interior stair interlock vestibules for the Tagger Area and Counting House/Hall D. They will be installed in fire rated enclosures with hollow metal doors and frames interlocked to the dumbwaiter operation.

3. Signage

The following signage will be provided: General Interior – room number, room identification, door number Warning and Emergency – radiation areas, exits, electrical hazards, chemical hazards (interior and/or exterior), and waste accumulation postings. Radiation Contamination signage will be furnished by TJNAF for installation by the Contractor.

J. Security

The Hall D Complex will be established as a new security area to control and detect unauthorized access. The walls, doors, locks, and detection systems will meet requirements of DOE Manual 5632.1C-1, Safeguards and Security Standards and Criteria. Door alarms will be provided on all exterior doors, as required by DOE Manual 5632.1C-1, Chapter IX, section 3, (b) (1). Additionally, the alarm and access control features will meet the requirements set forth by the existing security system.

All wall penetrations into the Hall D Complex will be reviewed, inspected, and/or installed per DOE Manual 5632.1C-1.

K. Life Safety/Means-of-Egress Analysis

The Life Safety/Means-of-Egress Analysis is provided in Appendix A, Architectural Data.

L. Drawings

The revised conceptual design drawings are included as a separate publication.

M. Design Assumptions

The following assumptions have been made to complete this submittal:

- Assume the revised Tagger Area Scheme 'B' sketch issued for review and comment on February 13, 2006 is the desired plan.
- Assume the revised Counting House Scheme 'A' sketch issued for review and comment on February 13, 2006 is the desired plan.

- Assume the revised finished floor elevations as discussed at the February 2 & 3, 2006 conceptual design meetings and as listed on the Beam Line/Floor Elevations spread sheet issued on February 16, 2006 are desired. Note that HSMM has received supplemental information on February 24th, too late to incorporate into the Revised Concept Drawings. HSMM acknowledges this information (Revised Beam Line Dimensions, Rev C; additional Electron Beam Dump criteria; acceptable Tunnel Extension slope; location of the Beam Line in relation to the Tunnel walls; and lifting plate requirements in the Tunnel Extension for the bending magnets.

N. Required Information

The following information is required to complete the design:

- Acceptance of this revised Conceptual Design Report and accompanying revised drawings.
- Acceptance of radiation shielding and separations as depicted on the revised Concept Drawings.
- Verification of the existing tunnel extension's waterproofing system material for compatibility of the proposed new system.

III. CIVIL

A. Criteria: General criteria for project design are listed in Section I, General. The following criteria are specifically applicable to the civil design:

1. Virginia Department of Transportation (VDOT), "Road and Bridge Specifications and Standards"

B. Siting and Layout

The proposed facility will be located in the eastern portion of the property at the east end of the north linac. All site work will be with reference to the east horizontal control point which is the center of the east arc of the accelerator tunnel. Existing building 39 is at the approximate point of tangency along the tunnel. The proposed facility will be an extension of the existing tunnel starting at building 39 and will extend east.

C. Site Work

Site work for the facility includes locating the buildings to accommodate the needs of the facility, roadwork, parking and sidewalks, site grading and drainage, earthwork, and security fencing.

A service road will be constructed to access the Hall D Complex. The service road will accommodate two-way traffic and will connect to the loop road in two locations to allow for ease of maneuverability of large trucks delivering supplies and gases to the facility. The service road design will allow an AASHTO WB-50 design vehicle (i.e. truck semitrailer) to maneuver anywhere within the complex. The anticipated large truck route is clockwise from the east end of the North LINAC around Hall D

and back to the east end of the loop road. Parking will be provided at the Service Building and the Counting House adjacent to Hall D.

D. Site Preparation

Site preparation will include clearing and grubbing the wooded area of the Hall D complex site, installing erosion and sediment control measures such as silt fence, and installing a security fence.

E. Paving

The paving is designed in accordance with VDOT design standards.

F. Grading and Drainage

The site will be graded to accommodate the Hall D complex, which includes minimal grading to the north, a berm over the beam line and a depressed area to the south. The south portion of the Hall D complex is approximately 10 feet below the north portion. Truck ramps access the below-grade portion of the buildings which are approximately 10 feet below the site grade on the south side. A retaining wall will be constructed on the south side of the access road to accommodate this required grade. Because the grade to the south and the truck ramps are significantly lower than the existing grade, the stormwater runoff from these areas will be pumped up to existing grade to the south and will discharge to a gravity system. This gravity system will then convey the runoff to the retention pond. The runoff to the north of the buildings will be conveyed via gravity storm drain to the retention pond.

The required berm over the beam line will be constructed as presented in the drawings. Where existing and new facilities do not allow full use of the earthen berm retaining walls will be used as earth detention and shielding.

G. Earthwork

Cut material from the retention pond and the southern portion of the Hall D complex will be used in fill areas and in construction of the berm over the beam line. It is anticipated that there will be enough borrow material from these areas to "balance" the site. Should further design indicate other borrow or waste areas are required other grading schemes will be considered rather than considering off-site sources.

H. Security Fence

The fence will totally enclose the construction site and lay-down area with gates for access. The fence shall remain a permanent site feature to maintain security within certain limits of the complex while the beam line is active.

I. Utilities

Water: Domestic and fire water will be supplied to the Hall D complex by connection to the existing water main on-site. Fire hydrants will be located along the new water main in easily accessible locations from the access road.

Sanitary Sewer: Sewerage will be collected and pumped by force main from pump stations within the buildings as required. The force mains will combine and discharge to an existing sanitary sewer manhole on-site.

J. Landscaping

Native grasses will be used to establish vegetation and control erosion at all disturbed areas not to receive pavement.

A landscape berm 3-4' tall will be provided along the eastern property line parallel to Canon Boulevard. The Berm will be planted with evergreen trees, shrubs and deciduous trees to provide a visual buffer from the public road onto and into the site. The berm will be constructed with topsoil removed during the grading of the site.

In addition, foundation plantings consisting of evergreen and deciduous shrubs will be provided around the Counting House. Shade trees will be provided at the parking lot.

K. Calculations

None for this submittal.

L. Drawings

Drawings are included as a separate publication for the Updated Concept Design submittal.

M. Required Information

Require a true survey with correct coordinates not rotated, translated or scaled. Also require survey control points and preferably survey point data.

IV. STRUCTURAL

A. General criteria for the project design are listed in Section I, General. The following criteria are specifically applicable to the structural design:

1. ACI 318-02, Building Code Requirements for Structural Concrete

2. AISC Manual of Steel Construction – Allowable Stress Design, 9th Edition

2. ASCE 7-02, Minimum Design Loads for Buildings and Other Structures

3. AWS D1.1: 2000, Structural Welding Code- Steel

B. Analysis and Design Loads

1. Dead Loads: In accordance with ASCE 7-02.

2. Floor Live Loads: In accordance with ASCE 7-02 and as follows:

   Slab-on-Grade: 250 psf

3. Minimum Roof Live Load: 20 psf

4. Snow Loads

   Ground Snow Load: 15

5. Wind Loads

Basic Wind Speed (3-Second Gust): 100 mph

6. Seismic Loads

Design Category C
Site Class E or D

7. Load Combinations

In accordance with ASCE 7-02.

8. Horizontal Loads on Interior Walls and Partitions

5-psf minimum, in accordance with IBC 2003, Section 1607.13.

C. Materials

1. Concrete

ACI 318, 4,000-psi minimum 28-day compressive strength for all concrete. Type I or II portland cement; maximum 25% fly ash by weight of cementitious materials. Air-entrain all concrete exposed to weather in the finished structure.

2. Reinforcing Steel

Reinforcing bars: ASTM A615, Grade 60, deformed bars.

3. Structural Steel

ASTM A992 for wide-flange members; ASTM A36 for angles, channels, plate, and threaded round stock; ASTM A53, Grade B, for pipe; ASTM A500, Grade B, for rectangular hollow structural sections (HSS).

4. Bolts

Anchor Bolts:	ASTM F1554, Grade 36
Framing Bolts	ASTM A325-N

D. Geotechnical Subsurface Investigation

Geotechnical characteristics are gleaned from the Report of Subsurface Exploration and Geotechnical Engineering Analysis, July 13, 1999, by ECS, Ltd (ECS Project No. N3489).

E. Photon Beam Direct Burial Encasement

The geotechnical report prepared in 1999 by ECS estimates that for structures on mat slabs founded on Yorktown Formation soils, settlement will be about one inch. Generally differential settlement is estimated to be about half of the total settlement.

The Conceptual Design provided by SURA shows the photon beam being contained in a six-inch pipe between the tunnel extension and the collimator. Given that the predicted settlement is one inch, centering the photon beam in a

six-inch pipe enclosure appears sufficient. This provides a three-inch space around the photon beam on all sides. If either Hall D (and the collimator) or the tunnel extension settle the full one inch, there are still two inches of space between the beam and the inside of the enclosure pipe. If the pipe enclosure were to settle an additional inch, which is a conservative assumption given that differential settlements are generally on the order of one half of the maximum settlement, that would still leave an inch of clearance between the beam and the inside of the pipe enclosure.

Given the critical nature of maintaining beam alignment and the difficulty of adjusting the alignment once the pipe enclosure is in place, we recommend that the pipe enclosure be ten inches inside diameter rather than six.

F. Calculations

Calculations are provided in Appendix C.

G. Drawings

Drawings are not provided for the Updated Conceptual Design.

V. MECHANICAL

A. Heating, Ventilating, and Air Conditioning (HVAC)

1. Criteria: General criteria for project design are listed in Section I, General. The following criteria are specifically applicable to the HVAC design.

a. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1) Duct Construction Manuals
2) Seismic Design Manual

a. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

1) Fundamentals Handbook, 2005

2) HVAC Applications Handbook, 2003

3) ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality

4) ASHRAE Standard 90.1-1999, Energy Standard for Building Except Low-Rise Residential Buildings

c. Virginia Uniform Statewide Building Code, 2003 Edition, incorporating the International Mechanical Code (IMC), 2003 Edition

d. National Fire Protection Association (NFPA) Standards:

1) NFPA 90A, Installation of Air Conditioning and Ventilating Systems, 1999

2. General Requirements:

a. All systems will be designed to allow access for operation, maintenance and repairs.

b. All systems will be labeled in accordance with TJNAF labeling standards.

3. Design Conditions:

a. Temperature and Humidity:

OUTDOOR DESIGN TEMPERATURES (DEGREES F)

Function	Dry Bulb	Wet Bulb
Summer outdoor design	95°F	78°F
Winter design	18°F	N/A

NOTE: The above temperatures are based on the ASHRAE Fundamentals Handbook, 0.4% values for cooling and 99.6% values for heating.

Miscellaneous Outdoor Design Data

3549 heating degree days (Base 65)

5247 cooling degree days (Base 50)

37.13 N latitude

INDOOR DESIGN CONDITIONS

Space	Summer Temperature, Degrees F	Summer Relative Humidity	Winter Temperature, Degrees F	Winter Relative Humidity
Hall D	70	40-60%	70	40-60%
Tunnel Extension	85	60% Max(1)	60	60% Max(1)
Tagger Area and Beam Dump	70	40-60%	70	40-60%
Counting House (Rack Area)	65	40-60%	65	40-60%
Counting House (Remainder)	72	40-60%	72	40-60%
Service Bldg (Electrical Side)	80	UC	50	UC
Service Bldg (Mechanical Side)	105	UC	50	UC
Cryogenics Building	105	UC	50	UC

UC = Uncontrolled

Notes:

1) System will be designed to maintain humidity in this range. However, system will not have humidification capability, so in winter, when outside air humidity is lower than design, indoor humidity may fall below target.

b. Personnel Load

Only the Counting House will have a normal staff of 12-15 people. All other spaces will normally be unoccupied. Heat gain associated with personnel will be assumed to be 250/200 Btuh sensible/latent for office workers . Source: ASHRAE 2005 Fundamentals Handbook, Table 1, page 29.4.

c. Occupancy Schedule

The facility operates 24 hours per day, 7 days per week. Night-time and second shift staff at the counting house will be reduced to 4-5 people.

d. Equipment Heat Release

See load summary table below.

LOCATION/TYPE OF LOAD		LCW LOAD		CW LOAD		CHW LOAD		REMARKS
		KW	GPM	KW	GPM	KW	GPM	
								All flows assume 10°F DT unless otherwise noted.
TUNNEL EXTENSION								
	Trim Magnets	144	98					Load on extension of existing LCW system; does not

								count towards capacity of new LCW system.
	Room HVAC					21	14	Estimate
TAGGER AREA								
	Tagger Magnet	68	46					85% of 80 KVA
	Tagger Magnet					8	5	10% of 80 KVA; Magnet's contribution to HVAC Load
	Rack HVAC					12	8	
	Room HVAC					11	7	2W/SF lights; 1 W/SF envelope; 1 W/SF Misc
ELECTRON BEAM DUMP								
	Dump Skid	54	37					90% of 60 KW; TJNAF's water estimate was 30 GPM
	Dump HVAC					6	4	10% of 60 KW; Dump's contribution to HVAC Load
	Rack HVAC					2	1	
	Room HVAC					3	2	2W/SF lights; 1

								W/SF envelope; 1 W/SF Misc
SERVICE BUILDING								
	Trim Magnets PS	16	11					10% of 160 KVA Power Supply
	5 x 2 kW Racks					10	7	Part of HVAC Load
	10 x 0.5 kW Racks					5	3	Part of HVAC Load
	Tagger Magnet PS	8	5					10% of 80 KVA Power Supply
	Trim Magnets PS					8	5	5% of 160 KVA Power Supply; Unit's contribution to HVAC Load
	Tagger Magnet PS					4	3	5% of 80 KVA Power Supply; Unit's contribution to HVAC Load
	Room HVAC					16	11	400 SQ. FT /Ton + 1W/SF Misc
CRYO BUILDING								
	Cryo Compressors			215	146			
	Cryo Refrigerator				6			
	Cryo Vacuum System				2			

COUNTING HOUSE								
	12 x Counting Racks					120	82	10 kW per Rack
	2 x PSS Racks					1	1	0.5 kW per Rack
	15xPC					2	2	PC's In Computer Room; 155 W per PC
	4xPC					0.8	1	PC's Outside Computer Room; 200 W per PC
	Building HVAC					42	29	300 SQ. FT /Ton + 1W/SF Misc
HALL D								
	Listed Equipment					249	169	Meeting Handout From Chris Cuevas
	Subtractions from List					-40	-27	Email of 2/14/06
	Solenoid PS	67.5	46			7.5	5	75 kVA per Email of 2/14/06; 90% Load to LCW; 10% Load to Spot Cooler
	Pair Spectrometer PS	171	116			19	13	190 kVA per Email of 2/14/06; 90% Load to LCW; 10% Load to Spot Cooler

	Collimator Magnet PS					10	7	Email of 2/14/06
	Building HVAC					78	53	300 SQ. FT /Ton + 1W/SF Misc
SUBTOTAL		385	261	215	154.2	594	404	
ADD LCW LOAD TO CW LOAD				385	261			LCW adds directly to Condenser Water Load
ADD CHW LOAD TO CW LOAD					505			CHW load adds to Condenser Water Load at 3.0/2.4 Ratio
TOTAL			261		921		404	
CONVERT TO TONS							168	TONS

e. Ventilation

Counting House: The minimum requirement for outdoor air is 20 cfm per person. Additional outdoor air will be provided to meet pressurization and exhaust requirements.

