MAR -8 2011

Dr. Bruce L. Chrisman
Chief Operating Officer
Fermilab
P.O. Box 500
Batavia, IL 60510

Dear Dr. Chrisman:

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DETERMINATION AT FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB) – MICRO BOOSTER NEUTRINO EXPERIMENT (MICROBOONE) PROJECT

Reference: Letter, from B. Chrisman to M. Weis, dated February 24, 2011, Subject: National Environmental Policy Act (NEPA) Environmental Evaluation Notification Form (EENF) for the MicroBooNE Project

I have reviewed the Fermilab EENF for the MicroBooNE Project. Based on the information provided in the EENF, I have approved the following categorical exclusion (CX):

Project Name	Approved	CX
MicroBooNE Project	3/04/2011	B3.10, B1.15

I am returning a signed copy of the EENF for your records. No further NEPA review is required. This project falls under a categorical exclusion provided in 10 Code of Federal Regulation 1021, as amended in November 1997.

Sincerely,

Original Signed by
Mark E. Bollinger-
Deputy Manager

Michael J. Weis
Site Manager

Enclosure:
As Stated

cc: P. Oddone, w/o encl.
Y. - K. Kim, w/o encl.
N. Grossman, w/encl.
T. Dykhuis, w/encl.

bc: P. Siebach, CH-STS, w/encl.
M. McKown, CH-OCC, w/o encl.
J. Scott, FSO, w/o encl.
R. Hersemann, FSO, w/encl.

FERMILAB ENVIRONMENTAL EVALUATION NOTIFICATION FORM

Project/Activity Title: Micro Booster Neutrino Experiment (MicroBooNE)
ES&H Tracking Number: 01082
Funding Source: Operating
Fermilab Project Manager: Catherine James (X2287)

I herby certify via my signature that every effort would be made throughout this project to comply with the commitments made in this document and to pursue cost-effective pollution prevention opportunities. Pollution prevention (source reduction and other practices that eliminate or reduce the creation of pollutants) is recognized as a good business practice which would enhance site operations thereby enabling the Lab to accomplish its mission, achieve environmental compliance, reduce risks to health and the environment, and prevent or minimize future DOE legacy wastes.

Fermilab Project Manager: Catherine James

Signature Catherine James

Date 2/22/11

Fermilab NEPA Reviewer: Teri L. Dykhuis

Signature Teri L. Dykhuis

Date 2/22/2011

I. Description of the Proposed Action and Need

Purpose and Need:
The purpose of the proposed Micro Booster Neutrino Experiment (MicroBooNE) project and subsequent experiments is to build, operate, and extract physics discoveries from the first ever large Liquid Argon Time Projection Chamber (LArTPC) detector that would be exposed to a neutrino beam. The LArTPC is the most promising new technology under development for future beam-based neutrino research that offers extraordinarily precise event reconstruction and particle identification, as well as potential scalability to ultra-large (>100 kiloton) detectors. With unparalleled capabilities in tracking, vertexing, calorimetry, and particle identification with full electronic readout, the MicroBooNE would represent a major advance in detector technology for neutrino physics in the energy regime of most importance for elucidating neutrino oscillation phenomena. Development of LArTPC has been widely endorsed as a crucial next-step for the high energy community.

The MicroBooNE is needed to meet three specific scientific goals, outlined in the Department of Energy, Office of Science Mission Need Statement. Those goals are the following:

1. Resolving the source of the MiniBooNE low energy excess by employing precision electron/photon differentiation offered by LArTPC's;
2. Measuring exclusive cross sections on argon in the 1 giga-electronvolt (GeV) range by exploiting high resolution event topology available from LArTPC's
3. Developing technological innovations and methods to provide a basis for the design of the next generation of LArTPC detectors at larger scales.

Proposed Action:
The proposed MicroBooNE detector would be exposed to the existing Fermilab Booster Neutrino Beam (BNB) [BNBflux] with 6.6×10^{20} protons on target as well as an off axis component of the NUMI neutrino beam [Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) for both of these projects can be found on the DOE website and the potential for building a second detector is mentioned in the EA for the Proposed 8 GeV

Fixed Target Facility at the Fermilab Booster and for the Booster Neutrino Detectors.] The BNB would be operated in the same configuration as that used for the MiniBooNE neutrino operation, thereby significantly reducing the systematic uncertainty in the comparison of MicroBooNE data with MiniBooNE data.

