SECTION 2: Conceptual Design Report

Office, Technical, and Education Building

FESS/Engineering Project No. 10-8-1

2.1.1 OVERVIEW

The Illinois Accelerator Research Center (IARC) program's primary goal is to establish Northern Illinois as a national center for accelerator development; and to initiate, promote, and support related industry in Illinois. Secondary goals include providing:

- Education: In association with local universities, support training of scientists and engineers in accelerator physics and related technology.
- Office Space: Provide office space plus conference/meeting rooms to facilitate laboratory collaboration with private industry, and universities.
- Outreach: Provide exhibit space for visitors, including members of the public, students and teachers and VIP visitors.

This project provides for the construction of an Office, Education and Technical (OTE) building as part of Fermilab's Industrial Area Campus to meet the primary and secondary goals stated above.

2.1.1.1 Goals and Objectives

In order to provide a standard in which to evaluate the architectural building and site design, the following list of goals and objectives were developed for the OTE building:

- Meet the functional needs of the IARC mission
- Generate a dramatic, high profile building
- Produce a building that incorporates Fermi design philosophy
- Strengthen ability to attract new physics projects
- Maximize State funding with "bricks & mortars"
- Create a symbiotic relationship to existing CDF building
- CDF truck access must be maintained
- High degree of flexibility for rotating tenants
- State-of-the-art computing and video capabilities
- Accommodate parking
- Obtain LEED Gold Certification
- Comply with HPSB Guiding Principles

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2.1.2 EXISTING CONDITIONS

2.1.2.1 Project Site

The project site is the area south of Road D, north of the Tevatron and land north and west of the Collider Detector Facility (CDF). One of goals of the project is to "create a symbiotic relationship to the existing CDF building." After analysis of the sites surrounding the CDF, the project site was selected because the OTE building:

- Is more prominent approaching from the west and from Wilson Hall.
- Provides improved access to the west side of the CDF's high bay space which has higher floor loading than the east side.

The project site is approximately 97,300 square feet **or** 2.24 acres of land west and north of the CDF.

2.1.2.1.1 West

The area west of the CDF is bordered by a retaining wall and fence to the south, D Road to the north, and an above ground pipe line to the east. The area is approximately 83,000 square feet or 1.91 acres. Another key feature is an approximately 67-foot ramp descending to an overhead door on the west elevation of the CDF that provides truck access to the building. In addition, two (2) chillers and an electrical substation are located along the south edge of the site adjacent to the retaining wall.

2.1.2.1.2 North

The area north of the CDF is bordered by D Road to the north. The area between the CDF and D Road is approximately 14,300 square feet or 0.33 acres. The distance from the northwest corner of the CDF to D Road is approximately 50-feet and the distance from the southwest corner of the CDF to D Road is approximately 60-feet,

2.1.2.2 Facilities

Significant buildings and experiments adjacent to the OTE project site are the Collider Detection Facility (CDF) and the Tevatron. The other facilities in the Industrial Area are located directly across Road D to the north.

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2.1.2.2.1 Collider Detection Facility

The CDF structure has a foot print of approximately 102'x 254' (25,900sq.ft.) and is approximately 33' tall. The CDF building consists of several primary programmatic components:

- A high bay space that spans the building from east to west along its north end
- A three story, 22' deep, band of office space along the building's south side
- A lower assembly hall level which connects to the Fermilab Tevatron south of the CDF.

The 'Grade Level Assembly Floor' (i.e. first floor level accessible from grade) of the CDF sits at approximately 3'-6" below grade. The main entrance is located on the southwest corner of the building. There are two 20' wide service ramps, one on the east and one on the west side of the CDF, which provide truck loading access from grade to the Assembly Floor level.

The CDF houses one of two detectors positioned along the four-mile Tevatron accelerator ring. Physicists use the detector to study the array of particles and forces within the atom by recording data about collisions of protons and anti-protons in the machine. The detector operation is extremely sensitive to ground vibrations.

2.1.2.2.2 Tevatron

The Tevatron is the most powerful proton-antiproton accelerator in the world. It accelerates beams of protons and antiprotons to 99.99999954 percent of the speed of light around a four-mile circumference. The two beams collide at the centers of two 5,000-ton detectors positioned around the beam pipe at two different locations. The Tevatron tunnel is buried 25 feet below grade, underneath an earthen berm.

2.1.2.2.3 Industrial Complex

The Industrial Complex is located directly across Road D from the CDF, and is composed the Industrial Center Building and four (4) high bay Industrial Building (1 through 4).

2.1.2.3 Site Features

Site features that are located on or adjacent to the project site for OTE building include Road D, parking, the bicycle/pedestrian path, the protective berm over the Tevatron tunnel, cooling ponds and other on-site equipment.

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2.1.2.3.1 Road D

Road D is part of the main east-west vehicular circulation path at Fermilab. At the west end, Road D connects to the Main Entrance Road in front of Wilson Hall and at the east end connects to Batavia Road. Road D will provide the primary vehicle access to the OTE building.

2.1.2.3.2 Parking

Parking for the CDF facility is provided at the west end of the building and on the north side of Road D.

2.1.2.3.3 Bicycle and Pedestrian Path

A bicycle and pedestrian path starts near Wilson Hall runs along the south side of Road D and passes in front of the CDF building and project site. The path's width varies along its route from 8 to 10 feet.

2.1.2.3.4 Earthen Berm

A major site feature is the earthen berm that was constructed over the 4-mile Tevatron tunnel. The berm is located south of the project site, and is roughly 15-feet above grade at its highest point.

2.1.2.3.5 Retaining Walls

Concrete retaining walls that cut into the earthen berm are located in the area south, west and east of the CDF. The west retaining wall is approximately 260 linear feet and defines the south boundary of the project site.

2.1.2.3.6 Equipment

The area immediately outside the west entrance of the CDF contains several pieces of large electrical and mechanical equipment including:

- An electrical substation with three (3) 1500 kva transformers
- Two (2) air switches serving the transformers
- Two (2) large chillers units
- Diesel generator

2.1.2.4 Utilities

Site utilities that are located on or adjacent to the project site for OTE building include domestic water, industrial cooling water, sanitary sewer, storm sewer, and medium voltage electricity. The following utility descriptions are based on completion of the Industrial Area Site Upgrade project #3-2-178.

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2.1.2.4.1 Domestic Water Service (DWS)

An 8-inch HDPE DWS line enters the project site at the west end, and turns northeast crossing Road D. The DWS line continues parallel to Road D on the north side until it turns north towards the Industrial Center Building. A 8-inch HDPE DWS line crosses Road D and enters the CDF at the northwest corner. A 6-inch HDPE DWS line crosses Road D and provides a connection point for the project along the north elevation of the CDF.

2.1.2.4.2 Industrial Cooling Water (ICW)

An 14-inch HDPE ICW line enters the project site at the west end, and turns northeast crossing Road D. The ICW line continues parallel to Road D on the north side until it turns north towards the Industrial Center Building, and then branches east. A 6-inch HDPE ICW line crosses Road D serving a fire hydrant on the south side of Road D. An 8-inch HDPE ICW line crosses Road D and enters the CDF at the northwest corner. A 6-inch HDPE ICW line crosses Road D and provides a connection point for the project along the north elevation of the CDF.

2.1.2.4.3 Natural Gas

A 4-inch natural gas line runs along the north side of D Road. A 4-inch gas line branches to the south crossing Road D and enters the project site west of the CDF. The gas line turns east and parallels the berm and provides a connection point for the project. The natural gas lines operate at 90 PSI.

2.1.2.4.4 Electrical

A medium voltage electric manhole (MH P-27) is located approximately 55-feet from the northwest corner of the CDF. Medium voltage electric lines run north, south and west from P-27. The south lines serve two (2) air switches located just south of the CDF west ramp. The air switches serve the three existing transformers and allow for one additional future transformer.

- From one air switches, two (2) 5-inch conduits serve one of the existing 3 transformers and provide a connection to a transformer pad.
- From the other air switch, two (2) 5-inch conduits serve two existing transformers.
- In addition, an electrical duct bank runs from the new transformer pad to a termination point along the north elevation of the CDF.

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Three (3) sets of power lines run from each of the transformers to the CDF. Each set consist of four (4) 5-inch PVC conduits encased in concrete. Two of the sets of power lines run northeast and enter the CDF along the west elevation. The third set of power lines runs parallel to the south side of the building and enters the CDF around midpoint in the south elevation. In addition, a 5-inch underground rigid steel conduit runs south from the substation through the berm.

2.1.2.4.5 Communications

Communication lines are used to support the telephone, computing services, lab-wide Metasys building management system and FIRUS for equipment and fire alarm monitoring.

A communications manhole (MH C-23) is located approximately 55-feet from the northwest corner of the CDF. Communications lines run west, east and north from P-27. The west line runs under the existing parking lot towards MH C-21. Three communication lines head north and go under D Road. Two lines continue to head north and one turns east and runs north of D Road. The east line consists of four (4) 4-inch PVC ducts encased in concrete, and enters the CDF at the northwest corner.

An additional communication line, with 4 – 4" PVC ducts encased in concrete, runs along the south side Road D from Wilson Hall to the CDF. Pull cords are provided in each duct. The line terminates on the north side of the CDF.

2.1.2.4.6 Sanitary Sewer

A 10-inch sanitary sewer line enters the project site at the west end, and turns northeast crossing Road D. An 8-inch sanitary line continues east and provides a connection point for the project. The 10-inch line continues parallel to Road D on the north side until it turns north towards the Industrial Center Building and south, across Road to MH-22.

Sanitary sewer manhole (MH 22) is located approximately 25-feet from the northwest corner of the CDF. A 4-inch sanitary line runs east from MH 22 and enters the CDF in northwest corner.

In addition, an 8-inch sanitary line enters the east end of site north of the CDF and provides a connection point for the project.

There are abandoned sanitary sewer lines run under the project site west and north of the CDF.

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2.1.2.4.7 Storm Sewer

The storm water system on the project site includes lines west and north of the CDF. The lines are a combination of 18-inch and 24-inch HDPE pipes. There are several manholes within the project site.

2.1.3 BUILDING PROGRAM

The OTE building program consists of office, technical, educations and support elements.

2.1.3.1 Office Elements

The office elements are defined as upper level private offices, standard private offices, workplace cubicles and conference rooms. The OTE building program includes approximately 19,840 feet of flexible space to accommodate a mixture of 150 office elements, and provide a variety of office configurations.

The office areas will be designed as highly flexible space utilizing a manufactured demountable partitions system. A raised flooring system throughout will provide further flexibility. The systems will provide for fully integrated partition/flooring/and furniture.

2.1.3.2 Technical Element

The technical element includes light technical space for the fabrication and testing of assembly components The space is programmed at 4,800 square feet that can be subdivided into four (4) smaller independent spaces.

The technical space will be designed to offer maximum flexibility for rotating use. Although it will be the responsibility of each end-user to outfit and equip the technical space, the following will be provided as part of the base building:

- Capability to use as one large space or isolated 4 smaller spaces, each approximately 1200 square feet.
- Ability to secure in all configurations.
- The utilities shall be provided to each of the 4 tech spaces in such a manner that when one tech space is utilizing or modifying the utility, it has minimal or no impact on the on-going utility use of another tech space or the building as a whole.
- Central utility trunk - ability to access utilities and controls without entering other tech rooms.

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In addition to the items above, the technical space is to conform to the following requirements;

- The design of the tech space exterior envelope is to take into account the possibility of several types of future exhausts and intake. These knockout panels will be incorporated into the envelope design scheme.
- Vertical shaft(s) through the roof to be incorporated into the building design scheme. Shafts will be sized to accommodate 2-14" diameter ducts for each of 4 subdivisions within the tech space.
- The floor slab in the tech space shall have a load capacity of 600lbf.
- Cable tray to be provided for all power lines.
- Fiber optics feed to the tech space to be provided.
- 2 welding outlets to be provided for each subdivision of tech space.
- 2 phone/data outlets to be provided for each subdivision of tech space.
- 75 foot-candles of light to be provided throughout the tech space
- Tech space to accommodate valves/fittings for possible future purified/filtered water system (4) from raw water supply.
- Provide dedicated hot water line from building hot water supply to each of 4 subdivisions within the tech space, with valves/fittings to facilitate future temperature controls, boosters, etc.
- Cold water supply to be provided via. Individual run to each of 4 subdivisions of tech space, valves and capped for future use.
- A minimum of one 4" in floor drain and one 4" stub (capped, not trapped, for future use) to be provided in each tech space subdivision for incidental use.
- One chemical sump basin with associated valves/connections for future equipment to be provided for each subdivision of tech space (filtering equipment by future

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tenant).

- Dedicated HVAC with humidity control
- Tech space designed to accommodate future 3 ton overhead bridge crane full length of space.
- Tech space designed to accommodate possible future clean room with raised floor.
- Epoxy floor to be provided throughout tech space.
- Space to be provided to accommodate exterior pads for future equipment - air scrubbers, dewar tanks, etc.
- Acoustical treatment to be provided between tech space, lobby, and office to reduce sound transmission.

2.1.3.3 Education Element

The education element consists of four (4) classrooms approximately 600 square feet each totaling 2400 square feet. A key feature of the education element is providing flexibility to reconfigure the four (4) classrooms into two (2) 1200 square feet rooms, or into one (1) 2400 square foot assembly space. The purpose of the education element is to provide space for a state-of-the-art conference and teaching space that can be used by Illinois Accelerator Research Center, and by other Fermilab departments. The space will be designed to facilitate ease of future upgrades for emerging technologies.

2.1.3.4 Support Elements

The support elements consist of the building lobby large enough to be used as small exhibition area, and a lunch room for the building occupants. Other elements accommodate Leadership in Energy and Environmental Design (LEED) and High Performance and Sustainable Building Assessment and Compliance Tool for New Construction (HPSB) related criteria such as a room dedicated to recycling operations and shower/changing rooms to support bicycle riders.