Service Building: Normal ventilation of 0.05 cfm/square foot (minimum) will be provided in accordance with the mechanical code.

Other Buildings: All other spaces will be normally unoccupied, irradiated spaces when the beam is on. Therefore no normal ventilation will be provided. Special ventilation exhaust fans will be

provided for intermittent use during beam shutdown when maintenance and experiment modification is being undertaken. The purpose of the fans will be to sweep out welding and other fumes generated by maintenance and construction activities. In Hall D and the Tagger Area, exhaust will be via HEPA filter banks to limit release of radioactive materials to the atmosphere. Exhaust volume shall be per TJNAF direction. The air conditioning systems will not be sized to maintain conditions when ventilation is on, so there will be a loss of temperature/humidity conditions when the ventilation is in use.

f. Filtration

Standard air filter efficiencies shall be based on ASHRAE Test Standard 52.2-99. HEPA filters will be required to comply with UL-586.

HVAC systems will be provided with standard 30% efficient, pleated media throw-away filters.

Special exhaust systems will be provided with HEPA filters as noted above. All contractor furnished HEPA filters will be 99.9% efficient, with 30% efficient pre-filters. Per TJNAF, the HEPA filter banks do not have to be bag-in/bag-out type nor do they need to be DOP tested for integrity.

4. System Descriptions

a. Site Utilities:

1) Existing 8" underground chilled water pipe in the vicinity of building 49 will be removed. New pipe will be laid re-routing chilled water flow around the tunnel extension. The new pipe will be pre-insulated, direct bury type with a PVC carrier, polyurethane insulation, and PVC jacket.

Since the existing chiller water systems allow flow to approach building 49 from either direction, it is not necessary to provide temporary chilled water lines while the new work is being installed – a simple cross-connect from supply to return at the break point will suffice.

2) New chilled water (CHW) piping will be provided between the new service building and the other buildings of the Hall D complex. The mains will be 6"; branches will be smaller. This pipe will be routed above ground as much as possible. Where above ground, the pipe will be black steel with fiberglass or polyurethane insulation and an aluminum jacket. Where below ground, the new pipe will be pre-insulated, direct bury type with a PVC carrier, polyurethane insulation, and PVC jacket.

3) New condenser water (CW) piping will be provided between the cooling towers and the new service building and between the service building and the cryogenics building. The tower piping will be approximately 8"; the cryo piping will be 4". This pipe will be entirely above ground. The pipe will be black

steel or copper with fiberglass or polyurethane insulation, an aluminum jacket, and electric heat tape for freeze protection.

4) Tunnel Extension: A new air handling unit (chilled water cooling and electric heat) will be provided. This unit will have dehumidification controls. Ductwork will be minimal. Chilled water piping will be extended to the new HVAC unit. Condensate drains will be led to a location to be determined. Existing stainless steel LCW piping mains will be extended into the area for later connection to experimental equipment by TJNAF personnel.

5) Tagger Area and Beam Dump: A new air handling unit (chilled water cooling and electric heat) will be provided. A redundant backup unit will also be provided. Ductwork will be minimal. An inline exhaust fan with HEPA filter bank will be provided as described above. Matching louvers, goosenecks or other arrangements will be provided for air intake and exhaust. Chilled water piping will be extended to the new HVAC units. Condensate drains will be led to a gravity drain system for collection. New LCW piping mains will be extended into the area for later connection to experimental equipment by TJNAF personnel.

6) Service Building: The electric room will be air conditioned. A new air handling unit (chilled water cooling and electric heat) will be provided for this purpose. Ductwork will be minimal. Chilled water piping will be extended to the new HVAC unit. Condensate drains will be led to grade outside. New LCW

piping mains will be extended into the area for later connection to experimental equipment by TJNAF personnel.

The mechanical room will not be air conditioned. Instead, propeller type exhaust fans will be provided to draw air through the space in summer. They will be controlled by thermostats. Matching louvers or other air intakes will be provided. Electric unit heaters will be provided for winter heating.

The mechanical room will house the chilled water plant, portions of the condenser water plant, and the LCW plant. The chilled water plant will consist of two (2) chillers (one operating and one standby backup), two (2) chilled water pumps (one operating and one standby backup), piping and supporting accessories. The chillers will be water-cooled centrifugal type, utilizing R-134A refrigerant. Estimated size of each chiller: 170 tons. Estimated size of each pump: 410 GPM. "Chilled water" will be a 30/70 propylene glycol/water mixture for freeze protection. The system will be designed for variable primary flow. A refrigerant monitor will be provided to activate the exhaust fans in the event of a refrigerant leak, per ASHRAE 15.

The condenser water plant will consist of two (2) induced draft cooling towers (one operating and one standby backup) located outside, two (2) condenser water pumps (one operating and one standby backup) located inside, piping and supporting accessories. Estimated capacity of each tower: 4605 MBH. Estimated capacity of each pump: 920 GPM.

The towers will have variable speed fans for capacity control, and basin heaters for freeze protection. Tower construction will be galvanized steel with plastic fill and distribution system. Exterior piping between the towers and the building will be insulated and heat traced.

7) Cryogenics Building: The cryogenics building will house cryogenics equipment provided by TJNAF. Condenser water piping will be extended into the building for later connection by TJNAF personnel. Two (2) approximately 6000 cfm exhaust fans will be provided with matching intake louvers. These fans will be controlled by thermostats. Electric unit heaters will be provided for winter heating.

8) Counting House: The counting house has three locations requiring different temperature controls. The first is the rack room – an interior space with a large internal load maintained at specific humidity and temperature conditions. The temperature will be colder than in other portions of the building. The second location is the computer room/workstation area – also an interior space with a large internal load maintained at specific humidity and temperature conditions. The temperature will be warmer than the rack room. The third location is the open office/meeting area – a perimeter space with significant internal and envelope loads.

A separate air handling system will be provided for each of these three locations. For the first two locations, a "computer room unit" (CRU) will be provided for each location, with a

standby backup CRU. (Total four (4) units: one for each location plus backups). CRU's are integrated systems with built-in cooling, heating, dehumidification and humidification functions. The CRU's will utilize chilled water cooling and electric heating. For the third location, a standard air handling unit, chilled water cooling and electric heat, but without dehumidification or humidification controls, will be provided. It will not have a backup unit.

Exhaust fans will be provided for the toilet and kitchen areas.

Ductwork will be minimal. Chilled water piping will be extended to the five new HVAC units. Condensate drains will be led to grade outside.

9) Hall D: A new air handling unit (chilled water cooling and electric heat) will be provided. A redundant backup unit will also be provided. The air handlers will be sized to cover the envelope and lighting loads, plus a safety factor. The units will not be sized to cover the large internal loads from the experimental equipment.

Ductwork will be minimal. An inline exhaust fan with HEPA filter bank will be provided as described above. Matching louvers will be provided for air intake.

Chilled water piping will be extended into the building and around the perimeter, with branches to the new HVAC units and approximately fourteen (14) 2" branches, or "drops" for

later connection to spot coolers to be provided by TJNAF personnel. Each drop will have an isolation valve, balance valve, and cap. Condensate drains will be led to a gravity drain system for collection. New LCW piping mains will also be extended into the building for later connection to experimental equipment by TJNAF personnel.

5. Piping Materials:

Above-ground chilled water piping will be welded black steel in the larger sizes (3" and larger) and type L copper in the smaller sizes. Insulation will be fiberglass or polyurethane with vapor barrier. In outdoor locations, an aluminum jacket will be provided. In indoor locations, standard all-service jacket will be provided.

All underground chilled water piping will be pre-insulated, direct-bury type with PVC carrier pipe, polyurethane insulation, and PVC jacket.

Condenser water pipe will be the same as above-ground chilled water pipe.

Condensate drains will be PVC with polyurethane insulation.

6. Duct Materials:

All ductwork will be G90 galvanized steel constructed to SMACNA standards. Supply ductwork will be externally insulated with fiberglass insulation, vapor barrier and all-service jacket. Return ductwork will be similarly insulated where it passes through plenums, mechanical or other spaces with a normal ambient temperature greater than the space served by the ductwork. Exhaust ductwork will be uninsulated.

7. Controls:

All new controls will be Direct Digital type (DDC). All controls will be Honeywell, based on the ASHRAE BACNet standard.
HVAC controls will be interlocked with associated radiation and fire alarm systems where required. The nature of these tie-ins remains to be determined.

8. Parameters:

Operating temperatures will be as follows:

Operating Temperatures

	Degrees F	
Media	Supply	Return
Chilled Water	42°F	52°
Condenser water	85°	95°

9. Life Cycle Cost Analysis:

The systems described above will be the baseline alternative for the life cycle cost analysis. Additional alternatives will include:

1.) Provision of a water-side economizer, consisting of a plate-and-frame heat exchanger installed in parallel with the chillers, and appropriate controls. During the winter months, this will permit generation of chilled water without running the chillers, resulting in significant energy savings.

2). Substitution of LCW or chilled water for condenser water to the cryogenics plant. This could result in significant material savings.

3). Use of screw chillers in lieu of centrifugal chillers. These chillers are not available in R-134A, but are available in R-407C and R-410A versions.

4). Use of Reverse Osmosis waste water for cooling tower makeup.

B. Plumbing

1. Criteria: General criteria for the TJNAF project design are listed in Section I, General. The following criteria are specifically applicable to the plumbing design:

a. IPC 2003, International Plumbing Code

2. Water Distribution

Potable water shall be supplied from the new site water piping and shall be supplied to the plumbing fixtures in the Counting House and also to Hall D and the Service Building for miscellaneous use. Protection of the potable water supply from contamination caused from either backflow or backpressure will be provided by an RPZ backflow preventer installed in the Service Building Mechanical Room and also in the Counting House Mechanical Room.

3. Pumped Discharge Piping System

Sanitary and condensate drainage piping from Hall D shall be routed to a holding tank with a high level alarm. After quality verification, the effluent shall be pumped to the site sanitary system utilizing duplex pumps; connection point to the existing site sanitary system shall be near Building number 37 where the existing sanitary continues as a gravity system. Sanitary drainage from the Service Building shall be routed to a duplex sump pump and pumped to the new force main exiting Hall D. The sanitary sewer from the Counting House shall be routed to an exterior

duplex sewage lift station and connected to the new sanitary force main exiting Hall D.

4. Pumped Storm Drainage Piping System

The two access ramps at Tagger Area, and Hall D shall each have trench drains at the bottom of the ramp and also inside the door. Storm water drainage from these trench drains shall be routed to a duplex sump pump and pumped to the site storm drainage system.

5. Low Conductivity Water System

The Service Building shall house a 300-gpm Low Conductivity Water (LCW) system. The water shall have a resistance of 2 Mohm and shall be distributed to the Tagger Area and Hall D. The system shall consist of a Reverse Osmosis feed water system capable of 300-gallons per day supply. The LCW system shall incorporate a De-ionized water system including resins tanks, filtration and UV sterilization capable of producing 25 gallons per minute. The LCW system shall also include De-Ox contactors to remove oxygen from the system. LCW system distribution piping system shall be constructed of orbital welded stainless steel with some plastic piping utilized locally within the RO and De-ionizer systems. The LCW system shall be circulated by duplex 300-gpm stainless steel pumps. The circulating pumps shall be redundant with each pump sized for 100% of the total anticipated load. The LCW system is connected to the condenser loop and includes a 300-gpm heat exchanger.

6. Nitrogen

Nitrogen required for the LCW system shall be piped from the Cryo plant area.

7. Plumbing Fixtures

All plumbing fixtures shall be commercial grade and located as indicated on the plans.

Emergency eyewash stations shall be barrier free, wall-mounted with spray head protected by a dust cover.

Lavatories shall be vitreous china, wall hung with carrier support and ADA approved trim. Faucet sets will be slow-closing type with 0.5 gpm discharge.

Water closets shall be wall-hung vitreous china with flush valves, floor carriers and designed for 1.6 gallons per flush

Break Room sink shall be double-compartment stainless-steel sink with hose spray.

Mop Sink shall be pre-cast terrazzo, floor mounted with vacuum breaker, edge guard, hose and wall faucet.