To fulfill the above purpose and need, the MicroBooNE project and subsequent experiments would include building and operating a large, approximately 175-ton, liquid Argon Time Projection Chamber (LArTPC) neutrino detector that would be located along the BNB line, just upstream of the MiniBooNE detector enclosure. A new Fermilab enclosure (below grade cylinder structure similar to that of MiniBooNE and at the same grade) is proposed to house the detector tank and supporting refrigeration; the delivery area and electronics room would be contained in an at-grade shed structure. MicroBooNE would employ a LArTPC contained within a conventional cryostat, and the high purity liquid argon in the LArTPC would serve as the neutrino target and tracking medium for the particles produced in neutrino interactions. The MicroBooNE proposed design would allow for tests of liquid argon purity that could be obtained both with and without use of vacuum and the LArTPC active volume would form a rectangular solid of dimensions 2.3 m × 2.6 m × 10.4 m. MicroBooNE would detect neutrino interactions through the observation of outgoing charged and neutral particles that convert in the liquid argon. Details of the proposed MicroBooNE Infrastructure, along with a drawing indicating the proposed enclosure location on the Fermilab site, are included in Appendix A and B at the end of this document.

Alternatives

The MicroBooNE project was initially proposed to be located in the MiniBooNE detector enclosure (cylinder) once the MiniBooNE detector was removed. However, Fermilab management determined additional valuable date could be obtained from a continued run of MiniBooNE, and therefore removal of the MiniBooNE detector has been postponed. The MiniBooNE enclosure could not accommodate both detectors; therefore, a new location for MicroBooNE was necessary.

Fermilabs expertise, infrastructure, and an existing accelerator facility that is capable of delivering neutrino beam(s), essential for the desired science, preclude an alternative neutrino source location. Since the detector must be along the Booster Neutrino Beamline, the only alternative to locating the enclosure directly upstream of the MiniBooNE enclosure would be to locate it further downstream of the MiniBooNE enclosure. This option would have impacted wetlands and therefore was not selected.

The 'No Action' alternative would not meet the above stated purpose and need.

II. Description of the Affected Environment

The proposed location of the proposed project is in the southeast corner, defined by the intersection of the MINOS Access Road and the MiniBooNE Access Road Stub, of the southwest section of the Lab (in Kane County),. It is a previously disturbed and farmed upland area with some light secondary growth from the last 40 years. Nearby wetlands would not be impacted by the project (Wetland Delineation Report was completed by Planning Resources Inc. on December 9, 2010; see Appendix B for drawing indicating wetland boundary in vicinity of the proposed project) and would be protected during construction activities via appropriate erosion control devices. Because greater than 1 acre would be disturbed during excavation, the DOE FSO would apply for coverage under the Illinois Environmental Protection Agency General National Pollutant Discharge Elimination System Permit for Construction Activities. Additionally a Storm Water Pollution Prevention Plan and an Erosion Control Plan would be created which would be followed during construction activities.

A below grade vertical concrete cylinder structure (approximately 44 feet deep), identical to the existing MiniBooNE Cylinder, is proposed for housing the MicroBooNE experiment. The center of the MicroBooNE Cylinder would be approximately 240 feet upstream of the center of the MiniBooNE Cylinder, along the MiniBooNE neutrino beamline which extends from the center of the MiniBooNE Target in the MI-12 building to the center of the excavated MiniBooNE Cylinder. It is anticipated that excavation and construction techniques, similar to those used to construct MiniBooNE would be employed.

An inverted conical pit would be excavated, and the spoil would be placed in a temporary pile on the west side of the MINOS Access Road at the same site used for temporary storage of the MiniBooNE spoil during its construction. After the MicroBooNE Cylinder is constructed, most of the spoil would be used to fill in the conical excavation with the exception of the volume of the newly constructed cylinder. The remaining spoil would be placed on one of the onsite stockpiles or disposed off site. The argon tank/detector would be inserted into the Cylinder via an exterior movable crane through removable roof sections. It is not proposed to construct an above grade shielding hill (for cosmic background reduction) as was done for MiniBooNE. Instead a 10 foot thick layer of concrete shield blocks would be placed on the roof of the new cylinder. The new cylinder roof would be constructed with sufficient capability to carry this additional load.