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2.1.4 BUILDING DESIGN

The OTE building is a 46, 200 gross square feet and connects to the CDF along its north elevation and stretches to the west. The 3-story structure is 47-feet tall and is 540 feet long. The design has two separate program areas at the ground level at the east and west ends that make up the building's bases. The second and third floors connect to the CDF at the east end and then angles southwest to "sit" on top of the west base. The office floors bridge between the two base components and over the west truck access ramp of the CDF. The offices are framed with two triangular elements on east and west ends that contain conference rooms and the lunch room, respectively. This gives the new OTE building a unique form that creates a symbiotic relationship with the CDF and a dynamic, fresh identity for the IARC.

The design provides approximately 32,400 square feet of useable or occupiable square feet with a building efficiency of 70 percent.

2.1.4.1 Programmatic Layout

The OTE building program is organized onto three floors with the education and light tech elements located on the first floor, and the office elements housed on the second and third floors.

2.1.4.1.1 First Floor

The first floor is approximately 15215 gross square feet divided into a 2.383 square foot east base and a 12.832 square foot west base. The larger west base consists of the main entry lobby and display area, primary vertical circulation core, restrooms, classrooms, light tech space, and support and mechanical spaces. The east base is located along the north elevation of the CDF and is made up of a small entry lobby, secondary vertical circulation core, restrooms with shower/changing rooms, and mechanical space. Descriptions of the primary functional areas include:

- Lobby/Exhibit Space: The main entrance lobby is approximately 1,856 square feet with a 14-foot ceiling height. The space is designed to function as both an exhibit space and/or a pre-function area for the education/conference center. The primary vertical circulation and restrooms are located directly off the lobby.
- Education/Conference Center: The education/conference center is approximately 2,385 square feet with a 14-foot ceiling height. The center is located at the west end of the building directly adjacent to the main entrance lobby. The

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space is designed to be configured into 1, 2, 3 or 4 rooms using an operable partition system. When arranged into four (4) classrooms, each space is 520 square feet and able to accommodate 25 persons.

- Light Technical Space: The light technical space is approximately 4,822 square feet with a 16-foot ceiling height. The light tech spaces are located on the east end of west base adjacent to the CDF. The spaces are accessible from the main lobby by a corridor running along the south elevation. The space is designed to be configured into 1, 2, 3 or 4 spaces using operable partitions. When arranged into four (4) tech spaces, each room is approximately 1,200 square feet. The space is designed to accommodate a 100 square foot modular office.

2.1.4.1.2 Second Floor

The second floor is approximately 16,068 square feet and houses a 2- story lunch room with outdoor seating area, office space, a conference room, restrooms, and mechanical space. Descriptions of the primary functional areas include:

- Office Space: The second floor provides approximately 10,162 square feet of office space with a ceiling height of 9.5 feet. The office space that can be configured into a combination of private offices, workstations and conference rooms. Using Fermilab-standard office and workstation sizes, the second floor can accommodate 73 office elements.
- Conference Room: The design includes one (1) permanent conference room on the east end of the building. The conference room is approximately 262 net square feet and can accommodate 12 to 14 persons.
- Lunch Room: The west end of the second floor houses the approximately 1,102 square foot area with lunch room and café/vendor. The lunch room is a 2-story space that is 902 square feet and can accommodate approximately 46 persons.
- Outdoor Terrace: The 2,021 square foot roof over the education/conference center is designed as an outdoor terrace accessible to the building occupants. The outdoor area is immediately west of the lunch room, and can provide

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exterior seating during good weather. The occupiable part of the terrace shall be limited to less than 50 persons to meet egress requirements allowing a single exit.

2.1.4.1.3 Third Floor

The third floor is approximately 14,858 square feet and includes flexible open office space, along with two conference rooms, restrooms and vertical circulation cores. Descriptions of the primary functional areas include:

- Office Space: The third floor provides approximately 10,830 square feet of office space with a ceiling height of 9.5 feet. The office space that can be configured into a combination of private offices, workstations and conference rooms. Using Fermilab standard office and workstation sizes, the second floor can accommodate 78 office elements.
- Conference Room: The design includes one (1) permanent conference room on the east end of the building. The conference room is approximately 262 net square feet and can accommodate 12 to 14 persons.
- Lunch Room: The west end of the third floor includes a small lunch room that overlooks the larger lunch room seating area on the second floor. The lunch room is 282 square feet and can accommodate approximately 15 persons.

2.1.4.2 Building Efficiency

The building design provides approximately 32,894 square feet of useable or occupiable square feet with a building efficiency of 71.3 percent. The BOMA/ANSI publication, *The Standard Method for Measuring Floor Area is Office Buildings* was used as guide in determining net and gross areas.. The measurements were performed in AutoCad for maximum accuracy.

2.1.4.2.1 Gross Square Feet

The Gross Square Feet (GSF) of the building includes all floor areas, exterior walls, horizontal and vertical circulation, toilets, building structure, vertical shafts, and all mechanical, electrical, plumbing (MEP) spaces.

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2.1.4.2.2 Net Square Feet

The Net Square Feet includes is the net usable square feet of the building, and excludes the following:

- Exterior walls
- Building structure
- Vertical circulation (stairs and elevators)
- Public corridors and circulation
- Toilets and shower rooms
- Vertical shafts
- Mechanical, Electrical and Plumbing (MEP) spaces

Floor/Space	Net Square Feet (NSF)	Gross Square Feet (GSF)	Efficiency NSF/GSF
First Floor	**9,826**	**15,215**	**64.6 / 35.4**
Lobby/Exhibit	1,856		
Education/Conference	2,385		
Light Technical	4,822		
Recycling	275		
Table/Chair Storage	175		
Shower/Changing Room	144		
Coat Room	87		
Vending Area	82		
Second Floor	**11,649**	**16,068**	**72.5 / 27.5**
Office	10,162		
Conference	262		
AV/Storage	45		
Storage	78		
Lunch Room	902		
Café Service	200		
Third Floor	**11,419**	**14,858**	**72.9 / 27.1**
Office	10,830		
Conference	262		
AV/Storage	45		
Lunch Room	282		
BUILDING	**32,894**	**46,141**	**71.3 / 28.7**

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2.1.4.3 Building Entrances

Two (2) building entrances are provided in the OTE building. The main entrance is at the west end of the building and enters the lobby space on the ground floor. The main entrance is designed to serve the building occupants, FNAL employees, and people attending functions at the education/conference center.

The secondary entrance at the east end is primarily for FNAL employees coming from other buildings in the Industrial Area campus and parking areas at the east end of the campus.

2.1.4.4 CDF Connections

The OTE building design provides entrances into the existing CDF at the east end on the first and second floors. The east building entrance provides an access onto the CDF manufacturing floor via a short flight of stairs, and a new elevator.

In addition, the second floor of the OTE building is designed to connect to third floor of the CDF with a "bridge" along the west end of the high bay space. The OTE second floor and CDF third floor elevations are both at 766. In addition, the "bridge" will provide a vantage point to observe activity on the CDF manufacturing floor.

2.1.4.5 Horizontal Circulation

Horizontal circulation at the first floor of the building is provided by the main entrance lobby that connects the education/conference center to the light tech space, and provides direct access to the elevators, stair and restrooms. In addition, access to the light tech spaces is provided by a corridor located along the south side of the building.

Horizontal circulation on the second and third floors is provided through the office space that connects the two vertical circulation cores. A variety of office layouts were completed to examine possible egress and circulation paths, as well as visually break up a potentially long "corridor."

2.1.4.5.1 Vertical Circulation

Vertical circulation for the building is provided by two (2) stair and elevator cores. The primary vertical circulation is provided at the west end of the building and is located directly off the main entrance lobby. The secondary vertical circulation is provided at the east end of the building.

2.1.4.5.2 Stairs

Egress stairs are provided at the west and east ends of the OTE building. The west egress stair is designed with 1-hour fire resistant glazing along its north elevation to make the stair both visible and prominent from the main lobby.

2.1.4.5.3 Elevators

The west core includes two (2) ADA accessible elevators that serve the three floors of the building. The east core includes one (1) ADA accessible elevator and an egress stair. The east elevator is front and back opening and serves the three floors of the building and provides handicapped access to the manufacturing floor of the CDF.

Because the OTE building is three (3) stories, the applicable codes allow the egress stairs to provide access between floors.

2.1.4.6 Sustainable Strategies

There are numerous features of the design that shall create a building that is environmentally respectful and meets the requirements for achieving a minimum certification rating of GOLD under the LEED (Leadership in Energy and Environmental Design) green building rating system and complies with the HPSB Guiding Principles

2.1.4.6.1 Building Orientation:

With the majority of the building façade facing north and south, the building is oriented in order to maximize north/south exposure and minimize east/west.

2.1.4.6.2 Façade Shading Systems

All façade shading systems are designed in order to minimize the impact of solar gain and thus reduce cooling loads of the building. These devices must also balance the need to maintain as much day lighting to interior spaces as possible.

2.1.4.6.3 Light Shelves

Light shelves on the south elevation shall act as horizontal shading devices that are designed to shade the building from the sun as well as maximize indirect daylight to interior spaces. These fixed in place, light-reflecting overhangs are placed above eye-level and generally have a high-reflectance upper surface that redirects daylight deeper into the interior of the building

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2.1.4.6.4 Building Enclosure

The exterior envelope of the building will be designed to provide maximum views and day lighting while still providing a high performance thermal barrier to winter and summer temperature variances.

2.1.4.6.5 Roof Surfaces

All roof surfaces are designated to be either 'white'/reflective roof surfaces, or vegetated green roofs.

2.1.4.6.6 Building Systems

Environmental, energy saving building systems that deal with mechanical, plumbing, and electrical needs of the building are being extensively investigated. For information on environmental building systems, please refer to the specific section for each system within this report.

2.1.4.6.7 Site Work

Sustainable strategies such as storm water run-off control and treatment, solar shading/collection, constructed wetlands, etc. are being studied in the development of this project.

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2.1.5 SITE DESIGN

The IARC programmatic goals influenced the building massing and site design. Key features of the site design are:

- Creating a prominent presence on the Fermilab campus especially when approaching from the west on Road D.
- Maintaining truck access to the west end of the CDF
- Providing easy and convenient access from the light technical spaces in the OTE building to the CDF manufacturing floor.
- Landscaping with native and adaptive plants with minimal maintenance requirements.
- Using permeable pavements to reduce the stormwater impacts of the project.

2.1.5.1 Vehicular Access and Circulation

Vehicular access to the site is provided by Road D, the primary east-west artery on the Fermilab campus. The design provides two vehicular entrances onto the project site from Road D, one for the new on-site parking and one for truck access.

2.1.5.2 Parking Entrance/Exit:

The parking entrance is located just west of the building and provides a drop off point near the main entrance.

2.1.5.3 Truck Access and Circulation

Maintaining truck access to the west overhead door of CDF was key influence in the design of the OTE building. During program verification, Fermilab personnel indicated the frequency of truck deliveries using the west overhead door were one or two times a week. The drawings show two options for trucks entering and exiting the site.

2.1.5.3.1 Turning Radius

The minimum turning radius of a 55-foot tractor trailer is 19-feet inner radius and a 45-foot outer radius. The site design provides a 25 + foot inner radius and a 50 + foot outer radius and can accommodate a truck coming from the east or west on D Road. The truck maneuvering patterns are shown on the drawings.

2.1.5.3.2 Entering

The truck would pull into the 22-foot wide paved area, equivalent to a 2-lane road in front of the OTE light tech space, and back-up to the west overhead door of the CDF.

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2.1.5.3.3 Exiting

Option 1 was developed based on the infrequency of projected truck traffic. Under Option 1, when leaving, the truck would pull forward, heading west and exit out the parking entrance/exit. Heading east on D Road, the truck would need to make a 3-point turn. Option 1 requires a truck to pass in front of the building entrance once or twice a week but provides the following benefits:

- Increased stormwater site capacity with less pavement and more landscaping.
- De-emphasizes the truck entrance and overhead doors to the light technical spaces.

Option 2 provides a dedicated exit for trucks and removes truck traffic from in front of the main entrance, but also requires an additional curb cut and a large amount of additional pavement. In addition, the site layout draws attention away from the main entrance to the building.

2.1.5.3.4 Building Protection

Three (3) of the building columns land near the perimeter of the truck maneuvering zones. The columns can handle am impact from a truck with no adverse affects based on structural analysis of the building. In addition, the site design provides generous 22-feet driving lanes to ease maneuvering.

2.1.5.4 Light Technical Space Access

Vehicular access to the light technical spaces is provided with the 22-foot paved area along the north side of the west core. Four (4) overhead doors exit onto the paved area that allows direct access to the west overhead door of the CDF.

In addition, the truck entrance allows vehicular access to the service yard immediately east of the west section of the OTE building.

2.1.5.5 Bicycle Access

Approximately 1000 feet of the existing bicycle path located along the south side of Road D will be rebuilt at part of the project to accommodate the new parking and building. The bicycle path is located to maintain a minimum 10-foot buffer from its north edge to the south edge of Road D. In addition, the buffer zone shall be graded to accommodate stormwater runoff from the bicycle path.

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2.1.5.6 Pedestrian Circulation

Pedestrian access to the site is provided by the bicycle path and new sidewalks connecting to three (3) crosswalks along Road D. The sidewalks and crosswalks provide paths from parking and the Industrial Area buildings located on the north side of Road D.

2.1.5.7 Pedestrian Plaza

The design includes a 22-foot wide pedestrian plaza at the main entrance that is an exterior addition to the lobby/exhibit and education/conference spaces. The plaza is an extension of the pavement serving the CDF truck entrance and light technical spaces.

2.1.5.8 Bollards

Two sets of remotely controlled, pneumatic operated bollards are shown on the site plan to restrict vehicular traffic in the pedestrian plaza. The controls would reside in the CDF since the bollards would lower into the pavement to allow truck traffic to use the plaza for exiting.

2.1.5.9 Parking

The project includes a new parking lot which is located immediately west of the OTE building. The lot has 65 parking spaces including 7 accessible spaces.