8. Piping:

Piping System	Schedule	Material	Insulated	Remarks
Potable Cold Water	Type L	Copper	Yes	
Potable Hot Water	Type L	Copper	Yes	
Sanitary Sewer	40	PVC	No	

Storm Drainage	40	PVC	No	
Pumped Sanitary	80	PVC	No	
Pumped Storm	80	PVC	NO	
Process Vacuum	Type L	Copper	No	
Nitrogen Gas	Type K	Copper	No	
LCW	Type 304	Stainless		orbital welded

9. Water Heating

Domestic hot water for the small number of fixtures in the Counting House shall be provided by an electrical water heater located in the Counting House mechanical room. Water heater shall supply hot water at 120 degree F. and due to the close proximity of the fixtures circulation of the hot water is not anticipated.

Domestic hot water is not supplied to other areas.

10. Drawings

No drawings are provided in the Updated Concept Design submittal.

C. Fire Protection

1. Criteria: General criteria for project design are listed in Section I, General. The following criteria are specifically applicable to the Fire Protection design:

   a. NFPA 13, Installation of Sprinkler Systems
   b. NFPA 14, Standpipe and Hose System

2. Systems

   All areas of the TJNAF will be provided with a wet-pipe or dry pre-action sprinkler system for ordinary-hazard occupancy, Group 1.

   The existing pre-action pipe sprinkler system in the Tunnel will be modified and expanded to supply the new Tunnel extension. The Counting Room in the Counting House shall be protected by a pre-action system and all other areas shall be protected by a wet-pipe sprinkler system.

   Hall D shall be provided with a piping header around the circumference of the building with stub-outs including shut-off valves and caps approximately every 20 feet.

   Stairwells shall be provided with dry standpipe systems.

   Fire Department Connections: A two-way fire department connection shall be provided at each new water supply for fire protection systems.

3. Water Supplies

The water supply for the new systems shall be fed from a new 8" water main which is a branch off the existing 12" water main. Preliminary information indicates that the city water supply is adequate to provide the required flow and pressure for the new systems and a fire pump will not be required

4. Area Classification/Water Demand

Classification	gpm/sq.ft.	Area of Demand sq. ft.	Duration, minutes
Ordinary Hazard Group 1	0.150	1500	60 – 90

250 GPM combined inside and outside hose flow

5. Piping

Interior piping shall be Schedule 40, black steel with malleable iron Class 150 or 300 fittings.

6. Drawings

No drawings are provided in this submittal.

7. Required Information

- Current hydrant flow test

VI. ELECTRICAL

A. Criteria: General criteria for the project design are listed in Section I, General. The following criteria are specifically applicable to the electrical system design.

1. American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), ASHRAE 90.1-1999

2. Illumination Engineering Society (IES) Handbook, Ninth Edition

3. National Electrical Manufacturer's Association (NEMA)

4. National Fire Protection Association (NFPA)

   a. NFPA 70, National Electrical Code (2002)
   b. NFPA 101, Life Safety Code (2000)

5. Virginia Uniform Statewide Building Code, 23003 Edition, incorporating the International Building Code (IBC), 2003 Edition

6. DOE STD-1020, Natural Phenomena Hazards Design and Evaluation for Criteria for DOE Facilities

B. System Descriptions

1. Primary Electrical Power Distribution

A 4-way high-voltage pad mounted switch will be connected to the existing 12.47kV service loop to feed two circuits to the Hall D complex buildings.

One circuit will feed a pad mounted substation transformer to serve the counting house electrical room, chiller & cryogenics plant. The second circuit will feed a pad mounted substation transformer to serve the large service building. The existing 12.47kV service loop will be extended via a 4-way underground duct bank to the new pad mounted switch. Two 12.47kV circuits from the pad mounted switch will be run to the new pad mounted substation transformers. The electrical services will be routed underground in ductbank into 480Y/277V three phase, four wire switchboards located in their respective electrical spaces.

2. Secondary Electrical Power Distribution (Counting House)

The new service switchboard feeds several panelboards, 480V: 120Y/208V three phase, four wire transformers, motor control centers, and UPS systems. The majority of this equipment is located in the Electrical Room and in Hall D. This service will feed a secondary service to the Cryo Plant. The Cryo Plant will have several panelboards, and 480v:120Y/208V three phase, four wire transformers. New chiller equipment may be served from this service depending on the location of this equipment. Additional distribution and branch equipment will be provided in the Hall D gas shed.
Conduit and wiring will be installed concealed for general-purpose lighting (where ceiling is provided), for general-purpose devices and for equipment in the Counting House areas. Conduit and wiring will be surface mounted for equipment in Hall D.

3. Secondary Electrical Power Distribution (Large Service Building)
The new service switchboard feeds several panelboards, 480V: 120Y/208V three phase, four wire transformers and motor control centers. The majority of this equipment is located in the Large Service building electrical space and

in the mechanical rooms. Additional distribution and branch equipment will be provided in the Electron Beam Dump. Branch circuitry will serve the tunnel extension, Tagger area and stair enclosures. Panelboards will be provided with padlockable devices on the circuit breakers.

4. Emergency Power

A backup power generator will not be included. Provisions for a future backup power generator will be included. An automatic transfer switch will be fed from the main switchboard to serve the emergency distribution panelboards. An Appleton receptacle will allow for a mobile power generator unit connection into the system

5. Devices

General-purpose duplex receptacles shall be 120 VAC, 20A, 3 wire, NEMA 5-20R type with screw terminal connections. The receptacles will be installed to serve process equipment where required. Convenience receptacles will be installed in each space, typically one on each wall. Maintenance and GFCI receptacles will be installed where required by code.

Special purpose 208 VAC, and 480 VAC NEMA outlets will be installed to serve special equipment where required. Matching NEMA plugs for the equipment are not required.

Lighting switches shall be suitable for 277V, 20A circuits and shall utilize screw terminal connections.

6. Lighting

a. General Indoor Lighting

Interior lighting in the Counting House will generally be 277-volt fluorescent fixtures utilizing electronic ballasts and high efficiency, low mercury, 4' 32W T-8 lamps. Lighting fixtures in the office areas will be deep-cell parabolic lighting fixtures providing a high (70 minimum) Visual Comfort Probability (VCP). Lighting fixtures in the other areas will be acrylic prismatic lens fluorescent fixtures. Lighting fixtures in the tunnel will be industrial fluorescent type with 8% minimum up-light component and wire guard. Lighting fixtures in the experimental hall will utilize higher wattage metal halide lamps.

b. Exit and Emergency Lighting (Important to Safety)

Exit and emergency lighting will be provided for required egress lighting to comply with NFPA 101. The egress lighting will provide a minimum of 1 footcandle average maintained along the paths of egress. The method of powering will be by the use of individual battery units. Exit lighting shall be red LED type and shall be by battery packs. The emergency and exit lighting systems will be designed to withstand a PC-2 seismic event (Safety Significant).

c. Exterior Lighting

Exterior wall-mounted fixtures that match the existing fixtures will be provided at the exterior doors. These fixtures will be sufficient for the limited exterior work.

7. Telecommunications Systems

The telecommunications systems will consist of empty pathways sized to accommodate at least 200 percent of the anticipated cabling requirements. At a minimum the pathways will be provided between the buildings as indicated on sheet C1 and from the Counting House telecommunications room to the work station outlets. Pathways will consist of exterior duct banks, cable tray above accessible ceilings and below accessible floors and conduits in inaccessible areas within the facilities.

8. Public Address System

The existing public address system consists of a facility wide series of speakers and head end equipment. The existing system will be expanded to include an empty conduit system consisting of speaker outlets and conduits extending from the existing speakers in the existing Tunnel to the Tunnel Extension, Tagger Area, Collimator Enclosure, and Hall D.

9. Access Control System

The access control system will consist of empty pathways and outlets which will accommodate future proximity readers and electric door latches for Hall D and the Counting House exterior main doors and roll up doors.

10. Fire Detection and Alarm Systems

a. Tunnel Extension, Tagger Area, and Exit Stair fire detection and alarm system devices will be connected to the existing accelerator fire alarm control panel located in the existing Machine Control Center (MCC).The devices will include non programmable spot heat detectors, addressable manual pull stations, and addressable smoke detection in the exit stair, flow switches, and tamper switches. Also, there will be two VESDA Laser Plus detector/display heads connected back to the VESDA head end in building 39. One detector/display head will be provided in the accelerator Building 39 with smoke transport pipe extending from the West Control Point to the beginning of the Tagger Area. The other detector/display head will be provided in the new exit stair with the smoke transport pipe extending from the far East end of the Tunnel Extension to the West end of the Tagger Area.

b. Hall D will include fire detection and alarm system devices that will be connected to a Siemens MXLV fire alarm control panel located in the Counting House vestibule. Addressable detection device loops are to be connected through ALD-2 analog loop drivers and loop address 1 and 2 are to remain spares. Voice evacuation notification circuits and speakers will be provided throughout. One Protectowire fire alarm releasing control panel for linear heat detection in Hall D will be provided in the Counting House control room. Hall D will also receive a standard heat detection zone at the ceiling. Also, there will be three VESDA Laser Plus detector/display heads connected back to a VESDA sub rack enclosure with display and network modules located adjacent to the Protectowire control panel in the Counting House control room. One detector/display

head will be provided in Hall D with smoke transport pipe extending to the ceiling area of the Hall enclosure. One or more detector/display heads will be provided in Hall D with the smoke transport pipe extending to the return air intake of each HVAC unit. One detector/display head will be provided in Hall D with smoke transport pipe extending to the Collimator enclosure and from floor to ceiling in the Hall enclosure.

11. Grounding System

The Hall D grounding system will incorporate a grid system under the floor slab with crossing points, ground rods and floor mounting plates all bonded together with exothermic welds. A common bond will be provided in all buildings for signal and power equipment to minimize voltage potentials between points in the system. Also, the grounding system for each building will be connected to the lighting protection system.

Exterior power substation grounding will incorporate a grid system under the concrete slab with crossing points and ground rods bonded together with exothermic welds. IEEE Guide for Safety in AC Substation Grounding will be utilized.

12. Lightning Protection System

a. Each building will include a lightning protection system that consists of air terminals, bonding cables and ground rods to form a completely bonded system to a counterpoise. The system will be provided in accordance with NFPA 780, Lightning Protection Code (2000).

13. Special Systems

a. Emergency Stop Safety System

Shunt trip circuit breakers and emergency stop buttons will be provided for the Tagger, Hall D and Counting Room areas.

C. Standards of Design

1. Voltage Drop

Feeder circuit conductors and branch circuit conductors will be sized in accordance with the National Electrical Code, NFPA-70. Voltage drop will not exceed 5 percent total for the building feeders and branch circuits to the utilization equipment.

2. Loading

Branch-circuit loading will be a maximum of 80 percent of breaker rating.

3. Ambient Temperature

Ambient temperature of the building interior is assumed to be 25 degrees C.

4. Power Distribution Voltages

Normal building power distribution voltage will be 480Y/277V, 3-phase, 4-wire, 60 Hz for lighting and HVAC loads and selected process equipment. The power distribution voltage for additional process equipment and general-

purpose equipment will be 208Y/120V, 3-phase, 4-wire, 60 Hz.

5. Lighting Intensities

Lighting intensities will be in accordance with IES Lighting Handbook, and will be as follows:

Area	Footcandles
Office Areas	50
High-Bay Test Areas	50
Corridors	20
Lobby	30
Mechanical and Electrical Rooms	30
Storage Areas	30

Lighting intensities will be at the work plane, except corridors and mechanical and electrical room intensities, which will be measured at the floor.

In office areas and test areas, additional task lighting will supplement the general lighting levels noted above.

Lighting calculations will be based on the Zonal Cavity Method as described in IES Handbook.

6. Connections

Motors and equipment connections rated 1/2 hp and larger will be connected

to 480-volt, 3-phase, 60-Hz power; smaller motors, receptacle or laboratory equipment loads are connected to 120-volt, 1-phase, 60-Hz as applicable

7. Wiring

Wiring will be in accordance with DOE 6430.1A and NFPA 70.

8. Grounding

Grounding will be in accordance with IEEE 80-2000, ANSI J-STD-607A, and NFPA 70.

9. Lightning Protection

Lightning protection will be in accordance with NFPA 780 standard for the Installation of Lightning Protection Systems.

10. Equipment Selection

Brand names or proprietary items are not generally used. Equipment is generally selected based on three reliable manufacturers being available.

D. Area Ratings

The electrical hazard classification per NEC is "General Purpose". Wiring will be installed in conduit per NEC for non-hazardous, non-corrosive locations.

E. Drawings

No drawings are included for the Updated Concept Design submission.

F. Required Information

None required at the time of this submission.

G. Seismic Evaluation (Safety Significant)

The existing electrical systems are not currently seismically braced. The new electrical devices, wiring, and conduit shall be supported to withstand a PC-2 Seismic event without failing.

APPENDICES

APPENDIX A

LIFE SAFETY/MEANS-OF-EGRESS ANALYSIS

LIFE SAFETY/MEANS OF EGRESS ANALYSIS February 28, 2006

BUILDING PLANNING

Applicable Code:

Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating the International Building Code (IBC) 2003. (Note that Section and Table references are IBC 2003.)

Occupancy Classifications:

Use Group B, Business occupancy (304.1) for Counting House, Hall D, and Tagger Area buildings.

Use Group F-1, Factory Industrial Moderate Hazard Occupancy (306.2) for Cryo Plant and Service Building.

Accessory Areas (302.2 &Table 302.1.1):

Mechanical Rooms – separation not required because building fully fire sprinklered.
Electrical Room - separation not required because building fully fire sprinklered. (Note: the National Electrical Code 110.26(C)(2) requires that electrical equipment rated at 1,200 amperes or more may require separation.)
Storage Rooms-separation not required because building fully fire sprinklered.

General Building Limitations: Assume Type IIB construction (602.2, Table 601 & Table 602)

Allowable Area (Table 503):

Use Group B: 23,000 SF
Use Group F-1: 15,500 SF

Area Modifications (506.3 & Table 503):

Automatic Sprinkler System Increase: 300% for single story buildings.