New duct banks for electrical power and communications, ICW, domestic water, and natural gas piping would be extended from manholes in the MiniBooNE Access Road stub just northeast of the MicroBooNE site. The MiniBooNE Access road would be relocated onto the original planned alignment of the arc of the road (see attached drawing), and the existing road surface would be lifted and properly disposed. The length of the proposed relocated road segment is approximately 250 feet. A new ICW pipe, which would run to the vicinity of the MINOS Service building, may be required to create an adequate "cooling loop" for ICW cooling water drawn from the ICW line near the new site.

Components of the MicroBooNE detector would be procured, fabricated and tested at existing facilities at Fermilab and other collaborating institutions. The main feature of the detector would be a cryostat vacuum vessel capable of containing 175 tons of LAr (13.2 m length; 4.7 m diameter). Electronic detectors, including wire planes for the TPC and photomultiplier tubes would be installed inside the cryostat, along with apparatus for applying voltage to the detectors and reading out signals from them. No hazardous materials would be used in the assembly of the cryostat. When installation is complete, the cryostat would be sealed and filled with LAr. Systems for maintaining the temperature and purity of the cryogen would also be installed. In its natural state, argon is an inert gas that can displace oxygen and hence would pose an oxygen deficiency hazard or a freezing hazard in the event of a major leak in the detector hall; however, appropriate safety measures would be part of the design and planning of this new experiment. Argon would not present an environmental hazard once it is inside the cryostat and procedures would be followed to minimize the possibility of freezing any flora or fauna that might be exposed due to a spill during filling of the cryostat.

III. Potential Environmental Effects (If the answer to the questions below is "yes", provide comments for each checked item and where clarification is necessary.)

A. Sensitive Resources: Would the proposed action result in changes and/or disturbances to any of the following resources?

- ☐ Threatened or endangered species
- ☐ Other protected species
- ☐ Wetland/Floodplains
- ☐ Archaeological or historical resources
- ☐ Non-attainment areas

B. Regulated Substances/Activities: Would the proposed action involve any of the following regulated substances or activities?

- ☒ Clearing or Excavation
- ☒ Demolition or decommissioning
- ☐ Asbestos removal
- ☐ PCBs
- ☒ Chemical use or storage
- ☐ Pesticides
- ☒ Air emissions
- ☒ Liquid effluents
- ☐ Underground storage tanks
- ☐ Hazardous or other regulated waste (including radioactive or mixed)
- ☒ Radioactive exposures or radioactive emissions
- ☐ Radioactivation of soil or groundwater

C. Other Relevant Disclosures: Would the proposed action involve any of the following actions/disclosures?

- ☐ Threatened violation of ES&H permit requirements
- ☐ Siting/construction/major modification of waste recovery or TSD facilities
- ☐ Disturbance of pre-existing contamination
- ☐ New or modified permits
- ☐ Public controversy
- ☐ Action/involvement of another federal agency
- ☐ Public utilities/services
- ☐ Depletion of a non-renewable resource

IV. NEPA Recommendation

Fermilab staff have reviewed this proposed action and concluded that the appropriate level of NEPA determination is a Categorical Exclusion. The conclusion is based on the proposed action meeting the description found in DOE's NEPA Implementation Procedures, 10 CFR 1021, Subpart D, Appendix B3.10 and B1.15.

B3.10 states the following: "Siting, construction, operation, and decommissioning of a particle accelerator, including electron beam accelerator with primary beam energy less than approximately 100 MeV, and associated beamlines, storage rings, colliders, and detectors for research and medical purposes, within or contiguous to an already developed area (where active utilities and currently used roads are readily accessible), or internal modification of any accelerator facility regardless of energy that does not increase primary beam energy or current."

B1.15 states the following: "Siting, construction, (or modification), and operation of support structures (including but not limited to, trailers and prefabricated buildings within or contiguous to an already developed area (where active utilities and currently used roads are readily accessible). Covered support buildings and structures include those for office purposes: parking; cafeteria services; education and training; visitor reception; computer and data processing services; employee health services or recreation activities; routing maintenance activities; storage of supplies and equipment for administrative services and routine maintenance activities; security (including security posts); fire protection; and similar support purposes, but excluding facilities for waste storage activities; except as provided in other parts of this appendix."