2.1.5.10 Service/Equipment Yard

The positioning of the OTE building in relation to the CDF creates a protected service yard for major pieces of equipment serving both buildings. The free space in the yard is 36’-10” wide by 84’-5” long, and can accommodate a 40—foot long mobile crane with fully extended outriggers and flat bed truck simultaneously. Vehicle entry to the yard is provided by 16’ clear opening.

2.1.5.11 Permeable Pavement

If technically feasible, permeable paving will be used for all new paved areas. Permeable pavements decrease stormwater runoff by allowing rainwater to seep through the pores and infiltrate into subsurface soils. Permeable paving is considered a Best Management Practice for storm water detention.

Permeable interlocking concrete pavement (PICP) will be used because of its strength, durability, ease of maintenance, and sustainable qualities. Further PICP technical information is provided at the end in the Appendix.

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2.1.5.12 Exterior Lighting

The new parking area shall include new site lighting. The new lighting will be solar powered and spaced approximately 72-feet x 108-feet based on the following:

- 18-foot mounting height
- 150 watt lamp
- Type III luminaries

The general arrangement of the poles and lighting include single luminaries around the perimeter, and double luminaries down the centerline of the lot. Hard wiring will be provided as back-up to the solar power.

2.1.5.13 Landscaping

Landscape design for the OTE Building focuses on plant materials native to the local soil and climate. A large part of the existing Fermilab property features native grasses and forbs. While the new building site should harmonize with this existing character of Fermilab, its new landscape areas will provide a visually intended clean foreground to the building when viewed from D Road as well as the Industrial Buildings on the north.

2.1.5.13.1 Native Plants

Short grasses and forbs will be mixed together within the long expansive planting beds along the north side of the building and the new parking lot. In order to compliment the proposed building materials and colors, the plants were selected that display blooms or leaves in a similar range of colors. The suggested combination of plants includes Little Bluestem, Prairie Dropseed, Blazing Star, and Foxglove Beardtongue.

2.1.5.13.2 Maintenance

Native plants have been selected for this project since they will be self-sustaining once they are established. Manual watering and weeding will be limited to an as-needed basis during the establishment period after installation. Pruning back the plants after winter will facilitate growth during the next season. The landscape design:

- Eliminates weekly mowing during spring, summer and fall
- Will not require an irrigation system
- Does not require “burning”
- Meets LEED criteria

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2.1.6 CODE ANALYSIS

The code analysis examines occupancy classifications, fire protection, egress and life safety requirements for the OTE building. The International Building Code (IBC) and NFPA 101, Life Safety Code are primarily used as the basis for the analysis.

2.1.6.1 Occupancy Classification

The OTE Building is a mixed use occupancy in accordance with Section 508 of the IBC, and Section 6.1.14.2 of the NFPA 101. In addition, the provisions of "separated occupancies" of both codes shall apply. The primary occupancies in the building are:

PROGRAM	OCCUPANCY CLASSICATIONS	
	IBC	**NFPA 101**
Office Elements	Business Group B	Business
Education Element	Business Group B	Assembly < 300
Light Technical Element	Factory Industrial F-1	Industrial, Special Purpose

2.1.6.2 Occupancy Load

The maximum occupant load for each floor of the building was calculated using Table 7.3.1.2. Occupant Load Factors in NFPA 101. Support elements, such as the lobby and lunch room, were assumed to primarily support the building's occupants and classified as "simultaneous" use spaces. The occupancy loads for individual spaces were calculated to design for life safety and fire protection provisions.

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Floor/Space	Net SF	SF per Person	Occupant Load
First Floor			**293**
Lobby/Exhibit	1,856	15	124
Education/Conference	2,385	20	120
Light Technical	4,822	100	49
Second Floor			**164**
Office	10,162	100	102
Conference	262	20	14
Lunch Room	902	20	46
Café Service	200	100	2
Third Floor			**138**
Office	10,830	100	109
Conference	262	20	14
Lunch Room	282	20	15

2.1.6.3 Occupancy Separation Requirements

NFPA 101 has stricter occupancy separation requirements than IBC. Under the IBC, there is no separation requirements between Group B and F-1 occupancies. Using NFPA 101, the applicable separation requirements are:

- 1-hour fire resistive ratings between Assembly < 300 (Education Element) and Business occupancies
- 2-hour fire resistive ratings between Industrial and Business occupancies which can be reduced to 1-hour where the building is protected throughout with an approved automatic sprinkler system.
- 2-hour fire resistive ratings between Industrial and Assembly < 300 (Education Element) occupancies which can be reduced to 1-hour where the building is protected throughout with an approved automatic sprinkler system.

On the first floor, the walls and doors separating the lobby from the classrooms and from the tech space shall be designed to provide 1-hour fire separation. The floor and ceiling assembly between the first and second floors shall be designed to provide a 1-hour fire separation.

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2.1.6.4 Construction Types

Several factors were used in selecting Construction Types:

- Allowable heights
- Maximum number stories above grade
- Maximum area allowed per story
- Fire resistive ratings for building elements

Both Type I-B and Type II-B construction types were evaluated, and the OTE building shall be constructed to Type II-B standards for buildings 5 stories and under, and 65-feet above grade and less. The equivalent NFPA construction type is Type II (000).

2.1.6.5 Allowable Heights and Building Areas

Per IBC Table 503, the maximum allowable number of stories and areas per floor, without allowable increases for an automatic sprinkler system, are:

	TYPE II-B	
Occupancy Group	**Stories**	**Area/Story**
A (Assembly)	2	9,500 SF
B (Business)	4	23,000 SF
F-1 (Industrial)	2	15,500 SF

The building design meets the Type II-B requirements with the:

- A (Assembly) occupancy not exceeding 2 stories or 9,500 square feet
- B (Business) occupancy not exceeding 4 stories or 23,000 square feet per floor
- F-1 (Industrial) occupancy not exceeding 2 stories or 15,500 square feet

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2.1.6.6 Fire Resistive Rating Requirements

The required Fire Resistive Rating of Building Elements per IBC Table 601 and NFPA Table 8.2.1.2 are as follows:

	IBC	NFPA
BUILDING ELEMENT	**II-B**	**II (000)**
Structural Frame	0	0
Exterior Bearing Walls	0	0
Interior Bearing Walls	0	-
Multiple floors and walls	-	0
One floor or roof	-	0
Exterior Non-bearing Walls	See Table 602	0
Interior Non-bearing Walls	0	0
Floor Construction	0	0
Roof Construction	0	0

2.1.6.7 Minimum Number of Exits

Per IBC Table 1019.1, based on the calculated occupant load, each floor of the OTE building shall have a minimum of two (2) exits. The first floor has exits to grade from the lobby, classrooms and tech space. The required second and third floors exits are provided by two (2) egress stairs at opposite ends of the building.

Occupant Load	**Minimum Number of Exits**
(persons per story)	**(per story)**
1 - 500	2
501 - 1000	3
More than 1000	4

In addition, egress requirements for individual spaces in the OTE building were evaluated. Per IBC Table 1015.1, spaces exceeding an occupant load of 49 persons would required more than on exit from the space. Based on the calculated occupant load for individual spaces, there are no individual rooms that require more than one (1) exit. The room with the largest occupant load is the second floor lunchroom at 46 persons.

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Floor/Room	Net SF	SF per Person	Occupant Load
First Floor			
Classrooms (each)	521	20	27
Light Tech (each)	1205	100	13
Second Floor			
Lunch Room	902	20	46
Conference Room	262	20	14
Third Floor			
Lunch Room	282	20	15
Conference Room	262	20	14

However, both the classrooms and tech spaces can be combined into larger rooms. In these cases,

- The maximum occupant load for the classrooms exceeds 49 persons but is less than 500.
- The maximum occupant load for the tech space is 49 persons

In either case, the OTE building design provides 2 or more exits from the combined spaces.

Floor/Room	Net SF	SF per Person	Occupant Load
Classrooms (combined)	2385	20	120
Light Tech (combined)	4820	100	49

The exterior terrace located on the second floor shall be designed as a combination of occupiable and vegetative “green” areas to limit occupancy to less than 50 persons.

2.1.6.8 Egress Width

Per IBC Table 1005.1.1, the maximum number of occupants that can be served was by a 36-inch single door and a 48-inch egress stairway was calculated at 240 persons. On the first floor with a maximum possible occupant load of 307, multiple exits with 36-inch doors are provided to grade. On the second and third floors the maximum possible occupant loads are 162 and 141, respectively. These floors are served by two (2) 48-inch egress stairs that exceed 50% of the total occupant capacity per floor.

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Occupancies	With Sprinkler System (inches per occupant)	
	Stairways	Other Egress Components
A (Assembly) B (Business) F-1 (Industrial)	0.2	0.15

2.1.6.9 Travel Distance

Per IBC Table 1016.1.1, the travel distances with an approved sprinkler system are 250 feet for A (Assembly) and F-1 (Industrial) occupancies; and 300 for B (Business) occupancy. The OTE building exit access travel distances for the:

- First floor A (Assembly) occupancy is approximately 60 feet
- First Floor F-1 (Industrial) occupancy is approximately 135 feet
- Second and Third Floor B (Business) occupancies is approximately 210 feet.

Occupancy	With Sprinkler System (feet)
A (Assembly)	250
B (Business)	300
F-1 (Industrial)	250

2.1.6.10 Stairway Enclosures

Per IBC Section 1020.1, “exit enclosures shall have a fire rating … of not less than 1 hour where connecting less than four stories.” The stairways shall be designed as 1-hour rated enclosures. The west egress stair is designed with 1-hour fire rated glazing on the north side. In addition, both egress stairs are designed with areas of refuge.

2.1.6.11 Corridors

Per IBC Table 1017.1, for Occupancies A, B and F there is no fire-resistance rating required for corridors when the building is equipped with an automatic sprinkler system.

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2.1.7 STRUCTURAL SYSTEM

2.1.7.1 Substructure

The selection and design of the foundation system were influenced by:

- The cost of the systems
- Constructability; and
- Potential risks associated with constructing shallow foundations adjacent to the existing CDF basement walls and existing utility runs

The OTE building uses a combined foundation system consisting of shallow foundations for the west half of the building, and a deep foundation system for the east half of the building. The deep foundations are combination of straight shaft piers and belled caissons connected by grade beams at the east building, adjacent to the CDF facility.

The ground floor level will be supported on a 6" slab-on-grade with a perimeter frost beam. The light tech spaces, shall have a thicker slab-on-grade structure, currently anticipated to be 10"thick to meet the requested 600 psf in those areas.

2.1.7.2 Superstructure

The superstructure will typically consist of steel columns and beams with a composite concrete over metal deck floor system. The depths of steel beam members will be optimized based on considerations for cost, coordination with the architectural and services systems, and constructability. Currently, the beams are designed as 16"-deep wide flange sections spanning to deeper girders at the perimeter of the third floor and the roof, and spanning to deeper, upturned beams at the perimeter of the second floor which are upturned due to height considerations at the loading dock below. The concrete over metal deck will serve as a horizontal diaphragm to span between the north-south lateral systems at the east and west sides of the building.

The composite beam structure will span between two (2) 2-story steel trusses that run along each side of the second and third floors, and will be detailed with consideration for constructability of the beams relative to the steel truss members. The girders running parallel with the trusses at the 3rd level are inset from the trusses so as not to impose loading on the truss diagonals; these girders are supported at seated connections at the truss vertical member locations. The trusses span between steel columns located at approximately 70' on center typically. The building lateral

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system will consist of braced frames. The 2-story trusses serve as the lateral system in the longitudinal direction for the second and third floors, and for the roof.

The steel members in the roof system above Level 4 are sloped and/or offset in elevation in order to accommodate a slope of the roof from north to south. The longitudinal girders at the east end of the building are deeper than the typical girders in order to cantilever out to pick up the end of the roof without the provision of a vertical structural member at the corner of the building. At the west end of the building, a series of flat horizontal HSS members are provided as lateral support for the two-story façade from Level 2 to the roof.

The roof system over the first floor classroom areas at the west end of the building will consist of steel framing with composite lightweight concrete over metal deck to accommodate an exterior seating area off the lunch room at the second floor.

The roof system over the first floor light tech areas at the west end of the building will be either composite lightweight concrete over metal deck or metal roof deck alone.

2.1.8 MECHANICAL SYSTEMS

The mechanical system is anticipated to incorporate a ground source piping loop which will serve as heat sink for heating and cooling. Cooling and heating will be provided by multiple water to water heat pumps to the air handling units. The heat pumps will utilize the ground loop as heat sink. At this time it is anticipated that 20 to 25 ground wells will make up the loop field. The loop field will be located beneath the parking area. Water circulation for the loop field will be accomplished by circulating pumps located in the mechanical room. A back-up boiler will be installed for extreme conditions to supplement the well field as necessary.

2.1.8.1 Air Handling Units

Two (2) main air handling units will be utilized to accomplish control of discrete thermal zones. Air handling units will be located in mechanical rooms on the east and west ends of the first floor. The air handling units will provide constant 55°F supply air to the terminal units and air columns. AHU's will be provided with air side economizers, MERV 13 filters, hot water heating coil, chilled water cooling coil, supply fan and exhaust return fan. The air handling units will be variable air volume and the fans will be controlled by variable frequency drives. AHU's will be 2" thick double wall

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construction with stainless steel drain pans, access plenums, interior service lights and internal vibration isolation.

Water to the air handling units will be configured as a four pipe system to allow simultaneous heating and cooling to zones which have differing thermal requirements. Hot water and chilled water pumps will be provided for circulation to the air handling units.

2.1.8.2 Chilled and Hot Water

Chilled water and hot water will be supplied to the air handling units and heating devices by Multistack modular chiller heaters with Virtual Moveable Endcaps. Three 70 ton modules will be configured such that all modules can be in either heating or cooling or the modules can be mixed to provide chilled water and hot water simultaneously. The heat sink for the system is anticipated to consist of a geothermal field described below.