Actual Area:

Tunnel Extension & Tagger Area: 4,531 SF net. (Use Group B)
Hall D: 6,298 SF net. (Use Group B)
Counting House: 3,300 SF net. (Use Group B)
Cryo Plant: 800 SF net. (Use Group F-1)
Service Building: 2,646 SF net. (Use Group F-1)

Allowable Height (Table 503):

Use Group B: 4 stories.
Use Group F-1: 2 stories.

Actual Height:

Tunnel Extension & Tagger Area: 7 feet & 12 feet, respectively (note that these are buried less than 30 feet below grade)
Hall D: single story, 47'-6" with approximately 33 feet above grade.
Counting House: single story, 18'-6".
Cryo Plant: single story, 16'-0"
Service Building: single story, 13'-0"

FIRE PROTECTION

Fire Resistant Materials and Construction

Combustibility (Table 601);

Above grade exterior walls are non-load bearing and are of non-combustible materials; architectural metal panels on metal stud back-up walls. Interior surfaces are exposed foil-faced batt insulation except at Counting House where the insulation will be covered with gypsum wall board. Partial exposed exterior wall s of Hall D will be reinforced concrete.

Below grade walls are bearing walls and are of reinforced concrete.

Interior elements are of non-combustible materials; concrete masonry, gypsum wallboard, metal studs, fiberglass insulation, hollow metal doors and frames, gypsum wallboard ceiling and lay-in acoustic panels in suspension grid.

Roof is non-combustible; UL Class B or better system of silicone coated spray foam insulation on metal deck.

Fire Tests:

All materials have been tested in accordance with ASTM E119 (703).

Exterior openings are not required to be protected (704.12)

Parapet Walls: Not required (704.11).

Fire Separation Assemblies:

Exit stairs required to be 1 hour fire rated (707.4).

Dumbwaiter shaft required to be 1 hour fire rated (707.4).

Exit access corridors are not required to be fire rated (Table 1016.1).

Interior Finishes:

Flame Spread less than 25 required by DOE 1066.

Smoke Developed less than 50 required by DOE 1066.

FIRE PROTECTION SYSTEMS

Building will be protected by an approved automatic sprinkler system throughout installed in accordance with NFPA 13.

Fire extinguishers will be provided in accordance with NFPA 10.

MEANS OF EGRESS

Occupant Load: Occupant load for Use Group B and F-1 is 1/100SF. (Table 1004.1.2)

Tunnel Extension & Tagger Area Design Occupant Load: 46 Anticipated: 5
Hall D Design Occupant Load: 63 Anticipated: 10
Counting House Design Occupant Load: 33 Anticipated: 10
Cryo Plant Design Occupant Load: 8 Anticipated: 3
Service Building Design Occupant Load: 26 Anticipated: 5

Capacity of Egress Components (Table 1005.1):

Stairways: 0.2 inches per occupant for fully fire sprinklered buildings.
Other Egress Components: 0.15 inches per occupant for fully fire sprinklered buildings.

Tunnel Extension & Tagger Area: Stairs: 9.2 inches. Other: 6.9 inches.
Hall D: Stairs: 12.6 inches. Other: 9.45 inches.
Counting House: Stairs; None required. Other: 4.95 inches.
Cryo Plant: Stairs: none required. Other: 1.2 inches.
Service Building: Stairs: None required. Other: 3.9 inches.

Provided:

Tunnel Extension & Tagger Area: Stairs: 48 inches. Other: 72 inches.
Hall D: Stairs: 48 inches. Other: 72 inches.
Counting House: Stairs: None. Other: 108 inches.
Cryo Plant: Stairs: None. Other: 72 inches.
Service Building: Stairs: None. Other: 144 inches.

Number of Exits (Table 1018.1):

Minimum number of exits all rooms and spaces for occupant loads of 1 to 500: 2 required.

Arrangement of Means of Egress:

Dead-end corridors (1016.3, Exceptions 2 & 3): Maximum length 50 feet in fully fire sprinklered buildings. Unlimited length where length is 2.5 times the width.

Common path of travel (1013.3, Exceptions 2 & 3): Maximum length 100 feet in fully fire sprinklered buildings.

Travel Distance to an Exit (Table 1015.1): Use Group B: Maximum 300 feet. Use Group F-1: Maximum 250 feet.

Tunnel extension, Tagger Area, Hall D, Cryo Plant and Service Building are not accessible to the physically disabled. Counting House is designed to be accessible to the physically disabled in accordance with ADA and ANSI A117.1-2003.

Exit doors are 36 inches wide providing a 32 inch clear width in accordance with ANSI A117.1-2003, 404.2.2.

BUILDING CODE ANALYSIS DATA SHEET

Jurisdiction: Thomas Jefferson National Accelerator Facility

Building Description: Tunnel Extension and Tagger Area

Building Location: Newport News, Virginia

Applicable Building Code(s): Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating 2003 Editions of the International Codes

Occupancy Classification(s): Use Group 'B', Business.

Seismic Zone: Design Category C

Building Area

Allowable Area: 23,000 SF; 69,000 SF with fire sprinkler increase.
Actual Floor Area: 879 SF (Tunnel Extension) + 3,652 SF (Tagger Area) Per Floor:
Total: 4,531 SF Per Floor: 4,531 SF

Number of Stories: 4 stories allowable; 1 story actual.

Building Height: (~~i.e. feet above grade~~) (Areas are approximately 10' below existing grade.)

Allowable: 4 stories Actual: 12 feet

Type of Construction: IIB, fully fire sprinkler protected.

Occupancy Loads

Per Code: 46 (total) 46 (per floor)
Actual Anticipated: 5 (total) 5 (per floor)

Fire Ratings:

Bearing Walls: Interior/Exterior: 0 hour
Nonbearing Walls & Partitions: Exterior/Interior: 0 hour
Columns: 0 hour
Beams: 0 hour
Floor Construction: 0 hour
Roof Construction: 0 hour
Exits and Exit Passageway: 1 hour
Vertical Exit Enclosure: 1 hour
Vertical Shafts: 1 hour
Exit Access Corridors: 0 hour

Special Fire Protection Features: (i.e. sprinklers, standpipes, etc.)
Building is to be fully fire sprinkler protected. Standpipes are to be provided in all stairs.

BUILDING CODE ANALYSIS DATA SHEET

Jurisdiction: Thomas Jefferson National Accelerator Facility

Building Description: Hall D

Building Location: Newport News, Virginia

Applicable Building Code(s): Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating 2003 Editions of the International Codes

Occupancy Classification(s): Use Group 'B', Business.

Seismic Zone: Design Category C

Building Area

Allowable Area: 23,000 SF; 69,000 SF with fire sprinkler increase.
Actual Floor Area: 6,298 SF Per Floor: 6,298 SF
Total: 6,298 SF Per Floor: 6,298 SF

Number of Stories: 4 stories allowable; 1 story actual.

Building Height: (i.e. feet above grade)

Allowable: 4 stories Actual: 47'-6"; approximately 33' above grade.

Type of Construction: IIB, fully fire sprinkler protected.

Occupancy Loads

Per Code: 63 (total) 63 (per floor)
Actual Anticipated: 10 (total) 10 (per floor)

Fire Ratings:

Bearing Walls: Interior/Exterior: 0 hour
Nonbearing Walls & Partitions: Exterior/Interior: 0 hour
Columns: 0 hour
Beams: 0 hour
Floor Construction: 0 hour
Roof Construction: 0 hour
Exits and Exit Passageway: 1 hour
Vertical Exit Enclosure: 1 hour
Vertical Shafts: 1 hour
Exit Access Corridors: 0 hour

Special Fire Protection Features: (i.e. sprinklers, standpipes, etc.)

Building is to be fully fire sprinkler protected. Standpipes are to be provided in all stairs.

BUILDING CODE ANALYSIS DATA SHEET

Jurisdiction: Thomas Jefferson National Accelerator Facility

Building Description: Counting House

Building Location: Newport News, Virginia

Applicable Building Code(s): Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating 2003 Editions of the International Codes

Occupancy Classification(s): Use Group 'B', Business.

Seismic Zone: Design Category C

Building Area

Allowable Area: 23,000 SF; 69,000 SF with fire sprinkler increase.
Actual Floor Area: 3,300 SF Per Floor: 3,300 SF
Total: 3,300 SF Per Floor: 3,300 SF

Number of Stories: 4 stories allowable; 1 story actual.

Building Height: (i.e. feet above grade)

Allowable: 4 stories Actual: 18'-6"

Type of Construction: IIB, fully fire sprinkler protected.

Occupancy Loads

Per Code: 33 (total) 33 (per floor)
Actual Anticipated: 10 (total) 10 (per floor)

Fire Ratings:

Bearing Walls: Interior/Exterior: 0 hour
Nonbearing Walls & Partitions: Exterior/Interior: 0 hour
Columns: 0 hour
Beams: 0 hour
Floor Construction: 0 hour
Roof Construction: 0 hour
Exits and Exit Passageway: 1 hour
Vertical Exit Enclosure: 1 hour
Vertical Shafts: 1 hour
Exit Access Corridors: 0 hour

Special Fire Protection Features: (i.e. sprinklers, standpipes, etc.)
Building is to be fully fire sprinkler protected. Standpipes are to be provided in all stairs.

BUILDING CODE ANALYSIS DATA SHEET

Jurisdiction: Thomas Jefferson National Accelerator Facility

Building Description: Cryo Plant

Building Location: Newport News, Virginia

Applicable Building Code(s): Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating 2003 Editions of the International Codes

Occupancy Classification(s): Use Group 'F-1', Factory.

Seismic Zone: Design Category C

Building Area

Allowable Area: 15,500 SF; 46,500 SF with fire sprinkler increase.
Actual Floor Area: 800 SF Per Floor: 800 SF
Total: 800 SF Per Floor: 800 SF

Number of Stories: 4 stories allowable; 1 story actual.

Building Height: (i.e. feet above grade)

Allowable: 4 stories Actual: 16'-0"

Type of Construction: IIB, fully fire sprinkler protected.

Occupancy Loads

Per Code: 8 (total) 8 (per floor)
Actual Anticipated: 3 (total) 3 (per floor)

Fire Ratings:

Bearing Walls: Interior/Exterior: 0 hour
Nonbearing Walls & Partitions: Exterior/Interior: 0 hour
Columns: 0 hour
Beams: 0 hour
Floor Construction: 0 hour
Roof Construction: 0 hour
Exits and Exit Passageway: 1 hour
Vertical Exit Enclosure: 1 hour
Vertical Shafts: 1 hour
Exit Access Corridors: 0 hour

Special Fire Protection Features: (i.e. sprinklers, standpipes, etc.)
Building is to be fully fire sprinkler protected. Standpipes are to be provided in all stairs.

BUILDING CODE ANALYSIS DATA SHEET

Jurisdiction: Thomas Jefferson National Accelerator Facility

Building Description: Service Building

Building Location: Newport News, Virginia

Applicable Building Code(s): Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating 2003 Editions of the International Codes

Occupancy Classification(s): Use Group 'F-1', Factory.

Seismic Zone: Design Category C

Building Area

Allowable Area: 15,500 SF; 46,500 SF with fire sprinkler increase.
Actual Floor Area: 2,646 SF Per Floor: 2,646 SF
Total: 2,646 SF Per Floor: 2,646 SF

Number of Stories: 4 stories allowable; 1 story actual.

Building Height: (i.e. feet above grade)

Allowable: 4 stories Actual: 13'-0"

Type of Construction: IIB, fully fire sprinkler protected.

Occupancy Loads

Per Code: 26 (total) 26 (per floor)
Actual Anticipated: 5 (total) 5 (per floor)

Fire Ratings:

Bearing Walls: Interior/Exterior: 0 hour
Nonbearing Walls & Partitions: Exterior/Interior: 0 hour
Columns: 0 hour
Beams: 0 hour
Floor Construction: 0 hour
Roof Construction: 0 hour
Exits and Exit Passageway: 1 hour
Vertical Exit Enclosure: 1 hour
Vertical Shafts: 1 hour
Exit Access Corridors: 0 hour

Special Fire Protection Features: (i.e. sprinklers, standpipes, etc.)
Building is to be fully fire sprinkler protected. Standpipes are to be provided in all stairs.

BUILDING CODE ANALYSIS DATA SHEET

Jurisdiction: Thomas Jefferson National Accelerator Facility

Building Description:

Building Location: Newport News, Virginia

Applicable Building Code(s): Virginia Uniform Statewide Building Code (VUSBC), 2003 Edition, incorporating 2003 Editions of the International Codes

Occupancy Classification(s): Use Group 'B', Business.

Seismic Zone: Design Category C

Building Area

Allowable Area: 23,000 SF; 69,000 SF with fire sprinkler increase.
Actual Floor Area: Per Floor:
Total: Per Floor:

Number of Stories: 4 stories allowable; 1 story actual.

Building Height: (i.e. feet above grade)

Allowable: 4 stories Actual:

Type of Construction: IIB, fully fire sprinkler protected.

Occupancy Loads

Per Code: _____(total) _____(per floor)
Actual Anticipated:_____(total) _____(per floor)

Fire Ratings:

Bearing Walls: Interior/Exterior: 0 hour
Nonbearing Walls & Partitions: Exterior/Interior: 0 hour
Columns: 0 hour
Beams: 0 hour
Floor Construction: 0 hour
Roof Construction: 0 hour
Exits and Exit Passageway: 1 hour
Vertical Exit Enclosure: 1 hour
Vertical Shafts: 1 hour
Exit Access Corridors: 0 hour

Special Fire Protection Features: (i.e. sprinklers, standpipes, etc.)
Building is to be fully fire sprinkler protected. Standpipes are to be provided in all stairs.