V. DOE/CH-FAO NEPA Coordinator Review

Concurrence with the recommendation for determination:

Fermi Site Office Manager: Michael J. Weis

Signature [signature] for

Date 3/18/11

FSO NEPA Coordinator Reviewer: Rick Hersemann

Signature Rick Hersemann

Date 3/1/11

VI. Comments on checked items in section III.

Clearing or Excavation
Approximately 15,000 cubic yards of soil would need to be excavated for construction of the MicroBooNE Cylinder and Shed Facility. Approximately 11,700 cubic yards would be backfilled and the net surplus of 3,300 cubic yards would be placed on one of the onsite stockpiles or disposed off site.

Because greater than 1 acre would be disturbed during excavation, Fermilab would provide the necessary documentation to enable DOE FSO to apply for coverage under the Illinois Environmental Protection Agency General National Pollutant Discharge Elimination System Permit for Construction Activities. Additionally a Storm Water Pollution Prevention Plan and an Erosion Control Plan would be created, which would be followed during construction activities.

Demolition or decommissioning
Approximately 250 lineal feet of the existing MiniBooNE access road would be relocated. The existing road surface and subgrade would be removed and properly disposed off site. If the subgrade material is in good enough condition, it would be reused as subgrade for the relocated road.

When the MicroBooNE experiment is finished it would be decommissioned and dismantled; materials would be sorted for potential recycling and proper disposal according to applicable regulatory requirements.

Chemical use or storage
Storage facilities for Liquid Nitrogen (LN2) and Liquid Argon (LAr) would be located on the surface at ground level as shown in Appendix A. LN2 would be periodically delivered, as needed, by truck and would be stored in a horizontal Dewar and LAr would remain stored on site in the LAr trailer of the tractor trailer that it arrived in. Safety and spill considerations would be managed in the same manner as the many other Fermilab locations where LN2 and LAr is currently handled and used. LAr would not present an environmental hazard once it is inside the cryostat and procedures would be followed to minimize the possibility of freezing any flora or fauna that might be exposed to cryogens during filling or operation of the cryostat.

In its natural state, argon is an inert gas that can displace oxygen and hence would pose an oxygen deficiency hazard (ODH) in the event of a major leak in the detector enclosure; however, appropriate safety measures (ODH alarms, etc.) would be part of the design and planning of this new experiment. The refrigeration equipment would all be located in the cylinder "pit" about 40 feet below grade such that if there was a leak, it would be contained within the insulated portion of the lower level of the pit and vented through the emergency exhaust system so that conditions could not exceed ODH-1.

Air emissions
Some argon gas may be released during the filling of the cryostat, but it is not a regulated air pollutant and the amount would be small. Since argon is an inert gas, no adverse environmental impact would be expected. The tanks used for filling the cryostat would be on a concrete loading dock so the gas should not affect either flora or fauna.

A natural gas emergency power generator, rated at 50 KW (below the rating that would require an IEPA preconstruction permit) would be installed. The potential emissions would be included in the site wide inventory.

Liquid effluent
A groundwater sump would be installed in the base slab; the groundwater would be pumped to the surface and discharged into a ditch. All ditches, roads, and driveways around the facility would be graded to direct water into the neighboring wetlands, just as the natural and existing road ditch system does at present. The ditches would prevent any ponding on the MicroBooNE site. Any Industrial Chilled Water (ICW) for cooling would be closed loop and not discharged to surface waters.

Radiation exposures or radioactive air emissions
Experimenters may use small sealed radioactive sources for checking the electronic detectors, but expected exposure would be minimal (below detectable levels for personal dosimeters).