Chilled water and hot water piping systems will include in-line pumps located in the east mechanical room. Redundancy will be factored into the pump selections. Piping systems will be complete with air separators, strainers, control valves, etc for a complete and operational system. Pumping systems will be variable flow with VFD's for all pumps.

2.1.8.3 Geothermal Field

The anticipated geothermal well field will be located north of the east section of the OTE building and the CDF between the bicycle path and Road D. The well field will be immediately adjacent to the mechanical room on the ground floor housing the units served by the geothermal system.

The well field will consist of multiple bore holes circulating a mixture of propylene glycol and water. The well field will be sized with a minimum of one extra bore hole which can be isolated and bypassed in case of failure. Pumps for the well field will be end suction base mounted pumps located in the east mechanical room. The pumps will be provided with VFD's for balancing purposes. It is anticipated the geothermal field will consist of 20 to 25 wells of approximately 600' depth to provide 140 tons of capacity.

2.1.8.4 Zone Control Terminal Units and Air Columns

Zone control for spaces will be provided by a combination of VAV terminal units, Fan Powered VAV terminal units and Vertical "Air Column" terminal units.

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VAV terminal units will be utilized at the lunch room to provide air along the perimeter of the room. VAV terminal units will be provided with hot water re-heat coils for heating.

Fan Powered VAV terminal units (series flow) will be utilized at conference rooms and classrooms. The classroom Fan Powered units will be used to blend return air and primary air to provide air to the spaces in a displacement distribution scheme. Fan Powered units at conference rooms and lobby will be used to provide constant air flow to the rooms. All Fan Powered units will be provided with hot water re-heat coils.

Air Columns will be utilized for zone control for the general office spaces. Air columns at the perimeter exposures will be controlled as VAV with re-heat and will supply 55°F air in cooling mode and 90° F maximum in heating mode. Separate air column zones will be provided for north and south building exposures. Interior office spaces will be served via an under floor air distribution (UFAD) plenum. The air will be ducted within the plenum due to the extended length of the plenum. The air Columns will mix primary air and return air for the interior spaces to satisfy space load. Interior air columns will be controlled to maintain floor plenum pressure and will supply air at a constant 65° F.

Tech Space rooms will be conditioned by individual four pipe fan coil units. Fan coil units will be configured for economizer and make-up air mode operation for future potential process exhaust requirements. Unit selections will accommodate a minimum of 50% OA.

Environmental Control for the occupied space will consist of zone sensors and adjustable (UFAD) floor diffusers. Air Columns which serve perimeter zones will be controlled off of localized sensors. VAV boxes and Fan Powered VAV boxes serving individual spaces will be controlled off of localized sensors. Interior office spaces will be manually adjustable by the occupant to suit individual preference.

2.1.8.5 Miscellaneous Spaces

A computer room air conditioning unit (CRAC) will be provided for the main data closet. The CRAC will utilize the ground loop for condenser water.

Roof mounted exhaust fans will be provided for the exhaust of toilet rooms and janitor's closets and elevator machine rooms.

Mechanical and electrical rooms will be provided with hot water and electric unit heaters respectively.

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2.1.9 PLUMBING SYSTEMS

2.1.9.1 Plumbing Fixtures

An estimated occupant count of 408 was used for calculating the minimum number of plumbing fixtures. This occupant counts assumes support elements, such as the lobby and lunch room, primarily support the building's occupants and are classified as "simultaneous" use spaces. The calculations assume half are men and half are women. The table shows the required number of plumbing fixtures per the Illinois Plumbing Code for Office and Public Buildings and the number of plumbing fixtures in the design .

Minimum Plumbing Fixture Count			Persons		Min. No.	Design
Water Closets	5	for each	110	males	5	
	1	for each additional minus urinals	40	males	3 -3	
				men	**5**	**7**
	5	for each	110	females	5	
	1	for each additional	40	females	3	
				women	**8**	**11**
Urinals		no more than 50% of water closets		**Total**	**4**	**4**
Lavatories	1	for each	125	males	5	
	1	for each additional	45	males	1	
				men	**6**	**8**
	1	for each	125	females	5	
	1	for each additional	45	females	1	
				women	**6**	**8**
Drinking Fountains	1	per public restroom	75	**occupants**	**6**	**6**
Service Sinks	1	per floor with restrooms			**3**	**3**

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2.1.9.2 Domestic Cold Water System

Metered services to the building will be extended from the 6-inch DWS main located in the vicinity of the East core of the building from a point 5 feet outside the building. Water will be distributed through mains, risers, and branches to plumbing fixtures and equipment.

An electric variable speed pumping system will be provided since the available data indicates that the pressure in the DWS main is insufficient to provide the required flow and pressure for the building.

2.1.9.3 Domestic Hot Water System

Hot water will be provided by heater(s) as described below and distributed through mains, risers and branches to plumbing fixtures and equipment.

The hot water requirements for the west part of the building include the restrooms on each floor and the tech spaces. Using gas as the heating medium, hot water will be generated in gas fired water heaters and supplied to draw-off points. The stored water in the tank will be heated via solar panels on the main roof and will serve to pre-heat the supply water to the gas heater.

The hot water requirements for the east part of the building include restrooms on each floor plus showers on the first floor. It is proposed that gas is used as the heating medium. Hot water will be generated in an instantaneous type water heater and supplied to fixtures. The heater will be located locally to the fixtures being served. To supplement this installation, a centrally located storage tank will be provided upstream of the heater. The stored water in the tank will be heated via solar panels on the main roof and will serve to pre-heat the supply water to the gas heater.

Heaters in both cores will be located close to the points of use however consideration will be given to the use of a re-circulated piping system incorporating a single in-line circulating pump to ensure satisfactory delivery time of hot water at the outlets.

At least 30% of the hot water needs of the building will be met via the solar panels.

2.1.9.4 Sanitary Waste and Vent System

Plumbing fixtures will be drained by gravity through soil, waste and vent stacks, house drains and house sewers, to and connected to site main. The East and West cores of the building have individual connections to the site main.

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2.1.9.5 Storm Drainage System

Roofs and outdoor plazas of building will be drained at low points by gravity through multiple inside leaders and connect to the storm system on site.

As an alternate, storm run-off from roof areas will be separated from grade run-off and will be routed to an underground holding tank for re-use as a 'grey water system' within the building.

Water closets and urinals would be supplied from the grey water system

If incorporated in the design, the holding tank will be provided with necessary accessories such as pre-screening inlet sump and electric booster pumps in order to provide the required flow and pressure for grey water system needs within the building.

The building will be provided with overflow scuppers in parapet walls, therefore a secondary system of overflow drainage will not be required.

2.1.9.6 Natural Gas System

Metered and regulated natural gas will be extended from the site distribution main and distributed through risers and branches to gas fired equipment.

2.1.10 FIRE PROTECTION SYSTEM

A service to East Core of the building will be extended from the 6-inch ICW line located by the at the east core and connected to the building's fire suppression system. The requirement for a meter on this service is still to be determined.

Based on available water pressure information in the ICW site main, the automatic sprinkler system will be able to operate without the need for an automatic fire pump.

A standpipe system is required since the IBC requires these systems for all buildings where the highest occupied floor is more than 30ft above grade.

Residual flow and pressure for standpipe system operation will be provided by Fire department pumper truck via the exterior fire department inlet connections.

Standpipe will be a wet pipe type with supply valve open and under water pressure at all times and cross-connected to fire department inlet. All standpipes will be interconnected.

Roof manifold with approved roof outlets and pressure gauges will be provided at the top of each standpipe as required by code.

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Sprinkler heads will be as follows:

- Office spaces, classrooms, conference rooms and public circulation areas – concealed heads
- Toilet rooms – semi-recessed heads
- Tech spaces and other areas with no suspended ceilings – exposed heads.

2.1.11 ELECTRICAL SYSTEMS

2.1.11.1 Incoming Electrical Service

The building will be served via two (2) - 3 phase 4 wire, 480/277-volt service from the site distribution network. A new ground mounted transformer will be located adjacent to the existing outdoor electrical equipment. Space will be allowed for a further future transformer should it become necessary to provide an isolated source of clean 400Hz power in the future. Conduits will be provided into the building from this location.

The service entrance location and main electrical room will be located at ground floor. This room will have a 3 hour fire rating.

Main mechanical plant will operate at 480/277 Volts. 480/277 Volt industrial power panels will be provided in the Tech area. Each of the four technical areas will have separate power supplies wired direct from the a dedicated main switchboard to minimize interference by process loads.

The remaining electrical distribution within the building will operate at 208/120 Volts, via (2) step-down transformers..

Our preliminary estimate of service capacity is in the order of 300kVA however a dedicated 1500kVA transformer will be provided to allow for future unknown process loads.

The building connected load has been determined using the following allowances:

System	Connected load (W/sf)
Lighting	1.0
Small Power	2.5
Server room power	80
HVAC	6

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2.1.11.2 Electrical Distribution

The office areas will be served from two electrical riser locations in order to reduce cable lengths. The primary electrical riser will be located towards the east end of the building and will comprise a walk-in electrical closet on each floor. A second electrical riser will comprise panelboards located within the mechanical rooms at the west end of the building. Each panelboard will be separately cabled back to the main switchgear at level 1.

2.1.11.3 Low Voltage Distribution

Electricity will be distributed throughout the building from the main electrical room to electrical distribution panels on each floor. These will be located in the core area in a landlord riser/closet. Step down transformers to provide 208/120 Volt supplies will be centrally located in the ground floor electrical room.

The distribution panels on each floor will serve lighting, convenience power, and local mechanical equipment. Sub-metering together with a data gathering system will be provided so that the building owner can monitor electrical usage area by area and system by system (e.g. lighting, mechanical power etc.) as part of his ongoing strategy to minimize energy usage.

2.1.11.4 Small Power

Small power will be distributed to office and classroom/conference areas within the raised access floor. An underfloor plug-in busbar trunking system will allow flush floor outlet boxes to be plugged in at any location to suit furniture layouts. Outlet boxes will be two-compartment power/data.

2.1.11.5 Lighting

Lighting to circulation and back of house areas will be energy efficient and will generally be controlled by local occupancy sensors. Lamps will be compact fluorescent or T5 tubular fluorescent.

Lighting to office areas will be high efficiency tubular fluorescent with recessed or suspended fixtures to suit the ceiling design. These will be occupancy sensor controlled and will be dimmable with daylight sensing and control to take maximum advantage of available daylight.

Lighting in classrooms/conference rooms will again be dimmable fluorescent. A control system will allow for multiple pre-set scenes to suit presentations, video conferencing, etc. This control system will be capable

of being interfaced with an AV control system which is outside of this scope.

2.1.11.6 Daylighting

Maximizing natural daylight within the building is essential for both physiological and energy efficiency reasons. LEED recognizes the benefits of daylight within buildings with two credits; one for achieving a good level of natural illumination internally and the other for maximizing views to the outside.

This needs to be balanced however with the functional requirements of the building.

Arrangements such as light shelves, skylights and light pipes to bring daylight as deep as possible into interiors will be studied further in final design.

2.1.11.7 External Lighting

The exterior of the building and the surrounding landscaping will require night lighting both for effect and for the safety of visitors. The design of this lighting is expected to be a collaboration between architect, and landscape designer. The lighting will be highly energy efficient, using LEDs where appropriate, and will enhance surfaces with no spill light into the night sky.

2.1.11.8 Lightning Protection

A lightning protection assessment will be conducted during the design development phase. If it is determined that lightning protection is to be provided, a UL Master Labeled system will be specified in accordance with NFPA 780. The system would comprise an air termination network at roof level. The building's structural reinforcement would form the down conductors and driven earth rods would form the ground termination network. The air termination network would be connected to the structural reinforcement system via disconnectable test joints at roof level. The lightning protection system would be bonded to the service main grounding system per Code.

2.1.11.9 Emergency Power Supply

Per code, a standby generator is not required for this building Any owner equipment requested to be supplied with a standby power supply, will require a dedicated battery back-up system

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2.1.11.10 Emergency Lighting

Egress lighting and exit signs will be provided in accordance with National Electrical Code. The back-up power source for the emergency lighting system will be provided from integral emergency battery ballasts within specific light fixtures .

2.1.11.11 Fire Detection and Alarm

The fire alarm system will be a fully addressable system, and will be designed in conformance with NFPA 72.

The Fire Command station, consisting of the Fire Alarm Panel, Voice Communications Control Panel and Elevator Status Control Panel will be located in the ground floor entrance lobby.

Automatic smoke or heat detectors will be provided throughout the building. Manual pull stations will be located in areas that are supervised by staff to reduce the risk of malicious use. Alarms will be given by combined sounder/strobe units.

2.1.11.12 Elevators

All elevators will run on normal utility power only, , and will operate in a sequenced manner upon loss of utility power supply. Elevator recall will also be provided per Code, and will be triggered by the sprinkler flow detector of each floor zone. 4 hour battery lighting will be provided in each elevator cab, per Code.

2.1.11.13 Photovoltaics

Photovoltaic panels placed on the building or integrated into its façade can provide sustainable energy which both reduces the building's overall energy cost and contributes to the percentage of on-site renewable energy generation. Both of these factors contribute to the building's LEED rating.

PV panels will be considered for the project to contribute to LEED rating points and to offset the energy consumption of the building. Locations identified for possible location of PV panels include the roof of the existing building and as a shading canopy above the parking area.

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The performance requirements listed below describe the project specific requirements that exceed or are not addressed in the applicable building codes and standards requirements and referenced in Section 2.4, Quality Levels.

2.2.1 REFERENCE MATERIALS

Following are a list of project specific reference materials followed for the design of the OTE Building.