TJNAF
Hall D Complex
Beam Line/Floor Elevations
HSMM Commission #70095

Date: 02/16/2006
Revised:

Location	7/05/05 Concept Drawings						2/3&4/06 Concept Meeting Revisions					
	Fin. Flr. Elev.		Beam Elev.		Elev. Difference		Fin. Flr. Elev.		Beam Elev.		Elev. Difference	
	Feet	Meters	Feet	Meters	Feet-Inches	Meters	Feet	Meters	Feet	Meters	Feet-Inches	Meters
Existing Tunnel	11.25'	3.40m	11.82'	3.80m	6 27/32"	0.40m	11.25'	3.40m	11.86'	3.61m	7 9/32"	0.185m
Tunnel Extension - high point	26.03'	7.93m	29.53'	9.00m	3'-6"	1.07m	27.33'	8.33m	29.53'	9.00m	2'-2 13/32"	0.67m
Tunnel extension - low point	26.03'	7.93m	29.53'	9.00m	3'-6"	1.07m	23.63'	7.20m	29.53'	9.00m	5'-10 7/8"	1.80m
Tagger Area	20.25'	6.17m	29.53'	9.00m	9'-3 23/32"	2.83m	23.63'	7.20m	29.53'	9.00m	5'-10 7/8"	1.80m
Electron Beam Dump Extension	20.25'	6.17m	29.53'	9.00m	9'-3 23/32"	2.83m	23.63'	7.20m	29.53'	9.00m	5'-10 7/8"	1.80m
Collimator	25.57'	7.79m	29.53'	9.00m	3'-11 33/64"	1.21m	24.75'	7.54m	29.53'	9.00m	4'-9 23/32"	1.47m
Hall D	16.75'	5.11m	29.53'	9.00m	12'-9 23/64"	3.89m	18.02'	5.49m	29.53'	9.00m	11'-6 1/8"	3.51m
Counting House	31.5'	9.60m	-	-	-	-	31.5'	9.60m	-	-	-	-

TJNAF
Hall D Complex
Newport News, Virginia

HSMM Commission #70095
Date: February 28, 2006

CHEMICAL SUMMARY

Chemical Name	Material Group	Class	Total Quantity English Units	Total Quantity Metric Units	Allowable Quantity	Use Group	Building/Area Name					
							Tagger Area	Hall D	Cryo Plant	Service Bldg.	Counting Hse	
Helium	-	-	4,000.0 CF	113,267.4 L	Not Rated	-			4,000 CF			
Nitrogen	-	-	353.0 CF	10,000 L	Not Rated	-			353 CF	? CF		
Argon	-	-	45.9 CF	1,300 L	Not Rated	-		45.9 CF				
Carbon Dioxide	-	-	45.9 CF	1,300 L	Not Rated	-		45.9 CF				
Methane	Flammable Gas		45.9 CF	1,300 L	1,000 CF	H-2		45.9 CF				
Ethane	Flammable Gas		45.9 CF	1,300 L	1,000CF	H-2		45.9 CF				
Tetrafluormethane (CF4)	-	-	45.9 CF	1,300 L	Not Rated	-		45.9 CF				
Perfluorbutane (C4F10)	-	-	483.2 CF	42,000 L	Not Rated	-		483.2 CF				
Hydrogen	Flammable Gas		0.2 CF	0.5 L	1,000CF	H-2		0.02 CF				
TOTALS			5,065.9 CF	171,767.9 L			0 CF	712.7 CF	4,353.0 CF	0 CF	0 CF	0 CF

NOTES:
Provided by TJNAF
Determined by HSMM from VUSBC (Building Code)

LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

TJNAF Hall D Complex

Yes	?	No			
5	2	7	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
	?		Credit 1	**Site Selection**	1
		N	Credit 2	**Development Density & Community Connectivity**	1
	?		Credit 3	**Brownfield Redevelopment**	1
		N	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
		N	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		N	Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
Y			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		N	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
		N	Credit 5.2	**Site Development,** Maximize Open Space	1
Y			Credit 6.1	**Stormwater Design,** Quantity Control	1
Y			Credit 6.2	**Stormwater Design,** Quality Control	1
		N	Credit 7.1	**Heat Island Effect,** Non-Roof	1
Y			Credit 7.2	**Heat Island Effect,** Roof	1
Y			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
3		2	**Water Efficiency**		5 Points
Y			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
Y			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		N	Credit 2	**Innovative Wastewater Technologies**	1
Y			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
		N	Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
1	2	3	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
		N	Credit 1	**Optimize Energy Performance**	1 to 10
		N	Credit 2	**On-Site Renewable Energy**	1 to 3
	?		Credit 3	**Enhanced Commissioning**	1
Y			Credit 4	**Enhanced Refrigerant Management**	1
	?		Credit 5	**Measurement & Verification**	1
		N	Credit 6	**Green Power**	1

continued...

Yes	?	No			
4	1	8	**Materials & Resources**		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		N	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		N	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		N	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
Y			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
		N	Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		N	Credit 3.1	**Materials Reuse**, 5%	1
		N	Credit 3.2	**Materials Reuse**,10%	1
Y			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
	?		Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
Y			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regiona	1
Y			Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regiona	1
		N	Credit 6	**Rapidly Renewable Materials**	1
		N	Credit 7	**Certified Wood**	1

Yes	?	No			
7	5	3	**Indoor Environmental Quality**		15 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
		N	Credit 1	**Outdoor Air Delivery Monitoring**	1
		N	Credit 2	**Increased Ventilation**	1
Y			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
	?		Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
Y			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
Y			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
Y			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
Y			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
Y			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
	?		Credit 6.1	**Controllability of Systems**, Lighting	1
		N	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
	?		Credit 7.1	**Thermal Comfort**, Design	1
	?		Credit 7.2	**Thermal Comfort**, Verification	1
	?		Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
Y			Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
3		2	**Innovation & Design Process**		5 Points
	?		Credit 1.1	**Innovation in Design**: ???	1
	?		Credit 1.2	**Innovation in Design**: ???	1
		N	Credit 1.3	**Innovation in Design**:	1
		N	Credit 1.4	**Innovation in Design**:	1
Y			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
23	10	31	**Project Totals** (pre-certification estimates)	69 Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Hall D Beam Line Dimensions (Minimum Requirements)

Beam Line Element	Incremental Distance (m)	Distance from Point of Tangency (m)	Beam Height Above Finish Floor (AFF)	Accelerator Machine Coordinates (X = 80.60000)	Comments
Point of tangency	0		.185m	Y=100.00000 Z=201.21379	Approximately center of Bldg 39, E. Arc service bldg
Start of beam line incline	22.42	22.42		Y=99.5002 Z=223.63767	Request to increase dimension by 10 m for 8 deg bends. Civil to develop rough estimate of cost increase.
End of beam line incline	38	60.41		Y=104.70001 Z=261.62746	Nominal beam height is .69 m. Accelerator desires constant beam height. Need beam line required distance from N & S walls.
Radiator	26.58	87.0		Y=104.70001 Z=288.21379	
Tagger Magnet (west end)	3	90.0	1.8 m	Y=104.70001 Z=291.21379	Increase from concept beam height of 1.5 m AFF for "leveling platform".
Permanent Magnet	9.25	99.25			East end of the tagger area is 13 m from the west end of the permanent magnet.
Collimator (west end)	62.75	162.0		Y=104.70001 Z=366.21379	Need 75 m minimum from radiator to collimator.
GlueX solenoid	21.5	183.5			Approximate distance.
End of Hall D (interior east wall)	20	203.5		Z=407.71379	
Photon Beam Dump (east end)	5.5	209			
Fence	45.5	254.5			Need 66 m from center of Hall D (~30 m long) to fence for radiation protection.
Canon Blvd (west side)	~58	312.36		Z=513.57230	Location per new survey. Civil survey is less (312 m). Need to verify location of point (i.e. – Canon Blvd curb, centerline?) City of NN has requested a vegetation buffer of 75'
Electron Beam Dump					Need to calculate requirement. Assume 10 m between tagger area & electron beam dump.

Y=100.000 is beam height

APPENDIX B

SUMMARIES OF CONFERENCE

HSMM
ARCHITECTS ENGINEERS PLANNERS

SUMMARY OF CONFERENCE

PROJECT: Thomas Jefferson National Accelerator Facility - Hall D Complex

HSMM COMM. NO.: 70095

DATE: 2/2/06 – 2/3/06

LOCATION: Newport News, VA

PRESENT: See Attached Sign-In Sheets

SUMMARY: Kick-Off Meeting

GENERAL COMMENTS:

GENERAL:

1. Existing accelerator tunnel is 25' below grade.
2. Site is wooded.
3. DOE CD-2A Project Review – June 2006.
    a. Looking at longer lead items, and taking a close look at cost estimate and basis of cost estimate.
4. 35% Design Review/VE Study around July.
5. NTP 60% Design (August).
    a. Overall Project Director – Dr. Allison Lung.
    b. Look at two construction phases for project – Hall D and Tunnel Connection.
    c. 35% Submittal:
        i. One design package
        ii. Narrative strategy on the construction phasing based on March DOE guidance. (No drawing impact until 60%)
6. Foundations – Settlement at Hall – 1" allowable.
    a. Need to coordinate with Tagger and Beam line.
7. Problems with direct buried underground piping – galvanic corrosion and water infiltration.
8. Look at number and sizes of Service Buildings. Can they be combined and are they located in the proper relationships?
9. 12' of berm over beam line, including tunnels, Tagger and collimator.
10. HSMM to look at balanced cut and fill. Any fill should come from retention pond. Do not want to buy any fill.
11. Manholes are submerged (electrical). Electrical cable and joining methods need to reflect this.
12. HSMM to look at feeding cooling towers from two electric sources with automatic transfer. No motor control centers (MCC's) for cooling towers.
13. Provide spare conduits.
14. Provide variable frequency drives (VFD's) with automatic bypass.
15. Use vegetable oil in transformers

16. Need to coordinate outages for all utilities and the accelerator.
17. Communications Conduits – make sure to add extras (double?)
18. Power is very reliable – direct feed from VA Power.
19. No electronics in fire detection devises in tunnel, Tagger or Hall D.
20. LEED Certification: Not viable, but need to do LCCA.
21. Chilled water line at Building 49 to be shut off, removed during construction, and then reinstalled by contractor.
22. Detailed equipment shed with disconnects.
23. Hall D = 6% of total project cost.
24. Provide adequate clearances around equipment.
25. Indicate required safety clearances on drawings. Stripe floor. Watch for required overhead clearances.
26. Add extra conduits.
27. Restrictions on ground water removal.
    a. Water Tight Facility
28. Catwalk and incline ladder for crane access (Hall D).
29. Emergency Shower/Eyewash required at cooling tower and/or water treatment area for HVAC.
30. Ordinary Hazard for sprinkler design.
    a. Pre-action system in tunnel
    b. No fire protection in electron beam dump
    c. Tie detectors to shunt trips for equipment shutdowns.

CIVIL/SITE:

Site

1. Northern vehicular access to the Hall D Complex will be shifted west to be in alignment with adjacent access road.
2. Site plan will be modified in coordination with architectural regarding access points to various buildings in the Hall D Complex, and building locations/configurations.
3. The 35% submittal of the East Retention Pond plans will be supplied to HSMM in order to account for that material in the tunnel berm in the earthwork volume (cut/fill) calculations.

Utilities

1. A large portion of the southern area of the site will likely be below the East Retention Pond. This will require the storm water in this area to be collected in a sump and pumped to the retention pond. It is noted that this area should be kept to a minimum to minimize the size of the pump station.
2. The trench drains both inside and outside of the truck ramps will require pump stations to discharge to the retention pond.
3. One central sanitary sewer pump station will collect sewerage from any gravity systems in the Hall D Complex and discharge to the existing manhole.

Storm Water Management

1. Storm water management for the Hall D Complex will be accounted for in the East Retention Pond design by EE&T.
2. All upstream off-site drainage currently traversing the site will be diverted around the site under the East Retention Pond contract. Therefore, only Hall D Complex site storm water runoff will be accounted for and conveyed to the East Retention Pond under this project.
3. The 35% submittal of the East Retention Pond design will be provided to HSMM for coordination of the two projects.
4. HSMM understands the importance of coordination efforts with EE&T in the development of the Hall D Complex project and the East Retention Pond project.

ARCHITECTURAL:

1. Water table is approximately 5 feet below grade. Existing accelerator tunnels are approximately 20 to 25 feet below grade.
2. Waterproofing on existing tunnels is EPDM. Owner suggested that fish-mouth, bubbles and other defects be addressed immediately by installing Contractor.
3. Project may be executed and issued in several Phases for construction: Hall D, Tunnels, site(?).
4. Radiation only occurs while beam is on in tunnel. There is no excessive residual radiation after the beam is off.
5. Egress thru shielding will be thru a labyrinth.
6. Access to HVAC units and lighting should be considered and included.
7. Preferred roofing system is silicon coated spray urethane foam roofing. They know how to maintain this system. This may be acceptable of ALL roofs and not just the Counting House and Hall D.
8. Settlement of tunnels and structures will be critical. Attention to differential of settlements between structures and the buried pipes will affect alignment of beam.
9. Minimum wall thickness is 20 inches of concrete for radiation shielding.
10. All floor clearance areas will need to be stripped off. Consider vertical clearances, too.
11. Emergency Egress Lighting shall light the entire egress path and not just the egress points.
12. While dimensions on the bridging documents are in both metric and English units, construction drawings need only be in English units, rounded to the next metric unit.

STRUCTURAL:

1. The West Control Point for locating structures in this project is the Point of Tangency of the East Loop to the North LINAC. This occurs approximately at existing Building 39.