Appendix A (Excerpt from MicroBooNE Technical Design Report)

VII. MicroBoone Infrastructure (WBS 1.6)

A. Introduction

The existing MiniBooNE Facility was constructed in 1999-2000. It consists of a vertical concrete cylinder about 44 feet deep with a floor at elevation 706 feet. There is a single spiral staircase around the wall that extents to elevation 741', where a vertical ladder reaches to the main floor level at elevation 750 feet. The MiniBooNE Detector sphere is supported on six feet, and a cylindrical cap extends through the main floor. The detector electronics are all located on the main floor level with cabling to the photo-tubes in the interior of the sphere. A small access corridor at elevation 750 feet provides the only doorway into the facility. A pit in the floor of the access way is available for oil containment. A sump at elevation 706 removes ground water to the surface. Electrical power is provided by two 150 kVA transformers fed from feeder 40. HVAC has recently been augmented. An integral roof covers the cylinder and supports approximately 10 feet of earth shielding cover.

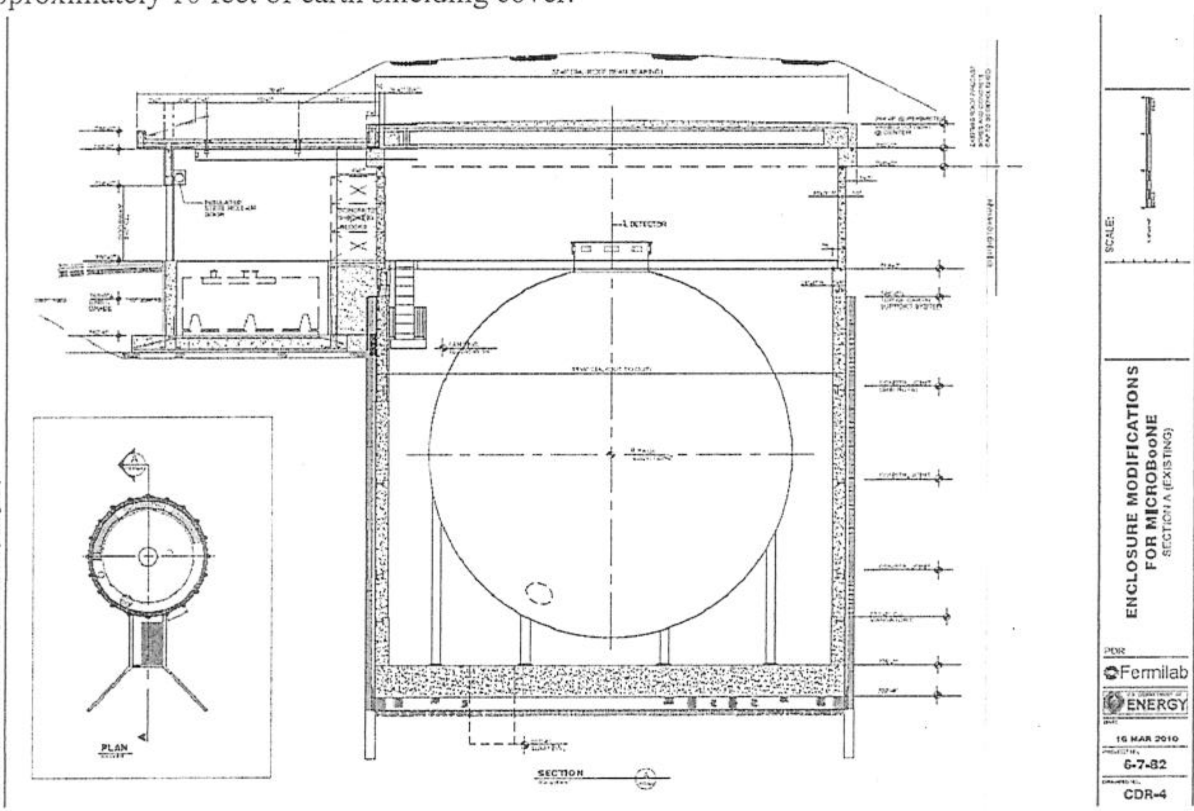

Figure VII.1 The existing MiniBooNE Detector in its concrete cylinder.

A proposal to reuse the MiniBooNE Facility after removal of the MiniBooNE Detector was developed, cost estimates for removal of the MiniBooNE Detector and modification of the facility were made, and a decision was reached not to proceed with this proposal. However, it was determined that much of the technical development of this rejected proposal was relevant to an alternate facility, and that the basic cylindrical structure of the MiniBooNE facility was the most cost effective underground construction. Thus, a proposal to create a duplicate cylindrical underground structure has been developed, located upstream but on the beamline of the MiniBooNE facility.