2.2.1.1 Fermilab Publications

- Designing for Maintenance Needs, FESS/Ops Standard, March 23, 2010
- A/E Consultant Handbook, FESS, April 2008
- CAD Standard Manual, FESS, April 2008
- Draft Programming Document V3, FESS, July 14, 2009
- Federal Publications
- Executive Order 13514—Federal Leadership in Environmental, Energy, and Economic Performance, October 8, 2009
- Executive Order 13423—Strengthening Federal Environmental, Energy, and Transportation Management, January 26, 2007
- Technical Support Document: 50% Energy Savings Design Technology Packages for Medium Office Buildings, Department of Energy, September 2009

2.2.1.2 Sustainable Design

- LEED 2009 for New Construction and Major Renovations Rating System, April 14, 2009
- High Performance and Sustainable Buildings Assessment and Compliance Tool for New Construction, Department of Energy

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2.2.2 GENERAL PROJECT REQUIREMENTS

The identified project requirements are listed below:

2.2.2.1 Disruption of on-going CDF and lab activities shall be kept to a minimum. Specific coordination with AD, PPD, TD and FESS-Ops is required.

2.2.2.2 Excessive vibration is not allowed. Specific coordination with AD, PPD, and TD is required.

2.2.2.3 Disruption of fire protection/life safety shall be kept to a minimum. Specific coordination with the Fire Department and building managers is required. Access to one exit on the west side of CDF shall be maintained at all times.

2.2.2.4 Fire Department personnel access will be maintained to the west (south) CDF entrance at all times.

2.2.2.5 Disruption of public traffic on Road D and the bike trail shall be kept to a minimum. Specific coordination with FESS-Services is required. Pedestrian access from the parking lot north of Road D to CDF shall be maintained.

2.2.2.6 Intermittent use of the west side loading ramp to CDF is required. Access shall be maintained.

2.2.2.7 Access for repair and maintenance to existing CDF utilities in the project area shall be maintained. This will include possible refueling of the generator.

2.2.2.8 LEED Gold certification will be achieved for this building and all work will be performed in compliance with the HPSB Guiding Principles.

2.2.2.9 All utilities shall be metered. Meters shall be programmable and capable of remote monitoring on an hourly basis and compatible with existing Johnson Controls Metasys.

2.1.1

2.1.2

2.1.3

2.1.4

2.1.5

2.1.6

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2.2.3 SUSTAINABLE REQUIREMENTS

The project is designed to achieve LEED Gold certification and meet the DOE requirements in the High Performance and Sustainable Buildings Assessment and Compliance Tool for New Construction. Specific criteria for this project are as follows:

2.2.3.1 Site Design

The site design shall achieve the following objectives:

- Provide bicycle storage on site
- Provide changing rooms and showers
- Provide parking spaces for low-emitting and fuel efficient vehicles
- The parking lot capacity shall not exceed local or established ordinances
- The site shall be developed to enhance and restore local habitats with use of native and adaptive plant species
- The site design shall maximize open space
- The site design shall minimize stormwater runoff by reducing the amount of impervious surfaces and use of permeable pavements
- The design shall reduce the heat island effect by using a combination of reflective and vegetative roofs.
- The design shall reduce the heat island effect by the using a combination of reflective paving materials and shading.
- The exterior lighting design shall be minimized to provide illumination for safety, and all exterior fixtures shall have full optic cutoffs.

2.2.3.2 Water Efficiency

The project design shall achieve water use reductions of at least 30% by using:

- Dual flush, low flow water closets
- Low, metered pneumatic lavatory faucets
- Ultra low flow urinals
- Low flow shower heads
- Landscape design that eliminates irrigation

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2.2.3.3 Energy and Atmosphere

The project has been designed to achieve the following objectives:

- Energy savings of at least 34% according to energy modeling
- Allowances for the use of on site renewal energy sources such as photovoltaics and/or a wind turbine
- Use of solar water heating to achieve a minimum of 30% of the hot water needs of the building
- Metering of resources and building systems for measurement and verification purposes

2.2.3.4 Materials and Resources

The project design shall meet the following objectives:

- Require the contractor to develop, document and implement a Construction Waste Management plan
- Use a materials with recycled content
- Use materials that are available locally and regionally
- Use materials that are rapidly renewable
- Use wood products that meet certified harvesting and processing requirements

2.2.3.5 Indoor Environmental Quality

The project design meets or shall meet the following objectives:

- Meet minimum indoor air quality performance as defined by ASHRAE
- Provide outdoor air delivery monitoring
- Require the contractor to develop, document and implement a Indoor Air Quality Management plan
- Use low emitting adhesives and sealants
- Use low emitting paints and coatings
- Use low emitting flooring systems
- Use low emitting composite wood products
- Provide controls for lighting that include occupancy sensors and photocells
- Provide controls for the HVAC system to enhance thermal comfort
- Achieves exterior views for 90% of the occupants

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- Achieves daylighting for 75% of the occupied spaces

2.2.4 SITE AND UTILITIES

The identified project requirements for the Site and Utilities portion of the work are listed below:

2.2.4.1 No work will be performed on the beam shielding (berm). Specific coordination with AD-ES&H is required. All work will be coordinated with AD to assure properly controlled access to radiation areas and maintenance of radiation shielding.

2.2.4.2 The connection of the new utility lines to existing lines shall be scheduled to occur within the same narrow time frame to minimize impacts to operations in the Industrial Area.

2.2.5 STRUCTURAL

2.2.5.1 Gravity Loads

Specific concentrated loads to be determined include the following:

- Elevators
- Overhead doors at the Light Technical spaces
- 3-ton capacity crane in Light Technical spaces – either an overhead bridge crane or a mobile gantry crane, currently

2.2.5.2 Seismic Loading

2.1.7 The geotechnical reports for the project site identified specific seismic design criteria to be used are as follows:

Factor	Value	
Seismic Design Category	B	
Site Class	C	
Spectral Response Acceleration Parameters	S_S	0.22
	S_1	0.07
	S_{DS}	0.18
	S_{D1}	0.08

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2.2.5.3 Truck and Impact Loading Criteria

2.1.8 Structural elements near the CDF loading dock driveways and ramp shall be designed for an impact load of 10 kips applied at a height of 2'-8" above the driving surface per the AASHTO Bridge Design Specification Chapt. 2.6 "Highway Clearances for Depressed Roadways".

2.2.5.4 Fire Resistance Rating

2.1.9 Spray-on fireproofing will be will be used on the primary floor structure as needed to achieve a fire resistance rating of one hour between the light tech space and the office above.

2.2.5.5 Materials

2.1.10 Based on the geotechnical reports and the project's structural design the following criteria shall be used in the building's construction.

Concrete	**f'_c (PSI)**
Footings, grade beams,	4,000
Deep foundations	5,000
Slab on grade	4,000
Lightweight concrete slabs on metal deck	4,000
Equipment pads and curbs	2,000

Concrete Reinforcement	**ASTM Designation**	**F_y (KSI)**
Typical reinforcement	A615	60
Welded wire fabric	A185	Varies

Steel	Designation	F_y (KSI)
Wide flange sections and tee sections	ASTM A992	50
Channels, angles, and plates	ASTM A36	36
Square and rectangular HSS	ASTM A500, Grade B	42
Pipes	ASTM A53, Grade B	35
Bolts	*TBD*	
Threaded rod anchor bolts	ASTM A572 Grade 50 U.O.N.	50
Welding electrodes	E70XX	
Metal deck	ASTM 653 SQ Grade 33	33

2.2.5.6 Structural Analysis

2.1.11 The following structural analysis programs were used in performing the structural design of the OTE building.

Structural Analysis Program	Usage
Microsoft Excel	General Structural Analysis
Autodesk Revit Structure	3D Modeling and Drafting of Structure
Oasys GSA	Finite Element Analysis of Building Superstructure and Substructure
RAM Structural System	Design and Analysis of select members

2.2.6 MECHANICAL

2.2.6.1 Temperature/Occupancy Criteria

Interior spaces will be designed in accordance with the following criteria.

- Office Spaces
  - **2.1...1** Winter Design 72° F (±2)
  - **2.1...2** Summer Design 75° F(±2)/50% RH Maximum
  - **2.1...3** 1 person/150 SF
- Tech
  - **2.1...1** Winter Design 72° F (±2)
  - **2.1...2** Summer Design 75° F(±2)/50% RH Maximum
  - **2.1...3** 1 person/300 SF
- Lobbies
  - **2.1...1** Winter Design 72° F(±2)
  - **2.1...2** Summer Design 75° F(±2)/50% RH Maximum
  - **2.1...3** 1 person/50 SF
- Classrooms and Conference Rooms
  - **2.1...1** Winter Design 72° F(±2)
  - **2.1...2** Summer Design 75° F(±2)/50% RH Maximum
  - **2.1...3** 1 person/25 SF
- Lunch Room
  - **2.1...1** Winter Design 72° F(±2)
  - **2.1...2** Summer Design 75° F(±2)/50% RH Maximum
  - **2.1...3** 1 person/25 SF
- Back of House (Mech/Elec rooms)
  - **2.1...1** Winter Design 60° F(±2)
  - **2.1...2** Summer Design – No Cooling
  - **2.1...3** Unoccupied

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2.2.6.2 Building Envelope

2.1.12 The following minimum criteria shall be used for the selection of the building envelope components.

- Roof – Maximum U=0.033 Btu/sf*°F (R=30 or better)
- Exterior Walls – Maximum U=0.05 Btu/sf*°F (R=20 or better)
- Vision Glass
  - **2.1...1** Shading Coefficient – Maximum 0.32
  - **2.1...2** U-Value 0.29 Btu/sf*°F (Center of Glass)
  - **2.1...3** U-Value 0.35 Btu/sf*°F (Overall glass/frame combined)
- Spandrel Glass
  - **2.1...1** Shading Coefficient – Maximum 0.32
  - **2.1...2** U-Value 0.05 Btu/sf*°F
  - **2.1...3** U-Value 0.10 Btu/sf*°F (Overall glass/frame combined)

2.2.6.3 Building Automation System (BAS) and Control System

A full Building Automation System (BAS) will be required for the project. The system will be capable of providing the following controls:

- HVAC Central Cooling System
- HVAC Central Heating System
- HVAC Air Handling Systems
- Exhaust Systems
- Lighting Systems
- Domestic Water
- Life Safety Monitoring
- Renewable Energy Systems
- Monitor Water Re-use strategies

A full DDC Building Energy Management Control System (BMS) will be provided. Equipment and software will be specified to match Fermilab

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standards. The following items of equipment will be monitored and/or controlled:

- All central HVAC equipment such as air handling units, chillers, boilers, pumps and exhaust fans.
- All decentralized HVAC equipment such as variable air volume units, reheat coils, thermostats, metering, air and water temperature sensors and system pressures.
- Trending output reporting estimated peak KWHR demand and estimated BTU use of previous day and quarterly reports of energy bills, energy use of EPA lease space and shared common areas.
- Light control systems.

2.2.7 PLUMBING

2.2.7.1 Water closets will be vitreous china siphon jet wall hung water-conserving 1.28 gallon flushometer type, with manual operation.

2.2.7.2 Urinals will be vitreous china, wall hung, siphon jet water-conserving 0.125 gallon flushometer type, with manual operation.

2.2.7.3 Public lavatories will be provided with 0.5 gpm flow restrictors using manually operated self-closing faucets.

2.2.7.4 Drinking fountains will have integral chiller units.

2.2.8 ELECTRICAL

2.2.8.1 Power Criteria

Interior spaces will be designed in accordance with the following criteria.

- Office Space
  - **2.1...1** Lighting 1.0 Watts/SF
  - **2.1...2** Equipment 1 Computer/Person
  - **2.1...3** Miscellaneous Equipment – 0.5 Watts/SF
- Light Technical
  - **2.1...1** Lighting - 5.0 Watts/SF
  - **2.1...2** Computers - 1 Per Person (150 Watts)

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2.1...3 Miscellaneous Equipment – 0.5 Watts/SF

- Lobby/Exhibit
  - **2.1...1** Lighting 1.0 Watts/SF
  - **2.1...2** Miscellaneous Equipment – 0.5 Watts/SF

- Classrooms and Conference Rooms
  - **2.1...1** Lighting 1.0 Watts/SF
  - **2.1...2** Computers 1 Per Person (150 Watts)
  - **2.1...3** Miscellaneous Equipment – 1.5 Watts/SF
- Lunch Room
  - **2.1...1** Lighting – 1.4 Watts/SF
  - **2.1...2** Miscellaneous Equipment – 1.5 Watts/SF
- Back of House (Mech/Elec rooms)
  - **2.1...1** Lighting 1.0 Watts/SF

2.2.8.2 Lighting Levels

Lighting levels are based on industry standards, and are outlined below:

Occupied Space	Recommended Lighting Level (fc)
Open Office Areas	40-50
Private Offices	50
Lobbies / Reception	15
Corridors	10
Classrooms	50-60
Technology Room	50-75
Print / Copy Rooms	15

2.2.8.3 Electrical Equipment

Major pieces of exterior electrical equipment, such as air switches and transformers, shall be located 25-feet from the building.

2.2.9 FIRE PROTECTION

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2.2.9.1 Work involving the ICW shall not interrupt fire suppression systems to existing buildings subject to coordination with the Fire Department and building managers**.**

2.2.9.2 The CDF building manager shall be informed of any work on ICW or communication lines**.**

2.2.9.3 Work involving the communication lines shall not interrupt fire alarm service to existing buildings subject to coordination with the Fire Department and building managers

2.2.10 BUILDING SYSTEMS EVALUATIONS

2.1.13 The mechanical systems for the building have been selected to integrate with the architecture of the building and the desire for energy efficiency. To meet the goal of designing to LEED Gold and beating ASHRAE 90.1 targets by a minimum of 30% the selected system consists of a Geothermal well field and a central Chiller/Heater which will provide both cooling and heating as needed. Although the cost of this system is anticipated to be higher than a more typical office building system of a packaged rooftop unit, the system will have a longer useful life and is expected to require lower operating and maintenance budgets.

2.1.14 Consideration was also given to utilizing the site's Industrial Cooling Water (ICW) in lieu of the geothermal well field. However, it was determined that utilizing the ICW will result in higher energy costs due to large fluctuations in the temperature of the ICW system (80F summer/36F winter) vs a more consistent geothermal temperature range of 55F to 65F.