MECHANICAL:

1. Project Specifications shall include the following:
   a. Commissioning for all systems.
   b. Variable frequency drives with Automatic Bypass.
   c. Special provisions for utility outages: all outages must be scheduled by the contractor in advance at the beginning of the project. The normal specification requirement that the contractor must schedule outages 7 to 14 days in advance will not be acceptable. This is because the accelerator cannot be shut-down except at specific times. A normal lengthy maintenance shutdown occurs around Christmas every year.
2. The project will include the following mechanical systems that will serve Hall D and its ancillary buildings: condenser water (CW), chilled water (CHW), and Low Conductivity Water (LCW).
3. Non-chemical water treatment has not been used at JLAB.
4. An open cell cooling tower is all right to use.
5. Condenser water temperatures - 85°
6. Spare (future) cooling capacity has to be determined by JLAB.
7. There is no JLAB Cathodic protection standard.
8. The condenser water system will circulate water through chillers (heat source), cryo plant (heat source), LCW heat exchangers (heat source) and open cooling towers (heat sink). Cooling towers shall be standard galvanized steel construction; pumps and piping shall be standard commercial construction. 100% redundant backup towers and pumps shall be provided. Cryo plant limits maximum condenser water supply temperature to 100°F.
9. The chilled water system will circulate water through air handlers (heat source) and chillers (heat sink). Chillers, pumps and piping shall be standard commercial construction. 100% redundant chillers and pumps shall be provided. Propylene glycol may be mixed with the chilled water for freeze protection; ethylene glycol is not acceptable due to its toxicity. Chillers must use green HFC refrigerant R-134A.
10. Exposed pipe is preferred.
11. The LCW system will circulate water through magnets and other electronic equipment (heat source) and a heat exchanger (heat sink).
    a. Desired operating temperature 85°F supply; 95°F return (this appears to be incorrect since the LCW system must be hotter than the condenser water system it is rejecting heat to, and condenser water temperature will most likely be 85 supply, 95 return. A more realistic number for LCW design would be 95°F supply; 105°F return. Informally, this was agreed to by JLAB personnel (Whitlatch) during one of the tours).
    b. Pumps shall be 100% redundant.
    c. LCW water will be very pure, 2 mega-ohm max conductivity. Makeup water shall be processed through a Reverse Osmosis system.
    d. Water quality shall be maintained by passing approximately 5% of pump flow through a side-stream filter system. The side stream system shall include a de-ox contactor (for removing oxygen), a filter, and a resin bed.

e. The de-ox contactor requires vacuum and nitrogen in addition to water connections. A water seal vacuum pump will be required for the vacuum supply. The nitrogen can be piped over from the cryo plant.
f. JLAB's initial reaction to the suggestion that, as a VE measure, chemical treatment with oxygen scavengers such as melamine or hydrazine could be used in lieu of the de-ox contactor, was negative due to the toxicity of these chemicals.
g. Heat exchanger may be shell-and-tube or plate-and-frame type; plate-and-frame type is preferred.
h. LCW water is highly corrosive and will be circulated through radioactive areas. The former tends to destroy most metals and the latter tends to destroy most plastics. Therefore all LCW piping and all wetted parts of components such as pumps shall be stainless steel. Gaskets and seals shall be Viton. All joints shall be welded, not threaded, to avoid leaks. Three-piece ball valves and lug-type butterfly valves are preferred over 2-piece ball valves and wafer-type butterfly valves.
i. JLAB's experience has been that the LCW water itself does not become radioactive. There is some minor buildup of radioactivity in the filters and resin beds, but the system does not, for example, develop "hot spots" in dead legs and pipe joints the way nuclear power piping does.
j. Given the above, use of plastic piping in non-radioactive areas should be feasible as a VE measure. JLAB's initial reaction to this suggestion was negative due to their experience with fiberglass piping.
k. Some existing LCW systems have fiberglass piping. JLAB personnel indicated the performance of this material was not acceptable, with cracks developing with time and in one case a catastrophic failure occurring. This pipe remains in service, however, and has not been replaced.
l. It is notable that the Users who tap into the LCW systems to cool their experimental equipment frequently do not adhere to the above rules regarding materials. A great deal of copper piping was observed within Hall B, for example.
m. It is also notable that JLAB's policy to date has been to divide "topside" LCW systems that serve predominantly non-radioactive spaces from "bottom-side" LCW systems that serve predominantly radioactive spaces (such as the racetrack tunnel), in order to avoid spreading contamination to clean areas. The Hall D LCW system will violate this policy. Per RADCON personnel present at this meeting, that is acceptable.

PLUMBING/FIRE PROTECTION:

1. The configuration of the Services Buildings may change or the building may be combined into one.
2. The new LCW system area does not need to be air-conditioned.
3. The facility uses city water and has good domestic water flow and pressures. There are no fire pumps required at the facility.
4. JLAB conducts their own flow tests and maintains the records.

5. The new LCW system will require back-up pumps and shall be constructed of stainless steel.
6. The existing LCW system does not have a storage tank.
7. The conductivity of the LCW system needs to be approximately 2 mega ohms; they do not want pure water.
8. One of the existing LCW systems is approximately 360 gpm, this system is similar to what will be required for Hall D.
9. The RO system in the feed water loop has low use in the range of 10-30 gpm and it includes a de-ox that utilizes vacuum at around 29 in hg and a small amount of pure nitrogen.
10. Fire suppression shall be in accordance with NFPA 13 for ordinary hazards.
11. Existing dry standpipes that were direct buried have corroded; JLAB does not like to use cathodic protection systems.
12. JLAB does not want the photon dump house to be sprinkled.
13. The existing double interlock preaction system shall be extended into the new tunnel extension, exit stair and Tagger to avoid possible contaminated water in the tunnel.
14. JLAB concentrates on fire prevention and detection to protect the workers.
15. Hall D Complex shall have 100% wet sprinkler protection except for the beam dump areas. There may be some Inergen systems for isolated electrical equipment installed at a later date.
16. Sprinklers will be added during build-out on various levels and JLAB wants a "ring-header" installed around the perimeter of Hall D to accommodate the systems added in the future. Provide 2" taps with supervised shutoff valves ever 20'. The height of the ring shall be determined by coordination with structure and other trades. The "ring-header" in Hall B is approximately 15' above finished floor and is not easily accessible when they want to add sprinklers.
17. JLAB wants ¾" hose bibs in Hall D near the main door to the Counting House.
18. JLAB wants the truck ramps drained to a common sump with duplex pumps on emergency power to remove the water. They have had problems in the past with flood water rise several feet against the roll up doors at the bottom of the truck ramps. JLAB suggested providing trench drains on each side of the door.
19. JLAB wants several spot drains in Hall D to satisfy future equipment needs and also drains on the exterior of the building for condensate drainage; they prefer to use floor sinks.
20. They anticipate 5,000 gpd of ground water needing removal as compared to 9,000 gpd currently pumped from Hall A, B, & C. JLAB also stated that pumping of the ground water is not allowed or is restricted on this project.
21. The tunnels currently have (8) sumps for removing water.
22. Eyewash stations are not needed except maybe near the cooling tower location.
23. JLAB maintenance indicated that currently the LCW systems are not mixed between the upper level and the lower system to avoid contamination. They currently have two different LCW systems with separate loops.
24. All condensate from drains is routed to a large holding tank approximately 10' x 10' x 30' deep. The volume level is monitored and the waste is tested prior to being pumped to sanitary system.

25. JLAB maintenance needs dual valves in a tee arrangement for the condensate drain lines from the HVAC units the extra line is for coil cleaning and to have separate containment of cleaning volume from holding tank.
26. JLAB maintenance request hose bibs in all building for general cleanup.
27. JLAB maintenance indicated that eyewash stations are located in several existing locations; portable units can be another option.

ELECTRICAL/COMMUNICATIONS:

1. Water tight penetrations must be made for all underground conduits. HSMM will investigate on the best approach.
2. HSMM to review IEEE 80-200, Grounding requirements. See handout (copy attached) provided by JLAB (Chris Cuevas).
3. E-stop mushroom buttons to be installed at all exits for Tagger, Hall D & Counting room. To operate power shunt trip circuit breakers to de-energize electrical power in these areas upon emergency conditions.
4. Hall 'B' operations are similar to Hall 'D'.
5. The experimental components – some are designed and some are being designed.
6. Use PVC and not buried steel conduits since they have had problems with galvanic action on the steel.
7. Provide Cutler Hammer metering and switchgear. JLAB has a lot of Cutler Hammer on site.
8. Proximity readers at main entrances. There is no intrusion detection.
9. Photon Tagger has heavy magnets and power requirements for the equipment.
10. Detector equipment has to have service loops for all utilities since the equipment moves. Our contract will not include all of the equipment branch circuits.
11. Cameras are used to monitor process equipment only. Not for security.
12. Duct banks into the building need to be waterproofed.
13. MCC – Machine Control Center
    a. The MCC has controls for CCTV, safety systems, main fire alarm control. Speakers and strobes "blue" are in the tunnel (get spacing distances).
14. North LINAC:
    a. There are also 30A and 20A receptacles in the tunnels for general maintenance. Provide welding outlets every 100' (one before ramp and one after ramp).
    b. Infrastructure in the existing beam dump will be removed by the owner.
    c. The existing 12" wide x 6" deep aluminum cable tray only has one row of cable along the bottom. Estimate how much capacity is left to determine if the added cabling will not exceed 50%. Remember to double pathway capacity for spare space.
    d. Speakers, strobes and power outlets are located along the inside wall for accessibility and visibility.
    e. Cabling runs behind the beam line and beam equipment.
15. Fire Alarm System:
    a. Follow outline provided by JLAB (Dave Kausch)(copy attached).

   b. Change out the existing "red" fire alarm graphic annunciator panel in the MCC (verify).
16. Access Control System (ACS) - Proximity readers at main door to Counting House, Hall D (both entrances and rollup door).
17. Intrusion Detection System (IDS) - None
18. Closed Circuit Television (CCTV) – None. They may add cameras later, but the spare pathway capacity will account for this.
19. The fire alarm VESDH existing connection will be made in the existing building 39.
20. The access control will be empty conduit only for the Hall D and Counting House only.
21. Provide emergency power off pushbuttons in the Tagger, Hall D and Counting House.
22. Verify duct bank routing from existing manhole as shown on sheet C1. Get information on existing manhole which includes dimensions, duct bank entries and cabling.

HALL D:

GENERAL:

1. Personnel Access Door with lift for 200+ pounds with enclosure from Counting House.
2. Need penetrations from Counting Room to Hall D – prefer cable trays – for fiber cable.
3. Hall D beam height is 3.5m +/- .3m.
4. 320-Ton Magnet/Detector/Supports (1 piece at 40,000 pounds).
5. Glue X Equipment includes 200-Ton Solenoid (Block).
6. 20" minimum concrete walls for radiation protection.
7. Need to maintain 20-ton bridge crane clearance.
8. Sheet A5 – Hook height minimum 9m (subsequently changed to 10 m).
9. Would like "office conditions" in Hall D.
10. Cable Tray from Counting House to Hall D – will run later in Hall D.
11. Need crash buttons to short power.
12. Concrete shielding on top of collimator (indicated on sheets A2, A3) is in contract – look at using existing blocks (concrete). Need to make concrete blocks OFCI – coordinate with owner regarding radiation requirements.
13. Use of steel blocks for photon beam dump – concerns about ground water contamination (encase in Concrete?) and settlement.
14. Need labyrinth from Hall D into collimator.
15. Collimator is to be 12m instead of 11.5m.
16. Collimator Hut:
    a. Need labyrinth, L-shaped for personnel and small equipment access.
    b. Need LCW to magnets.
    c. Need cooling. Power supply in Hall D.
    d. Need 1 – 6" conduit for signal wire to Tagger to Collimator.
    e. Vacuum pumps at both end of pipe (Tagger and Collimator).

CIVIL/SITE:

1. The truck entrance to Hall D is approximately 20 feet below the front entrance to Hall D.
2. It is anticipated that the rear portion of the site will drop approximately 10 feet and the additional 10 feet of drop will be in the truck ramp.
3. Storm water runoff from the truck ramp will be collected in a trench drain. The trench drain should be located far enough away from the door that the concrete can be pitched away from the door and will help keep water from entering the building.

ARCHITECTURAL:

1. Exterior stair at northeast corner to be eliminated. Interior access to Counting House will be required instead. Also, a vertical lift is desired from Hall D floor to the Counting House floor.
2. Shielding (by Owner) at southeast exterior man and overhead doors will be required due to radiation. A labyrinth will be provided (by Owner) for egress from the man door. Note that the man door will be considered as Controlled Access; the overhead door will be considered Restricted Access.
3. The east end of the adjacent Collimator will be open to Hall D (shielding will be by Owner). Stair access up to the Collimator floor will be required along with a landing capable of holding a pallet of shielding materials. The access tunnel to the Collimator will be a labyrinth.
4. A 20-ton bridge crane will be provided. The hook height shall be a minimum 9m (subsequently changed to 10 m) above the finished floor. The crane is to be an electric remote-control type. Building services are not to interfere with the bridge crane operation. Note that the cryogenic lines will require a straight line to the Cryo Building from the connection point in Hall D.
5. Required conduit and piping penetrations will require labyrinths for radiation shielding.
6. The beam is to be 3.5m +/- 0.3m (11'-4" +/- 1") in lieu of 3.7m (12'-0").
7. Shielding in the Collimator will be by Owner and installed by Contractor.
8. The Collimator Enclosure inside dimension will be 12m in lieu of 11.58m.
9. The item identified as "Concrete Shielding" at the west end of the Collimator is to be stacked CMU furnished by the Owner and installed by the Contractor.
10. Shielding:
    a. Can locate AHU outside above collimator and penetrate metal panel butt not concrete.
    b. At track dock assume stacked shielding blocks.
    c. Need to look at fencing and distance.
    d. Need 90° bend from Hall D to Counting House for cable tray.
    e. Need two doors with space for 10 people for key control with interlocked doors at Counting House level.
    f. Wire door required on access to collimator.
    g. Use concrete blocks stacked but not grouted at collimator.

STRUCTURAL:

1. Because of a deed restriction as part of the voluntary remediation plan (VRP) with the State of Virginia, it is not allowable to dewater the soil around Hall D permanently.
2. The Cerenkov in Hall D will move along floor-mounted rails.
3. The solenoid in Hall D weighs about 200 tons.
4. HSMM will communicate with JLAB (Dave Kausch) about requirements for the overhead bridge crane.
5. Concrete shielding outside the Collimator Enclosure is shown as directly buried blocks of concrete. The blocks are not uniform size or shape.
6. The heavy equipment in the Collimator Enclosure generally consists of magnets and steel or concrete shielding. Most items will be supported on tables, meaning the loads will be transferred to the floor on individual legs. At the entrance from the Collimator Enclosure to Hall D, the shielding consists of blocks of concrete stacked on the floor and of a lead wall sitting on a base about 15 cm thick.

MECHANICAL:

1. Collimator:
    a. The collimator will have two electromagnets and one crate of instrumentation. Power supply and heat gain information is included in a handout provided by JLAB (Chris Cuevas)(copy attached).
    b. LCW needed for a magnet(s).
    c. Weights of items shown on the floor plan, from left to right:
    2000 pound magnet on 3 pt table.
    40,000 on tables
    2000 pound magnet
    5000 pound iron on table
    90,000 concrete on floor
    50,000 pound, 15cm base lead
    d. Need a handtruck width path into collimator.
    e. Welder or power supply would be the heaviest item moved by hand.
    f. No door required (by user).
    g. Power supply – locate in Hall D, or move to a service building?

2. Hall D:
    a. The handout from JLAB (Chris Cuevas) includes heat gain data for all of the equipment to be installed in Hall D. His numbers are significantly less than JLAB's client's (Eric Scott) estimate of 50 racks at 15-20 kW per rack. It was agreed that JLAB's numbers would be used. (Check: 50 x 15kW x 3.4 MBH/kW = 2550 MBH = 212 tons of cooling. This exceeds JLAB's (Celia Whitlatch) chiller size estimate of 145 tons significantly.
    b. A dehumidifier will be installed in a portion of the building to serve some of the electronics.

c. HVAC requirements for Hall D are the same as the Tagger Area with the following caveats:
    i. The air handlers will not be sized to carry the entire equipment load. Instead, they will be sized to carry the envelope, people and lighting loads, plus a fraction of the equipment load to be determined (10 to 25%). Chilled water capacity will be provided for the remainder of the equipment load and the User will provide auxiliary chilled water spot coolers as necessary.
    ii. It is possible the design conditions will be revised to 67°F, 35-40% RH. JLAB will advise.
d. Need a vertical access to Counting House.
e. Hall D is not a shielded room, and does not require special electronic filtering or copper wire mesh, etc.
f. Need emergency power shunt trip switch at doors.

PLUMBING/FIRE PROTECTION:

1. Collimator Hut:
    a. LCW is required for magnets.
    b. This area may have dedicated HVAC; if so, coordinate drainage
2. Hall D:
    a. This is not a shielded room.
    b. The large magnet does not require LCW since it is cooled with cryogenics.
    c. JLAB wants spot drains for drainage of future equipment.
    d. Spot drains are needed along the exterior for condensate drainage.
    e. Fire suppression "ring" height is flexible and shall be coordinated with other trades.
    f. JLAB understands that wet sprinklers are required by code and for life safety, but have some concerns about equipment damage. JLAB stated that most of the equipment is expendable and Inergen or other gaseous systems are not considered worth the expense. Inergen systems can be considered in some isolated cases for very expensive equipment but these will not be installed as part of the Civil portion of the project.
    g. JLAB's practice has been to provide wet sprinkler systems and concentrate heavily on fire prevention and detection.

ELECTRICAL/COMMUNICATIONS:

1. Hall D & Collimator. Run conduit and cable tray between Hall D to counting room. Conduit is for facilities cable. Cable tray is for "users" cable.
2. Collimator electronics has to be within one meter of the equipment.
3. Hall D lighting will be normal light levels prescribed by IESNA standards for crane operations and material handling tasks.
4. Shielding from Hall D to the Counting House is required from conduit and cable tray penetrations. No direct runs. 90 degree bends are required.

5. Look at cable tray fire stopping material/assembly. JLAB (Dave Kausch) would like to see a more "permanent" assembly in lieu of "pillows". They would like to be sure it is airtight.
6. Hall D - Proximity readers at both doors, rollup door.
    a. Note that the Proximity reader at the rollup door will interface with door controller. Also, the HVAC controls will need to automatically open the door. Require specific information on the dimensions and pathway requirements for the Proximity readers and door latch from JLAB.

COUNTING HOUSE:

GENERAL:

1. Counting Room occupied 24/7 during runs at 12-hour shifts – 3 to 4 people when experiment is running.
2. 12 computer racks at south end of Counting Room.
3. During construction, 50 people in Hall D and Counting House.
4. Need four cubicles and meeting area (12 people) (60 sq. ft.).
5. Don't need kitchen – need microwave, small sink, small refrigerator, coffee pot.
6. Need alcove for Xerox.
7. Toilets need to be sized for Hall D load as well.
8. Double doors for Counting Room and Rack Room.
9. 12 workstations in Counting Room.
10. 72°F in Control Room / 70°F in Rack Room.
11. Clean Power required
12. Communications Room – site for network.
13. Need to provide room for future emergency generator (Equipment and controls).

ARCHITECTURAL:

1. Direct stair access (Controlled Access) will be required from the Counting House to Hall D. Also, a vertical lift will be desired. (See Hall D, Architectural, item #1.)
2. Windows are desired in the open office area.
3. Both the Kitchen and Copy Rooms will be eliminated in favor of "alcoves" off the open office.
4. The Counting Room will be divided with a glass wall into a Rack Room and Counting Room. Both the Counting Room and Rack Room will have access flooring. The Rack Room will be immediately adjacent to Hall D for its cable runs. Cable runs will be in a labyrinth due to radiation hazard. Two pair of double doors will be provided, one to the Rack Room and one to the Counting Room entry. The Counting Room will have 3 to 4 people on 24/7 shifts while in operation.
5. Ultimately, the population load will be under 10 people in the Counting House. Therefore, consideration of a single unisex toilet room may be valid. Toilet(s) are to be accessible from the stair to Hall D.

6. Open area for meetings of 10 to 12 people is desired. Also, there will be 4 student work stations (16 SF each).
7. Open office space is required for "hoteling" visiting technicians and scientists is required.
8. The plan from the bridging documents needs to be revised.

STRUCTURAL:

1. The Counting House doesn't have settlement requirements as strict as does Hall D. Pipes, ducts, and other items passing from the Counting House to Hall D must be flexible at the intersection of the buildings to allow for differential settlement.

MECHANICAL:

1. Counting House: The counting house floor plan will be revised extensively based on JLAB comments.
    a. The counting room within the counting house will be divided into two sections. One section will house equipment racks only (12 "User" racks at 15 kW each heat gain and 2 PSS Racks at 2 kW each heat gain). The other section will have 12-15 computer workstations, but a population of only 4. The wall between the two sections will be largely windows so the status readouts on the racks can be seen from the workstation section.
    b. Design conditions for the rack section will be 65°F, 40-60% RH.
    c. Design conditions for the workstation section will be 72°F, 40 – 60% RH.
    d. The open office space will have 4 desks and a large meeting table for 12 people. The separate kitchen and copy rooms will be eliminated; this space will be folded into the open office space and counters will be provided for a couple of small printers, a microwave, a refrigerator, and a coffee maker. A couple of vending machines will be added also.
    e. Four workstations – 60 sq. ft. for student workstation.
    f. Refrigerator, microwave, coffee pot is all that is needed for kitchen area alcove.
    g. Copy room can be another alcove.
    h. Counting room and rack room need double doors.
    i. Needs clean power.

PLUMBING/FIRE PROTECTION:

1. Sanitary sewer will likely need a lift station since the inverts are probably not adequate for a gravity system. The closest restroom located to this site is located to the west of Building 37.
2. There will not be a dishwasher or stove in the "kitchen" only a sink, refrigerator, and microwave oven.
3. JLAB wants to use wet sprinklers for the computer room.
4. JLAB prefers to use wall mount plumbing fixtures to assist with cleaning and maintenance.

ELECTRICAL/COMMUNICATIONS:

1. Provide a Proximity reader at the main entrance (covered entry).
2. The Counting House building will have a separate fire alarm control panel. Locate the panel in the vestibule.
3. The Counting House will also have a telecommunications room.
4. Locate 2 PSS racks in Counting House plus dedicated conduit for Hall D.

TUNNEL EXTENSION & TAGGER AREA:

GENERAL:

1. Electron Beam Dump:
    a. May need to thicken walls at beam dump for 120 KW beam to prevent ground water contamination.
    b. Need camera observation in dump.
    c. 2 – 3' x 5' water skids
        i. 30 gpm total condenser water.
        ii. Need to put in separate area from the beam dump. Requires 208v, 3-phase plus 110v convenience outlets.
    d. Need further direction on beam dump from JLAB.
2. Crack in ceiling of existing beam dump in North LINAC– does contract need to include correcting existing condition?
3. Photon Beam Line:
    a. 6" pipe can be larger – need to pull vacuum.
    b. HSMM to make recommendations on how to install.
4. Tagger – look at knockout panel for construction and installation of equipment at southwest corner of Tagger Area.
5. Assume shielding in place at tunnel in front of Tagger Area.
6. Tagger Area:
    a. Equipment will be assembled in the building.
    b. Two Magnets – 40-Tons each.
    c. Largest piece 13-Tons (Humistat).
    d. Vacuum chamber – 13m to 14m long.
    e. Look at access door at SW corner for equipment.
    f. Need Personnel Access for North side.
    g. Need dimensions of equipment (1m high x 3m long typically).
    h. Delicate operation of putting together tallest items – electronic racks.
    i. Beam centerline AFF 1.8m (5'-10"). Clear Height above beam line – 4.5m (14'–7") in Tagger Area.
    j. Alignment critical - .2mm tolerance ideally I-beam with 3-point suspension – 2" adjustment.
    k. Tolerance of beam to Hall -? Need to know 8mm to ends of pipe.
    l. Assume all energy into magnet is turned into heat load.
    m. Need crash button to shunt electric power to equipment.

n. Need clean power for electronics.
o. 2 Kva per crate – five crates.
p. Need 70°F in Tagger area 40-60% RH for equipment.
q. 6" electronic beam pipe is placed under vacuum and cannot be allowed to corrode.
r. Add two vacuum pumps.
s. 80 Kva for magnet – LCW at 95°F.
t. JLAB to provide data for LCW flow.
u. Need isolation transformers/transformers in service building – provide panelboards for utility loads, welding outlets, etc.
v. Allow for outlets in electron beam dump for cameras.
w. Beam line approximately 8" AFF at tangent points.
x. 2.4m dipoles, 9000 pounds each at bend bottom and top (total 4).
y. Quadra pole Girders / Beam Stop / extra.
z. 40-50 gpm LCW
aa. Need access to tunnel for personnel and small equipment.
bb. Beam height at 27" – 40".
cc. Might need bump-out in tunnel at shielding.
dd. Tunnel 7' x 7'.
ee. Nominal 27" clear above beam line.
ff. .4m long, 9000 pounds for magnets, 2' high, 2' wide.
gg. Make receptacles GFI.

ARCHITECTURAL:

1. The tunnel extension is to be eliminated and the Tagger Area extended 6.2m east. Relocate the access tunnel from the Stair to the west and add a vertical lift access.
2. Note that there is a 13m long pipe as a part of the Tagger. This pipe needs to have installation access. The current overhead door location will not permit this access. It is desired to move the access to the west end of the Tagger Area. This will require shielding that can be installed by the Owner after Tagger installation. The exterior access road will need to angle off the west tunnel extension for radiation protection.
3. In lieu of the direct buried electron beam dump pipe, consideration for an extension of the tunnel southeasterly may be able to accomplish the same. Otherwise a beam dump similar to the existing switchyard beam dump may be considered. The minimum separation dimension to the dump for particle scatter is 10m.
4. Emergency secondary egress (Controlled Access) from the Tagger Area and tunnel extensions may be required. Again, labyrinth shielding would be required.
5. The beam line is to be 1.8m (5'-10") above the floor in lieu of 4.55m (14'-9") in the Tagger Area. It will be 8 inches (0.21m) above the existing main tunnel floor.
6. Permanent magnets will be installed by the Owner immediately east of the Tagger. This will allow a secondary beam dump within the extended Tagger Area.
7. The tunnel extension west of the Tagger Area need only be 7 feet by 7 feet. (Code may require this to be 7'-6' if it is to be considered as habitable; access and equipment paths may require a wider tunnel extension).

STRUCTURAL:

1. The Tagger Vacuum Chamber is 13 m – 14 m (42'-2" – 45'-5") long and must be brought into the Tagger Area in one piece. HSMM will evaluate alternate locations for the Tagger Area Access Ramp to facilitate this process.
2. The Tagger Area is a shallow structure with finished floor at about elevation 20 feet(6.18m). Hall D is deeper, with finished floor at about elevation 16.75 feet (5.16m). Since the photon beam must be horizontal and must hit a small target in Hall D more than 200 feet away, establishing and maintaining alignment of the beam is critical. HSMM will study the subsurface investigation reports to help determine an economical foundation system that offers the best chance to maintain beam alignment within acceptable limits. HSMM will suggest details to help establish proper alignment.
3. Between the Tagger Area and Hall D, the photon beam is noted as being in a direct burial pipe. Between the Tagger Area and the Electron Beam Dump, the electron beam is also noted as being in a direct burial pipe. Since the facility has had problems with corrosion of buried pipes, they have asked HSMM to suggest ways to protect the pipe.
4. Dumps for the electron beam and photon beam are shown as directly buried blocks of steel. They may have to be enclosed in a concrete housing to protect them from groundwater corrosion.