2.1.15 To reduce the maintenance and operational expense central indoor VAV air handling units were selected to provide primary heating, cooling and ventilation requirements as opposed to distributed heat pumps with localized compressors. This also allowed the building design to utilize a lower floor to floor height and reduced envelope loads.

2.2.11 Energy Conservation Strategies

The project is designed for low energy consumption. The minimum target for energy conservation is to exceed ASHRAE Standard 90.1 by greater than 30%. To accomplish this we anticipate incorporating the following strategies.

- Geothermal well field or Industrial Cooling Water as heat sink

- Exterior Building Shading to reduce solar loads
- High Efficiency Condensing Boilers
- Building oriented on the East-West axis to reduce solar loads
- High performance Glazing and building components
- Extensive use of Daylight and Daylighting Controls
- Solar Thermal domestic water heating
- Possible use of renewable energy (Photovoltaics or wind turbine)
- Variable Frequency drives on pumps and air handling units

2.2.12 Life Cycle Cost Analysis

2.1.16 A preliminary Life Cycle Cost (LCC) analysis was performed comparing heat rejection options of the proposed Geothermal field, a conventional cooling tower/boiler system, and use of the Industrial Cooling Water (ICW) system. The baseline system of VAV rooftop units was not used for the LCC since it would not meet the requirement for 30% savings over ASHRAE 90.1. Consideration was also given to a system of distributed heat pumps in lieu of a central system but was not included in the LCC since it had both a higher energy usage and a higher installation cost.

2.1.17 Based on the LCC the design team's recommendation is to utilize the central heat pump system with a geothermal field and a back-up boiler. While the LCC shows this as having a higher life cycle cost it is the system which will meet project goals of low energy use and exceeds the minimum 30% savings over ASHRAE 90.1. However, during design development this should be re-visited since the systems are close in energy usage. If other building energy savings can be included in the project including possible use of renewable energy, then one of the lower first cost alternative can be utilized and still meet the project requirements.

2.1.18 Several assumptions were necessary in the preliminary LCC analysis. The owner should confirm the economic indices used for the analysis are appropriate. The system operation of the systems are similar with the exception of the heat rejection methodology. For the LCC increased maintenance was included for annual cooling tower maintenance and semi-annual cleaning of the ICW heat exchanger.

2.1.19 For the purpose of the LCC the following cost estimates were used:

- Geothermal Field installed cost - $3000 per ton
- Cooling Tower Installed Cost - $40,000 (includes strainer)

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- Cooling Tower Maintenance - $1,500 Annually
- ICW Heat exchanger Installed Cost - $25,000 Annually
- ICW maintenance $3,000 Annually

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2.3.1 SAFEGUARDS AND SECURITY

Direction for security issues related to the design of this project is taken from the current operating procedures of the Fermilab activities.

Access to the site areas outside any beam line excavation limits will be allowed during normal business working hours. Access to any radiological areas, areas in the area of the existing beam lines, are controlled by the Accelerator Division Radiation Safety and will require coordination of work efforts and beam line operations. GERT training will be required for all personnel that enter the berm area.

CDF is a controlled access building. Access to the controlled areas during normal working hours will be controlled by the Particle Physics Division's system of restricted identification card access. An identification badge is required for access to the building.

Access to utilities during normal working hours will be controlled by a FESS construction coordinator.

2.3.2 HEALTH AND SAFETY

All aspects of the project will be evaluated to ensure that the adequate health and safety precautions are incorporated in the design and construction of this project.

2.3.3 ENVIRONMENTAL PROTECTION

The overall environmental impact of this project will be evaluated and reviewed as required to conform to all applicable portions of the National Environmental Policy Act (NEPA). A Storm Water Pollution Prevention Plan and Notice of Intent to discharge water under the Illinois General Permit for Construction Activities will be required.

2.3.4 DECONTAMINATION AND DECOMMISSIONING

Decontamination and decommissioning procedures are an important part of Fermilab environment, safety and health policies. These policies are described in Chapter 8070 of the Fermilab Environment, Safety and Health Manual. Appropriate decontamination and decommissioning procedures will be instituted for this project.

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2.3.5 TELECOMMUNICATIONS

Telecommunication systems will be installed as part of this project.

2.3.6 COMPUTER EQUIPMENT

No computer equipment will be installed as part of this project.

2.3.7 ACCESSIBILITY PROVISIONS

The applicable requirements of the *Architectural Barriers Act* (ABA) and the *ADA and ABA Accessibility Guidelines* will be incorporated into the design of this project. The building, parking lot and routes to those areas served by the parking lot will be designed in full compliance with the existing statutes.

2.3.8 EMERGENCY SHELTER PROVISIONS

During construction, the existing emergency shelter in CDF will be utilized for this project during normal working hours

2.3.9 SPACE MANAGEMENT REQUIREMENTS

Offset space will not be required per FNAL Space Waiver(Oct2009).xls/DOE Bank 2002_2009_091112.xls.

2.3.10 COMMISSIONING

Commissioning of the facility will be required per LEED Gold requirements. A detailed commissioning plan will be developed during the design phase and incorporated into the construction documents.

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The design of this project will be in accordance with recognized architectural and engineering practice and will comply with the applicable portions of the U.S. Department of Energy and the State of Illinois codes, orders and regulations as incorporated into contract No. DE-AC02-07CH11359 between the U.S. Department of Energy and Fermi Research Alliance, LLC. A URL link to the contract is included in Appendix B of this document.

Fermilab has adopted the Necessary and Sufficient Process (NSP) for determining the Work Smart Set (WSS) of Standards which are used to determine the appropriate environment, safety and health standards used to ensure the safe and environmentally responsible operations of the Laboratory. The Work Smart Set in effect for this project is included in Appendix B of this Project Plan. Where no edition or "latest edition" is noted on the Work Smart Set, it is assumed that the edition in effect at the time of the acceptance of this Project Plan will be used.

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The Baseline Project Costs includes the costs associated with Engineering, Design, Contingency and Indirect Costs.

The estimated construction costs are based on cost data taken from Means Cost Estimating Guides, historical data and recent construction history at Fermilab. While the suggested project budget can provide input for the feasibility of the project, further design refinement will affect the final cost of the project. However, it is recognized that the final cost shall not exceed the project budget.

DOE Directive G430.1-1, Chapter 11 was used as guidance in estimating the appropriate Contingency for this project for costs not governed by the State limitation as established by the State line-item DCEO Budget Amount.

Indirect Costs rates are defined by DOE Order 4700.1 that states indirect costs are "...costs incurred by an organization for common or joint objectives and which cannot be identified specifically with a particular activity or project." The multipliers used in this document are based on current Fermilab rates.

The costs contained in the estimates listed above are based on FY2011 dollars. Cost estimates have been escalated to the midpoint of construction.

DOE Guide 430.1-1X, *DOE Cost Estimating Guide for Program and Project Management*" classifies cost estimates into one (1) of five (5) categories. These classifications are listed below in figure 8:

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Cost Estimate Classification	Primary Characteristics	
	Level of Definition (% of Complete Definition)	Cost Estimating Description (Techniques)
Class 5, Order of Magnitude	0% to 2%	Stochastic, most parametric, judgment (parametric, specific analogy, expert opinion, trend analysis)
Class 4, Intermediate	1% to 15%	Various, more parametric (parametric, specific analogy, expert opinion, trend analysis)
Class 3, Preliminary	10% to 40%	Various, including combinations (detailed, unit-cost, or activity-based; parametric; specific analogy; expert opinion; trend analysis)
Class 2, Intermediate	30% to 70%	Various, more definitive (detailed, unit-cost, or activity-based; expert opinion; learning curve)
Class 1, Definitive	50% to 100%	Deterministic, most definitive (detailed, unit-cost, or activity-based; expert opinion; learning curve)

Figure 8 - Cost Estimate Classifications

These classifications are based on the Association for the Advanced of Cost Engineering (AACE) Recommended Practice No. 18R-97. These classifications help ensure that the quality of the cost estimate is appropriately considered when applying escalation and contingency.

The classification for the cost estimates contained in this conceptual design report is considered a Class 3 (Preliminary) based on the preliminary nature and level of definition of the programmatic requirements.

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Difficult Conditions				5.6%	$ 605,457
Subconract Base Amount					$10,811,737
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Funding: **State + DOE**					
ITEM NO.	DESCRIPTION OF WORK:	QUANTITY	UNITS	UNIT COST	AMOUNT
A	**SUBSTRUCTURE $382,294**				
A1010	**Foundations**				
	Foundation underdrain, outside only, porous concrete, 6" diameter	1,000	L.F.	$15.85	$15,850.00
	Foundation dampproofing, asphalt coated board and mastic, 1/4" thick, 4' high	1,000	L.F.	$10.26	$10,260.00
	Frost beam, 12" wide	600	L.F.	$45.50	$27,300.00
	Spread footings, 3000 PSI concrete, load 300K, soil bearing capacity 3 KSF, 10' - 6" square x 25" deep	13	Ea.	$2,825.00	$36,725.00
	Spread footings, 3000 PSI concrete, load 1200K, soil bearing capacity 6 KSF, 15' - 0" square x 48" deep	6	Ea.	$9,400.00	$56,400.00
	Spread footings, 3000 PSI concrete, load 900K, soil bearing capacity 3 KSF, 19' - 0" square x 40" deep	1	Ea.	$13,275.00	$13,275.00
A1020	**Special Foundations**				
	Caisson, wet ground, 3000 PSI concrete, 10 KSF bearing, 800K load, 3' - 0" x 70' - 0"	8	Ea.	$10,150.00	$81,200.00
	Grade beam, 40' span, 40" deep, 12" wide, 2 KLF load	200	L.F.	$127.50	$25,500.00
A1030	**Slab-on-grade**				
	Slab on grade, 6" thick, non industrial, reinforced	9,745	S.F.	$5.94	$57,885.30
	Slab on grade, 12" thick, heavy industrial, reinforced	5,665	S.F.	$9.35	$52,967.75
A2010	**Excavation**				
	Excavate and fill, 10,000 SF, 4' deep, sand gravel, or	15,410	S.F.	$0.32	$4,931.20
B	**SHELL $3,911,104**				
B1010	**Floor & Roof Construction**				
	Structural Steel	570	ton	$2,400.00	$1,368,000.00
	Floor, metal deck, 18 ga, 3" deep, concrete slab, 11' span, 5" deep, 125 PSF superimposed load, 169 PSF total load	52,500	S.F.	$8.52	$447,300.00
B2010	**Exterior Walls**				
	Metal stud partition, non-load bearing, galvanized, 12'high, 6" wide, 20 gauge, 16" O.C., includes top & bottom track	23,000	S.F.	$2.77	$63,710.00
	Blanket insulation, for walls or ceilings, foil faced fiberglass, 6" thick, R19, 15" wide	23,000	S.F.	$1.35	$31,050.00
	Sheathing, plywood, CDX, 1/2" thick	23,000	S.F.	$1.37	$31,510.00
	Vapor Retarders, building paper, polyethylene vapor barrier, standard, .010" thick	230	Sq.	$25.00	$5,750.00
	Metal siding, steel, corrugated or ribbed, 20 ga, .0359" thick, colored	11,000	S.F.	$9.14	$100,540.00
	Metal siding, steel, sandwich panels, factory fabricated, 2" polystyrene, steel core, 22 ga, baked enamel	12,200	S.F.	$19.45	$237,290.00
	Metal siding, steel, sandwich panels, factory fabricated, 2" polystyrene, steel core, 22 ga, baked enamel	7,800	S.F.	$19.45	$151,710.00
B2020	**Exterior Windows**				
	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5' x 20' opening, 3 intermediate horizontals	8,600	S.F.	$28.25	$242,950.00
	Glazing panel, insulating, 1" thick units, 2 lites, light and heat reflective glass, tinted	8,600	S.F.	$46.80	$402,480.00
	Windows, aluminum, sliding, insulated glass, 8' x 4'	305	Ea.	$870.00	$265,350.00
	Windows, aluminum, picture unit, insulated glass, 2'-8" x 6'-	15	Ea.	$885.00	$13,275.00
	Screens, vertical shading devices	165	Ea.	$619.29	$102,182.85

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	Screens, horizontal shading devices	550	L.F.	$88.47	$48,658.50
	Window film, graphic	4,900	S.F.	$10.00	$49,000.00
B2030	**Exterior Doors**				
	Door, aluminum & glass, revolving, stock design, maximum, 6'-10" x 7'-0" opening	1	Opng.	$49,600.00	$49,600.00
	Door, aluminum & glass, without transom, full vision, hardware, 3'-0" x 7'-0" opening	4	Opng.	$4,175.00	$16,700.00
	Door, aluminum & glass, without transom, full vision, double door, hardware, 6'-0" x 7'-0" opening	2	Opng.	$5,900.00	$11,800.00
	Door, steel 18 gauge, hollow metal, 1 door with frame, no label, 3'-0" x 7'-0" opening	8	Opng.	$1,640.00	$13,120.00
	Door, steel 18 gauge, hollow metal, 1 door with frame, "A" label, 3'-0" x 7'-0" opening	2	Opng.	$1,975.00	$3,950.00
	Door, steel, overhead, rolling, electric operator, 12'-0" x 12'-0" opening	4	Opng.	$4,900.00	$19,600.00
B3010	**Roof Covering**				
	Roofing, single ply membrane, reinforced, PVC, 60 mils, fully adhered, adhesive	22,400	S.F.	$2.89	$64,736.00
	Insulation, rigid, roof deck, extruded polystyrene, 60 PSI compressive strength, 4" thick, R20	22,400	S.F.	$3.15	$70,560.00
	Outdoor seating, Wood deck, 4" thick, cedar	3,575	S.F.	$2.69	$9,616.75
	Green roof systems, hoist and spread soil mixture 6 inch depth up to five stories tall roof	3,575	S.F.	$2.48	$8,866.00
	Green roof systems, planting sedum mat, per SF, includes planting only, 4000 SF minimum	3,575	S.F.	$7.35	$26,276.25
	Base flashing, aluminum, .050" thick, mill finish, .025" aluminum reglet, .032" counter flashing	1,400	L.F.	$30.75	$43,050.00
	Roof edges, aluminum, mill finish, .050" thick, 8" face	400	L.F.	$27.80	$11,120.00
	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 3'-0", aluminum	1	Opng.	$1,353.00	$1,353.00
03	**INTERIORS $1,876,852**				
C1010	**Partitions**				
	Metal partition, 5/8"fire rated gypsum board face, 3-5/8" @ 24", 3.5" fiberglass insulation	22,000	S.F.	$6.79	$149,380.00
	Gypsum wallboard, on walls, standard, w/compound skim coat (level 5 finish), 1/2" thick	23,000	S.F.	$1.95	$44,850.00
	Storefront Systems, aluminum frame, monumental grade, clear 3/8" plate glass, 3' x 7' door with hardware, 400 SF	730	S.F.	$48.00	$35,040.00
	Fire Glass	730	S.F.	$64.00	$46,720.00
	Classrooms, Acoustic partitions, operable, with track, 3"	1,910	S.F.	$101.75	$194,342.50
	Tech space, Acoustic partitions, operable, with track, 3"	1,770	S.F.	$101.75	$180,097.50
C1020	**Interior Doors**				
	Labeled metal door/metal frame, hollow, 3 hr, 18 ga full panel, 2'-8" x 7'-0", KD frame, 5-3/4"	1	Ea.	$1,085.00	$1,085.00
	Labeled metal door/metal frame, hollow, 3 hr, 18 ga full panel, 6'-0" x 7'-0", KD frame, 5-3/4"	1	Ea.	$1,830.00	$1,830.00
	Wood fire door, metal frame, 1hr, 3 ply core, 1-3/4"thick, birch face, 3/0 x 7/0 (wxh)	7	Ea.	$850.00	$5,950.00