MECHANICAL:

1. The approximately 60 KW electron beam will leave the racetrack loop at the existing stub-out. At that time the beam centerline (beam line) will be about 8" above the floor.
2. The beam will be deflected in an S-curve up to the Tagger Area by "dipole" and "quad" magnets. These magnets will require LCW cooling. LCW piping already in the racetrack tunnel will be extended to the new magnets. JLAB will review the capacity of the existing piping and advise if it needs to be replaced with larger piping, and, if so, how far back the replacement should begin.
3. Where the beam bends in the existing tunnel and where it bends to the horizontal in the tunnel extension, there will be a 9,000 pound, 4m by 2m by 2m magnet dipoles. With the change in floor elevation of the new extension from the existing tunnel, a ramp system with a labyrinth may be required.
4. The wing walls at each side of the Tagger Area to the tunnels extensions as shown on the bridging documents will be eliminated.
5. The 6-inch photon beam pipe is to be considered as a minimum size. There will also be a requirement for up to 3-6" conduits in the "beam trench".
6. Tagger Area:
    a. The Tagger Area is the location of the Target. The electron beam impacts the Target, creating a photon beam. The photon beam continues into the Experimental Hall via the Collimator; the remaining electron beam is deflected by magnets to the Electron Beam Dump.
    b. The Tagger Area shall be extended 6.2 meters to the right; in other words the Tagger Area will be 6.2 meters longer than shown on the preliminary concept

drawings. Also, the entry door(s) will be reconfigured. The cargo door and ramp must be reconfigured to permit the experimental equipment to be moved inside. Rigging attachment points should be included in the structural design to facilitate equipment assembly. Additional man-doors will be needed. Ideally, there should be a man-door on either side of the beam line, but this is not essential.

c. The beam line will be 1.5 meters plus or minus 0.3 meters above the floor in the Tagger Area.
d. The primary apparatus in the Tagger Area will consist of two electro-magnets attached to a vacuum chamber. The chamber weighs 13 tons and is 13 meters long. The magnets weigh 38 tons apiece; their power supply is 80 kVA in size and will be located in the Large Service Building. The power supply and magnets will require LCW cooling.
e. In addition to the main equipment, there will be 5 crates of experimental instrumentation equipment (4 crates = 1 rack, so 2 racks; heat gain = 2 kW per crate) and 2 racks of PSS equipment (heat gain 0.5 kW per rack).
f. Vacuum pumps will not be needed in the Tagger Area; the beam passes through an evacuated pipe that is contiguous from the racetrack loop to Hall D and the Beam Dump. Vacuum pumps in these areas will maintain vacuum in the Tagger Area.
g. Cryo piping supply will not be required in the Tagger Area.
h. The access stair shown on the concept drawings may or may not remain. If it remains, a smoke removal system will be required.
i. The Tagger Area shall be air conditioned. Design space conditions: 70°F, 40-60% RH. An air handler with chilled water cooling, electric resistance heating, humidification and dehumidification will be provided. A redundant backup unit is required.
j. Contains a 36-Ton Magnet. The largest piece weighs 13-Tons.
k. The vacuum chamber is 13 meters long.
l. Only 6.2m of tunnel is needed down stream of Tagger room.
m. Electronics racks will be the tallest equipment brought in.
n. 8mm differential settlement is the tolerance.
o. Settlement during the first year is ok.
p. Maintain 40-60% RH.
q. (2) 15 kW racks plus magnet.
r. Magnet 80 kVA
s. Racks: 2 kVA/crate x 5 crates
t. SURA will provide LCW load on existing magnet.
u. Need one welding receptacle, maybe near door? Quad duplex outlet every 50 feet.
v. A portable crane will be used during construction.
w. Put transformer in Service Building, panels in Tagger Room.

7. Electron Beam Dump:
   a. The Electron Beam Dump is shown on the concept drawings as a separate space from the Tagger Area, connected by a direct bury pipe. This may be changed; the

direct bury pipe may be changed to a pipe in a man-size trench between the two spaces. This trench would be filled with shielding material during beam operation.

b. The Beam Dump will contain a large piece of metal which essentially grounds out and dissipates the electron beam. Significant radiation is produced. The dump is cooled by water circulating through it. The primary circulation system, complete with pumps, chemical treatment, and heat exchanger, will be a skid mounted system. Skid dimensions 4ft by 6 ft. The skid will be located in a side chamber, shielded by a labyrinth passage from the dump itself. LCW will be piped to the secondary side of the skid heat exchanger. LCW flow rate: 30 GPM.
c. There will two PSS racks located adjacent to the skid.
d. HVAC requirements for the Electron Beam Dump are the same as for the Tagger Area.
e. The buried steel blocks shown on the concept drawings and labeled NIC will instead be Owner furnished, Contractor installed. The blocks may be slightly radioactive. An enclosure is required.
f. (2) 3' x 5' water skids. 30 gpm of cooling water. 208v/ 30a for pumps.
g. Duplicate PSS requirements described above for Hall D.

8. Tunnel extension:
   a. 27 to 40" beam height in new tunnel extension. Hall tunnels are approximately 7' x 7'.
   b. Extend 50 gpm from existing LCW system from existing dump area all the way to the Tagger.
   c. 110 & 220v and welding before and after the ramp.
   d. Will need access to get magnets into tunnel extension.
   e. 4m long 9000 pound magnet 2' height.
   f. Make all outlets GFI.

9. Beam Pipe (Photon)
   a. 6" minimum vacuum pipe.
   b. 4.5cm tolerance of settlement.
   c. Flanged at each end.

PLUMBING/FIRE PROTECTION:

1. LCW load is determined by the magnets and operates at 95 degrees F and 10 degree delta T.
2. The magnet for this project is very similar to the one used in Hall B and JLAB will provide the LCW data on Hall B for reference.
3. Spot drains are intended to route to sanitary and trench drains at top and bottom of ramp route to a sump and then to sanitary.
4. Drains shall be around exterior of the Tagger building only.
5. Vacuum is pulled on 6" beam pipe only and when vacuum is required portable units are used and no central vacuum system is needed.

6. There is a load of approximately 50 gpm of LCW needed. Tie into the existing LCW lines in the existing Tunnel.
7. JLAB will provide information on the existing line sizes in the Tunnel near the connection point.
8. LCW lines will extend close to the Tagger area.
9. There is an additional LCW load of 30 gpm needed for the plate/frame heat exchanger in the dump area; the exact location has not been determined although it is suggested to not have the skid mounted within the dump area.

ELECTRICAL/COMMUNICATIONS:

1. Tagger area & tunnel extension. Run (1) 6" conduit from Tagger area to collimator hut for user signal cables. Signal cable should be at beam height.
2. There are vacuum pumps at the Tagger and collimator.
3. Electron Beam Dump area: It will be necessary to locate local panelboards behind the shielding. Equipment in this area will include pump skids & convenient receptacles. 208/120 volt, 3 phase is required. (3) 4" instrumentation conduits are required from this area to the service building.
4. Electron Beam Dump:
    a. 120v, 20A
    b. 208v for pumps
    c. Provide a conduit from Service Building.
    d. Provide PSS conduit from Service Building. (If it is a separate enclosure).
    e. Provide door interlock system on doors at grade level for all doors that lead to a controlled access area.
5. Look at small room for the two racks in the Tagger area just to keep the electronics in a conditioned space. (They want it in the open space).
6. There will be approximately 6 Kva per electronics rack (2 racks) in the Tagger area.
7. "Crates: we can put up to 4 "crates" in a rack. 2 Kva/crate.
8. 12 Kva total for the two racks.
9. 6" conduit and pathway link between Tagger and Collimator (run along with beam line).
10. PSS/Instrumentation located in Service Building.

CRYOGENICS (CRYO) BUILDING:

GENERAL:

1. Equipment exists already.
2. LN_2 dewar needs a 10' x 10' pad – vertical tank.
3. Need 13' clear height above finished floor – can be between rafters.
4. Refrigerator – 6' x 4' Housekeeping pad required.
5. >55°F during winter.
6. 55 fc - fluorescent lights.
7. 12" Ø sleeve at Hall D at grade.
8. Deliveries by 18-wheeler.

9. Need conduit for Central Control.
10. No floor drains.

CIVIL/SITE:

1. Provide Helium truck access to the Cryo Plant.
2. Turning radius of Helium truck will be considered throughout Hall D Complex.

ARCHITECTURAL:

1. The building's interior operates at 100dbA. Noise around the building may interfere with exterior operations.
2. Ventilation is thru wall louver intakes (approximately 12 feet by 4 feet) with roof mounted exhaust.
3. Provide 13 feet clearance in lieu of 12 feet.
4. Provide exterior lights above all doors.
5. Tractor trailer trucks will be transporting helium to this building. Truck access is therefore required.
6. No pits or trenches are required.

MECHANICAL:

1. No trenches are required.
2. Provide a 12" sleeve from plant to Hall D.
3. Need a control communication conduit.

PLUMBING/FIRE PROTECTION:

1. No drains or trenches are required.
2. Cooling will be required; use condenser water not LCW or chilled water.
3. A 12" sleeve to Hall building is typical.
4. It is best to keep the bends in the cryogenic piping to a minimum.
5. No domestic water is required.

ELECTRICAL/COMMUNICATIONS:

1. Cryogenics Plant. See handouts from JLAB (Dana Arenius) (copy attached). No backup electrical power is required for the process equipment. Telecommunications conduit will serve this building as pathway to the main telecommunications connection point.
2. There are signal requirements for the equipment. Provide a pathway to the Counting House telecom room.

SERVICE BUILDING(S):

GENERAL:

1. 150 Kva, 480v power supplies for 2 dipole magnets in Tagger Area to be located in small service building.
2. Water – cooled LCW – 10 gpm, 10% into water not into magnet/LCW.

3. Five racks – 30A, 208v (5-10KW total for the 5 racks into room air).
4. 24" wide x 30" deep x 84" high.
5. Power supply 4' x 4' x 6' – need 4' access around.
6. Need cable tray – 2 at 535 MCM (DC) 450A.
7. 60 cable (120 No. 10) and 2-535 MCM cables plus assorted 22 gauge twisted pair.
8. 110v receptacles (20A) rack.
9. Panelboards for equipment located in the Service Building to be located in the Service Building.
10. Instrumentation:
    a. ½ KW/rack – 8 racks at 20A service.
    b. 40 – ½" diameter
    c. 20 – ½" diameter
    d. Plus 3/8" communications cable - 20.
    e. 2 racks for PSS at 20A/rack.
    f. ½ KW/rack
    g. Need tie-in to network to Building 39.

ARCHITECTURAL:

1. The Small Service Building is associated with the tunnel extension.
    a. 4-foot clearance around all equipment will be required.
    b. Cable trays will be provided and installed by the Owner but space must be anticipated for them.
    c. The Electrical Code may require tow separate way out of the building.
    d. At 15 foot by 20 foot, the building may be too small to accommodate it equipment.
    e. Conduit connections will need to labyrinth type runs for radiation protection.
2. The Large Service Building is associated with the Tagger Area.
    a. The Electrical Code may require tow separate way out of the building.
    b. 4-foot clearance around all equipment will be required.
    c. The LCW System Room need not be air conditioned.
    d. The Power Supplies & Beam line Support Equipment Room is to be air conditioned.
3. These buildings may be combined if reasonable. Also their locations on the bridging documents are not static.

STRUCTURAL:

1. The number and locations of Service Buildings may change.

MECHANICAL:

1. The power supply for the "dipole" and "quad" magnets will be located in the Small Service Building. The power supply will be 4 ft. by 4 ft by 6 ft tall, and will require a minimum of 4 ft. service clearance. The power supply will be 150 kVA in capacity. It is essentially a transformer: roughly 5% of the 150 kVA will go into heating the

transformer; the remainder will go into heating the magnets. The transformer will be LCW cooled. LCW for the Small Service Building will come from new systems, not from existing systems.

2. Other items located in the small service building:
   a. 5 computer racks (heat gain 10 kW total for all 5)
   b. 8 instrumentation racks (heat gain 0.5 kW per rack)
   c. 2 PSS racks (heat gain 0.5 kW per rack)
   d. Racks are roughly 24" wide by 30" deep, with 36" service clearance (front and rear).
   e. Two PSS racks at 20A and 500w heat. 20 cables dedicated and locked. Same as North access building.

3. The Small Service Building shall be air conditioned. Design space conditions: 80°F Max, freeze protection Min, no humidity requirements. An air handler with chilled water cooling and electric resistance heat will be provided for this space. A redundant air handler is not required.
4. Power supplies in small service building:
5. 150 kVA serves the magnets.
6. 3 gpm cooling. 10% of water cooling upstairs.
7. Assorted smaller power supplies. 30A /208. 10 kW heat to room.
8. Big power supply is 4' x 4' x 6'.
9. Need tray above (leave space) same as existing service building.
10. 60 #10 pair cables and two large cables. Also 22 gauge wire for sensors.
11. No remote panels. Oversize conduit for bends.
12. Instrumentation 500 w/ rack x 8 racks. 20A
13. 40 cables plus 20 ½" wires

PLUMBING/FIRE PROTECTION:

1. A 360-gpm LCW system is required, with 2 mega-ohm water. Fill points needed. Liquid ring vacuum at 29" hg vacuum. Need nitrogen from cryogenics plant for the de-ox system. De-Ox uses 1 million gallons/year.
2. LCW piping is not required to be insulated since it is at 95° F.
3. JLAB anticipates less than 10 gpm LCW will be need for cooling equipment.
4. No domestic water required for Service Building (s).
5. The domestic water shown on conceptual plans is for fire protection purposes.

ELECTRICAL/COMMUNICATIONS:

1. 480v 150 Kva power supply
2. 4 or 5 relay racks 208v 30A racks 24" wide x 30" deep x 96" high.
3. There will be about 60 power supplies in the tunnel with #10 AWG cable.
4. 500W – 8 racks
5. 40 cables at .5" diameter for controls.
6. 20 cables at .325" diameter for controls.

7. PSS has 2 racks with 20A circuit. 20 cables at .375". Have to be physically isolated with any other cable. Has to be in conduit and the boxes need to have a locked cover. Also in the Counting House for equipment in Hall D.
8. Provide a telecom pathway from the manhole system that run on the north side of the site.

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