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	Wood fire door, metal frame, 1.5 hr, 3 ply core, 1-3/4" thick, birch face, 3/0 x 7/0 (wxh)	1	Ea.	$845.00	$845.00
	Wood door/wood frame, solid core/flush type, birch face, 2'-8" x 6'-8", pine frame, 3-5/8"	42	Ea.	$601.00	$25,242.00
	Hinges, full mortise, high frequency, steel base, 5" x 5" USP	52	Ea.	$29.00	$1,508.00
	Locksets, heavy duty cylindrical, non-keyed, privacy	40	Ea.	$118.50	$4,740.00
	Closers, rack & pinion, adjustable backcheck, 4 way mount, hold open arm	52	Ea.	$335.00	$17,420.00
	Push, pull handle, push bar, aluminum	12	Ea.	$193.00	$2,316.00
	Panic devices, narrow stile, bar and concealed rod, exit only	14	Ea.	$1,008.00	$14,112.00
C1030	**Fittings**				
	Toilet partitions, cubicles, ceiling hung, stainless steel	9	Unit	$2,220.00	$19,980.00
	Toilet partitions, cubicles, ceiling hung, handicap addition	6	Unit	$420.00	$2,520.00
	Urinal screens, floor mounted, 24" wide, stainless steel	3	Unit	$760.00	$2,280.00
	Shower stall, single wall, fiberglass, 2'-8" x 2'-8"	2	Ea.	$1,085.00	$2,170.00
	Lockers, two tier, maximum	20	Ea.	$146.50	$2,930.00
	Signs, interior electric exit sign, wall mounted, 6"	15	Ea.	$204.00	$3,060.00
	Directory boards, outdoor, black plastic, 36" x 24"	1	Ea.	$1,430.00	$1,430.00
	Chalkboards, sliding board, 1 board with back panel	600	S.F.	$46.72	$28,032.00
	Bathroom accessories, stainless steel, curtain rod, 5' long,	2	Ea.	$88.00	$176.00
	Bathroom accessories, stainless steel, towel dispenser,	12	Ea.	$489.00	$5,868.00
	Bathroom accessories, stainless steel, grab bar, 1-1/2"	96	L.F.	$78.50	$7,536.00
	Bathroom accessories, stainless steel, mirror, framed, with shelf, 72" x 24"	12	Ea.	$511.00	$6,132.00
	Bathroom accessories, stainless steel, toilet tissue dispenser, surface mounted, double roll	18	Ea.	$52.00	$936.00
	Bathroom accessories, stainless steel, towel bar, 30" long	2	Ea.	$138.50	$277.00
C2010	**Stair Construction**				
	Stairs, steel, cement filled metal pan & picket rail, 24 risers,	4	Flight	$22,400.00	$89,600.00
	Stairs, steel, cement filled metal pan & picket rail, 12 risers, w/o landing	2	Flight	$9,550.00	$19,100.00
C3010	**Wall Finishes**				
	Painting, interior on plaster and drywall, brushwork, primer & 3 coats	67,000	S.F.	$1.60	$107,200.00
	Ceramic tile, thin set, 4-1/4" x 4-1/4"	4,000	S.F.	$8.07	$32,280.00
C3020	**Floor Finishes**				
	Access floors, office application, steel panels, no covering, to 8" high, over 6,000 sf	29,000	S.F.	$10.23	$296,670.00
	Carpet tile, nylon, fusion bonded, 18" x 18" or 24" x 24", 42 oz	27,300	S.F.	$6.20	$169,260.00
	Polyurethane, thermoset, maximum	4820	S.F.	$17.45	$84,109.00
	Tile, porcelain type, maximum	1,200	S.F.	$13.60	$16,320.00
	Vinyl sheet goods, maximum	2,800	S.F.	$9.22	$25,816.00
	Composition flooring, epoxy terrazzo, maximum	2,100	S.F.	$17.50	$36,750.00
	Integral topping and finish, 1:1:2 mix, 1/2" thick	8,000	S.F.	$3.44	$27,520.00

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C3030	**Ceiling Finishes**				
	Acoustic ceilings, 3/4" fiberglass board, 24" x 24" tile, tee grid, suspended support	27,300	S.F.	$5.01	$136,773.00
	Gypsum board ceilings, 1/2" fire rated gypsum board, painted finish, 1-5/8" metal stud furring, 24" OC support	6,300	S.F.	$4.23	$26,649.00
D	**BUILDING SYSTEMS $3,316,745**				
D1010	**Conveying**				
	Hydraulic, passenger elevator, 3500 lb, 5 floors, 100 FPM	3	Ea.	$143,900.00	$431,700.00
D2020	**Plumbing Fixtures**				
	Water closets, battery mount, wall hung, side by side, first closet	5	Ea.	$2,140.00	$10,700.00
	Water closets, battery mount, wall hung, side by side, each additional water closet, add	12	Ea.	$1,990.00	$23,880.00
	Urinal, vitreous china, wall hung	3	Ea.	$1,365.00	$4,095.00
	Lavatory w/trim, wall hung, PE on CI, 19" x 17"	14	Ea.	$1,620.00	$22,680.00
	Service sink w/trim, PE on CI, corner floor, 28" x 28", w/rim guard	3	Ea.	$2,550.00	$7,650.00
	Shower, stall, baked enamel, terrazzo receptor, 36" square	2	Ea.	$2,450.00	$4,900.00
	Drinking fountain, 1 bubbler, wall mounted, full recessed, stainless steel	6	Ea.	$1,655.00	$9,930.00
	Supporting Piping	1	LS	$50,830.00	$50,830.00
D2020	**Domestic Water Distribution**				
	Solar, draindown, 3/4" tubing, 3 each 3' x 7' flat collectors, 120 gal tank	1	Ea.	$11,700.00	$11,700.00
	Gas fired water heater, commercial, 100< F rise, 75.5 MBH input, 63 GPH	1	Ea.	$4,875.00	$4,875.00
D2020	**Additional Utilities**				
	Water distribution piping, copper tubing, type K, 1-1/2" diameter, excludes excavation and backfill	280	L.F.	$23.54	$6,591.20
	Pump, pressure booster system, 5 HP pump, includes diaphragm tank, control and pressure switch	3	Ea.	$8,400.00	$25,200.00
	Drainage and sewage piping, 4" diameter, PVC SDR-35, excavation and backfill excluded	140	L.F.	$5.02	$702.80
	Gas service piping, 1" diameter, steel, Sch 40, plain ends, excavation and backfill excluded	140	L.F.	$15.15	$2,121.00
D2040	**Rain Water Discharge**				
	Roof drain, steel galv sch 40 grooved, 5" diam piping, 10' high	7	Ea.	$2,825.00	$19,775.00
	Roof drain, steel galv sch 40 threaded, 5" diam piping, for each additional foot add	200	Ea.	$73.00	$14,600.00
D3020	**HVAC System**				
	AHUS, Heat Pumps, Ventilation	43,600	S.F.	$29.00	$1,264,400.00
D4010	**Fire Suppression**				
	Wet pipe sprinkler systems, steel, ordinary hazard, 1 floor, 10,000 SF	14,600	S.F.	$4.12	$60,152.00
	Wet pipe sprinkler systems, steel, ordinary hazard, each additional floor, 10,000 SF	29,000	S.F.	$3.47	$100,630.00
D4020	**Standpipes**				

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	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, 1 floor	1	Floor	$7,250.00	$7,250.00
	Wet standpipe risers, class III, steel, black, sch 40, 4" diam pipe, additional floors	2	Floor	$1,650.00	$3,300.00
D5010	**Electrical Service/Distribution**				
	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 600 A	5	Ea.	$12,975.00	$64,875.00
	Feeder installation 600 V, including RGS conduit and XHHW wire, 1000 A	150	L.F.	$324.00	$48,600.00
	Switchgear installation, incl switchboard, panels & circuit breaker, 1600 A	1	Ea.	$44,400.00	$44,400.00
D5020	**Lighting and Branch Wiring**				
	Receptacle systems, conduit system with floor boxes, high	43,600	S.F.	$4.45	$194,020.00
	Wall switches, 5.0 per 1000 SF	43,600	S.F.	$1.35	$58,860.00
	Miscellaneous power, to .5 watts	38,800	S.F.	$0.16	$6,208.00
	Miscellaneous power, 3 watts	4,800	S.F.	$0.84	$4,032.00
	Central air conditioning power, 1 watt	43,600	S.F.	$0.36	$15,696.00
	Fluorescent fixtures, type D, 34 fixtures per 2000 SF	43,600	S.F.	$10.40	$453,440.00
D5030	**Communications and Security**				
	Telephone wiring for offices & laboratories, 8 jacks/MSF	43,600	S.F.	$3.52	$153,472.00
	Communication and alarm systems, fire detection,	1	Ea.	$38,600.00	$38,600.00
	Fire alarm control panel, 8 zone	1	Ea.	$2,085.00	$2,085.00
	Fire alarm command center, addressable without voice	1	Ea.	$3,700.00	$3,700.00
	Internet wiring, 8 data/voice outlets per 1000 S.F.	44	M.S.F.	$2,820.00	$124,080.00
D5090	**Other Electrical Systems**				
	Uninterruptible power supply, charger, inverter, and alarm 1 phase, 120 V, 15 kVA, incl 10 minutes battery	1	Ea.	$17,015.00	$17,015.00
E	**EQUIPMENT AND FURNISHING $147,199**				
E2010	**Fixed Furnishings**				
	Furnishings, shades, mylar, wood roller, single layer, non-reflective	18,300	S.F.	$7.57	$138,531.00
	Furnishings, floor mats, link-including nosings, steel-galvanized, 3/8" thick	400	S.F.	$21.67	$8,668.00
F	**SITE WORK $1,177,542**				
F2010	**Site Improvements**				
	Demo, bike path	844	SY	$8.05	$6,797.71
	Relocate chiller	1	Ea	$13,500.00	$13,500.00
	Micellaneous equipment pads, structural concrete, in place, equipment pad, 3' x 3' x 6", includes forms, reinforcing steel, concrete, and finishing	6	EA	$2,135.00	$12,810.00
	Site grading	9,753.98	SY	$2.42	$23,604.63
	Sidewalk, 6" thick concrete, 6" gravel base, 6' wide	100	LF	$41.03	$4,102.50
	Bike Path, 6" thick concrete, 6" gravel base, 8' wide	1,000	LF	$54.70	$54,700.00
	Parking and other pavment, 6" permeable paving system	35,954	SF	$12.53	$450,501.64
	Site lighting, solar, 72 W	5	EA	$8,350.00	$41,750.00
	Light pole, aluminum, 20' high, 1 arm bracket	2	EA	$2,035.00	$4,070.00
	Light pole, aluminum, 20' high, 2 arm brackets	3	EA	$2,135.00	$6,405.00

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FERMILAB - FESS/E CONSTRUCTION COST ESTIMATE					
ESTIMATED SUBCONTRACT AWARD AMOUNT					$14,056,123
Subcontractor Overhead and Profit				18%	$ 2,055,095
Escalation				5.4%	$ 583,834
Difficult Conditions				5.6%	$ 605,457
Subconract Base Amount					$10,811,737
Project Title: **Office, Technical and Education (OTE) Building**		Project No.	Status:	Date:	Revision Date:
Funding: **State + DOE**		10-8-01	CDR	July 24, 2010	4-Oct-10
ITEM NO.	DESCRIPTION OF WORK:	QUANTITY	UNITS	UNIT COST	AMOUNT
	Painted pavement markings, acrylic waterborne, white or yellow, 4" wide	1,300	LF	$0.45	$585.00
	Specialties, flagpole, aluminum, tapered, 70' high	3	EA	$2,135.00	$6,405.00
F2010	**Landscaping**				
	Planting beds preparation, excavate planting pit,heavy soil or clay	700	CY	$11.00	$7,700.00
	Deciduous trees, maple, red, B & B, 8' - 10', 1-1/2" caliper, in prepared beds	5	EA	$515.00	$2,575.00
	Shrubs and trees, evergreen, in prepared beds	5	EA	$340.00	$1,700.00
	Shrubs, holly, B & B, 15"-18", planted in prepared beds	20	EA	$167.50	$3,350.00
	Shrubs, euonymus, B & B, 15" to 18", planted in prepared beds	10	EA	$202.50	$2,025.00
	Ground cover and vines, english ivy, potted, 2 year, includes planting only, excludes preparation of beds	10	C	$243.00	$2,430.00
	Prarie plants	10	C	$200.00	$2,000.00
F3010	**Site Utilities**				
	Geothermal system closed loop	120	TON	$3,000.00	$360,000.00
	6-inch ICW service connection and meter	1	EA	$9,000.00	$9,000.00
	6-inch DWS service connection and meter	1	EA	$9,000.00	$9,000.00
	4-inch gas connection, reducing sration and meter	1	EA	$5,000.00	$5,000.00
	Electric Service				
	High voltage cable	200	LF	$36.30	$7,260.00
	Pad mounted transformer	1	EA	$20,800.00	$20,800.00
	Connect transformers	1	EA	$5,250.00	$5,250.00
	New data service				
	Trenching, common earth excavator,1/2 :1 slope, 2' wide, 6' deep, 3/8 CY BK	525	LF	$71.45	$37,511.25
	Underground duct banks, PVC, 1 @ 2" diameter	525	LF	$2.15	$1,128.75
	Low voltage cable	5	CLF	$428.00	$2,140.00
	Manhole/catch basin, concrete, cast-in-place,4' ID riser, 8' deep	1	EA	$6,025.00	$6,025.00
	Sanitary sewer connection	2	EA	$3,000.00	$6,000.00
	New storm sewer connection				
	Trenching, common earth excavator,1/2 :1 slope, 4' wide, 6' deep, 1/2 CY BK	600	LF	$19.45	$11,670.00
	Pipe bedding, side slope 1/2:1, 3' wide, pipe size 18" diameter	600	LF	8.27	$4,962.00
	Drainage and sewage piping, 18" diameter, excavation and backfill excluded	600	LF	31.75	$19,050.00
	Cleanout, extra heavy duty, 8" pipe size	2	EA	$817.00	$1,634.00
	Manhole/catch basin, concrete, cast-in-place,4' ID riser, 8' deep	4	EA	$6,025.00	$24,100.00

FERMILAB - FESS/E CONSTRUCTION COST ESTIMATE ALLOWANCES					
ESTIMATED SUBCONTRACT AWARD AMOUNT					$2,707,807
Subcontractor Overhead and Profit				18%	$ 395,899
Escalation				5.4%	$ 112,471
Difficult Conditions				5.6%	$ 116,637
Subconract Base Amount					$2,082,800
Project Title: **Office, Technical and Education (OTE) Building** Funding: **State + DOE**		Project No. 10-8-01	Status: CDR	Date: 25-Aug-10	Revision Date: 4-Oct-10
ITEM NO.	DESCRIPTION OF WORK:	QUANTITY	UNITS	UNIT COST	AMOUNT
01	**Interior CDF Bridge**	1	LS	$500,000.00	$500,000.00
02	**Demountable Partitions**	1,500	L.F.	$350.00	$525,000.00
03	**Light Tech Crane**	1	Ea.	$100,000.00	$100,000.00
04	**AV Equipment** **$67,800.00**				
	Projection Screens, motorized	6	Ea.	$2,500.00	$15,000.00
	Projectors and mounts	6	Ea.	$2,500.00	$15,000.00
	LCD Displays	6	Ea.	$2,000.00	$12,000.00
	Video Conferencing, cameras	6	Ea.	$500.00	$3,000.00
	Interactive Whiteboard	6	Ea.	$1,400.00	$8,400.00
	CPUs	6	Ea.	$1,200.00	$7,200.00
	Sound System, classoom, wireless	6	Ea.	$1,200.00	$7,200.00
05	**Acoustical Treatment** **$40,000.00**				
	Wall Construction	1,000	S.F.	$10.00	$10,000.00
	Ceiling Construction	1,200	S.F.	$25.00	$30,000.00
06	**154kW photovoltaic system**	1	LS	$850,000.00	$850,000.00

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FERMILAB - FESS/E CONSTRUCTION COST ESTIMATE ALTERNATE DEDUCTS					
ESTIMATED SUBCONTRACT AWARD AMOUNT					$1,597,932
Subcontractor Overhead and Profit				18%	$ 233,628
Escalation				5.4%	$ 66,372
Difficult Conditions				5.6%	$ 68,830
Subconract Base Amount					$1,229,103
Project Title: **Office, Technical and Education (OTE) Building** Funding: **State + DOE**		Project No. 10-8-01	Status: CDR	Date: 25-Aug-10	Revision Date: 4-Oct-10
ITEM NO.	DESCRIPTION OF WORK:	QUANTITY	UNITS	UNIT COST	AMOUNT
01	**North side, screens, vertical shading devices**	165	Ea.	$619.29	$102,182.85
02	**South, screens, horizontal shading devices**	550	L.F.	$88.47	$48,658.50
03	**Window film, graphic**	4,900	S.F.	$10.00	$49,000.00
04	**Outdoor seating, Wood deck, 4" thick, cedar**	3,575	S.F.	$2.69	$9,616.75
05	**Green Roof over Tech Space** **$35,142.25**				
	Green roof systems, hoist and spread soil mixture 6 inch depth up to five stories tall roof	3,575	S.F.	$2.48	$8,866.00
	Green roof systems, planting sedum mat, per SF, includes planting only, 4000 SF minimum	3,575	S.F.	$7.35	$26,276.25
05	**West Stair, rated glazing** **$76,803.30**				
	Storefront Systems, aluminum frame, monumental grade, clear 3/8" plate glass, 3' x 7' door with hardware, 400 SF max	730	S.F.	$48.00	$35,040.00
	Fire Glass	730	S.F.	$64.00	$46,720.00
	Metal partition, 5/8"fire rated gypsum board face, 3-5/8" @ 24", 3.5" fiberglass insulation	(730)	S.F.	$6.79	($4,956.70)
06	**Classrooms, Acoustic partitions, operable, with track, 3"**	1,910	S.F.	$101.75	$194,342.50
07	**Tech space, Acoustic partitions, operable, with track, 3"**	1,770	S.F.	$101.75	$180,097.50
08	**Tech space, change flooring** **$67,528.20**				
	Polyurethane, thermoset, maximum	4,820	S.F.	$17.45	$84,109.00
	Integral topping and finish, 1:1:2 mix, 1/2" thick	(4,820)	S.F.	$3.44	($16,580.80)
09	**Lobby, change flooring** **$29,526.00**				
	Composition flooring, epoxy terrazzo, maximum	2,100	S.F.	$17.50	$36,750.00
	Integral topping and finish, 1:1:2 mix, 1/2" thick	(2,100)	S.F.	$3.44	($7,224.00)
10	**Hydraulic, passenger elevator, 3500 lb, 5 floors, 100 FPM**	1	Ea.	$143,900.00	$143,900.00
11	**Change paving system** **$292,304.73**				
	Parking and other pavment, 6" permeable paving system	35,954	SF	$12.53	$450,501.64
	Parking and other pavment, Asphaltic concrete	(35,954)	SF	$4.40	($158,196.90)

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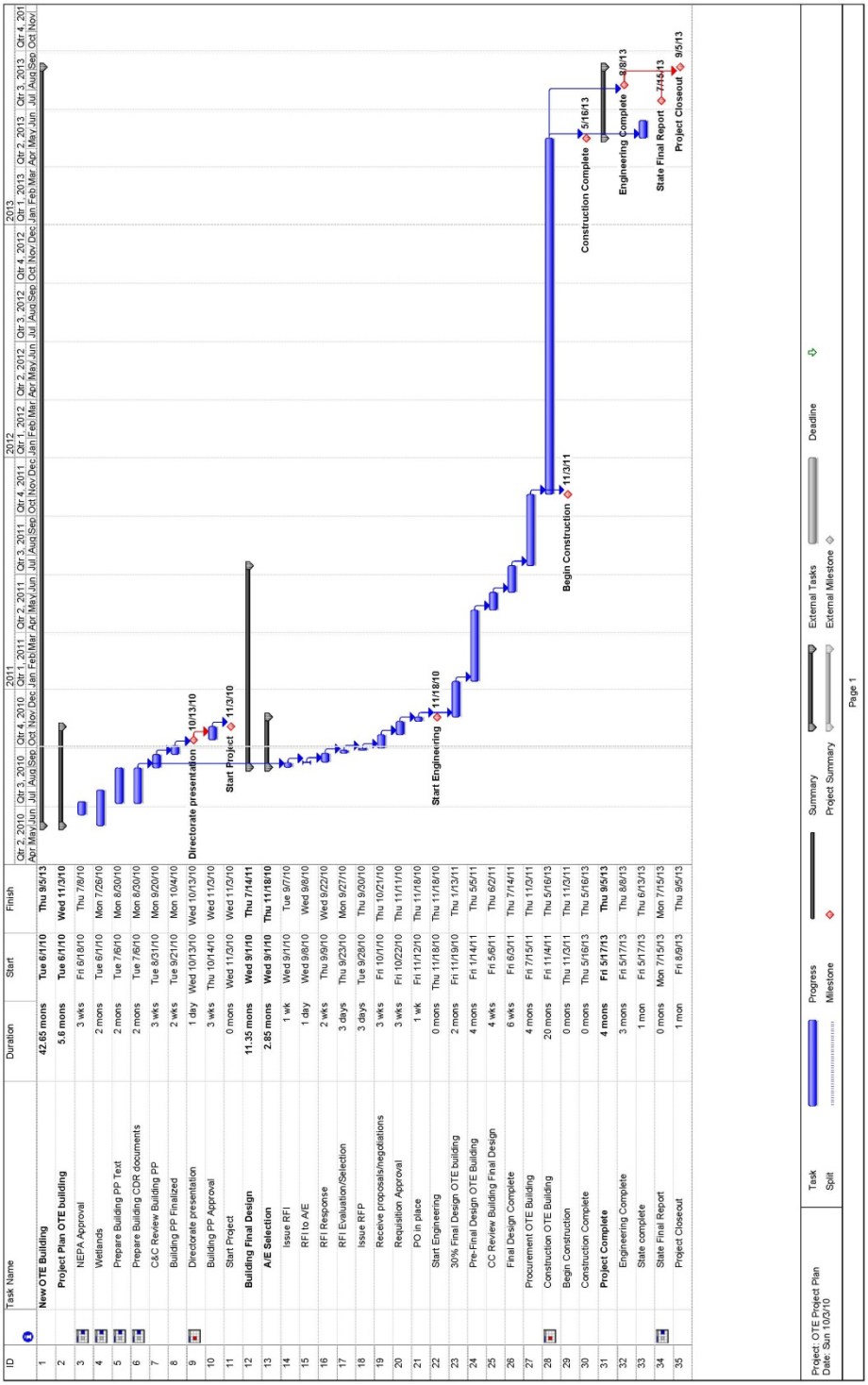

ID	Task Name	Duration	Start	Finish
1	**New OTE Building**	**42.65 mons**	**Tue 6/1/10**	**Thu 9/5/13**
2	**Project Plan OTE building**	**5.6 mons**	**Tue 6/1/10**	**Wed 11/3/10**
3	NEPA Approval	3 wks	Fri 6/18/10	Thu 7/8/10
4	Wetlands	2 mons	Tue 6/1/10	Mon 7/26/10
5	Prepare Building PP Text	2 mons	Tue 7/6/10	Mon 8/30/10
6	Prepare Building CDR documents	2 mons	Tue 7/6/10	Mon 8/30/10
7	C&C Review Building PP	3 wks	Tue 8/31/10	Mon 9/20/10
8	Building PP Finalized	2 wks	Tue 9/21/10	Mon 10/4/10
9	Directorate presentation	1 day	Wed 10/13/10	Wed 10/13/10
10	Building PP Approval	3 wks	Thu 10/14/10	Wed 11/3/10
11	Start Project	0 mons	Wed 11/3/10	Wed 11/3/10
12	**Building Final Design**	**11.35 mons**	**Wed 9/1/10**	**Thu 7/14/11**
13	**A/E Selection**	**2.85 mons**	**Wed 9/1/10**	**Thu 11/18/10**
14	Issue RFI	1 wk	Wed 9/1/10	Tue 9/7/10
15	RFI to A/E	1 day	Wed 9/8/10	Wed 9/8/10
16	RFI Response	2 wks	Thu 9/9/10	Wed 9/22/10
17	RFI Evaluation/Selection	3 days	Thu 9/23/10	Mon 9/27/10
18	Issue RFP	3 days	Tue 9/28/10	Thu 9/30/10
19	Receive proposals/negotiations	3 wks	Fri 10/1/10	Thu 10/21/10
20	Requisition Approval	3 wks	Fri 10/22/10	Thu 11/11/10
21	PO in place	1 wk	Fri 11/12/10	Thu 11/18/10
22	Start Engineering	0 mons	Thu 11/18/10	Thu 11/18/10
23	30% Final Design OTE building	2 mons	Fri 11/19/10	Thu 1/13/11
24	Pre-Final Design OTE Building	4 mons	Fri 1/14/11	Thu 5/5/11
25	CC Review Building Final Design	4 wks	Fri 5/6/11	Thu 6/2/11
26	Final Design Complete	6 wks	Fri 6/3/11	Thu 7/14/11
27	Procurement OTE Building	4 mons	Fri 7/15/11	Thu 11/3/11
28	Construction OTE Building	20 mons	Fri 11/4/11	Thu 5/16/13
29	Begin Construction	0 mons	Thu 11/3/11	Thu 11/3/11
30	Construction Complete	0 mons	Thu 5/16/13	Thu 5/16/13
31	**Project Complete**	**4 mons**	**Fri 5/17/13**	**Thu 9/5/13**
32	Engineering Complete	3 mons	Fri 5/17/13	Thu 8/8/13
33	State complete	1 mon	Fri 5/17/13	Thu 6/13/13
34	State Final Report	0 mons	Mon 7/15/13	Mon 7/15/13
35	Project Closeout	1 mon	Fri 8/9/13	Thu 9/5/13

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