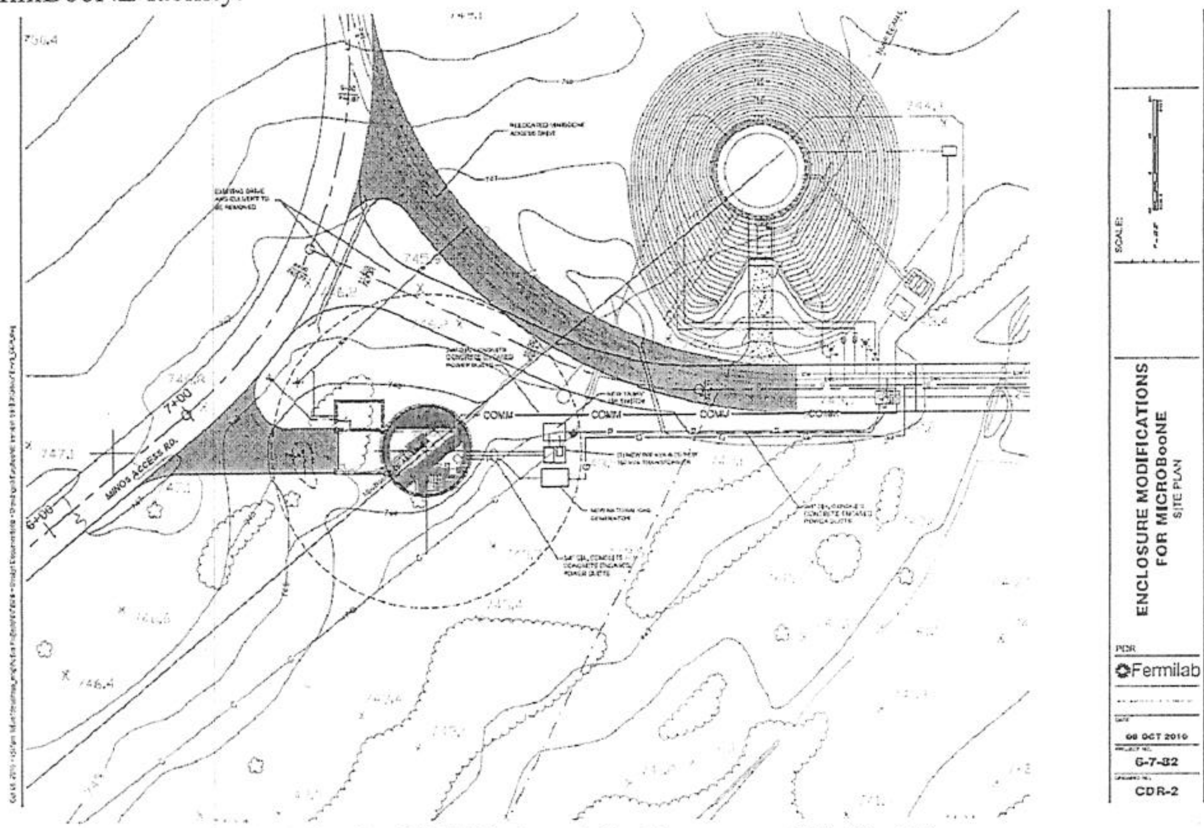

Figure VII.2 Location of the MicroBooNE "Cylinder and Shed" upstream of MiniBooNE.

New Utilities must be brought from the existing utility corridor, including 13.8kV electrical service, ICW, and natural gas. The MiniBooNE Facility would not be disturbed except for outages during utility connections.

For MicroBooNE there are two entries provided at grade: first a delivery area/electronics room area with truck access, and second, a door into a vertical stair column access the various below grade levels. A roof with a removable slot sufficient to permit the entry of the MicroBooNE Detector cryostat must be provided. The roof must have the carrying capacity for 10 foot of earth equivalent material. Electrical service would include one 150 kva transformer and one 500 kva transformer. Provision for safe egress in the event of ODH problems must be provided. Supports for the cryostat, readout electronics, and refrigeration equipment must be constructed. Adequate ICW for process cooling must be provided.

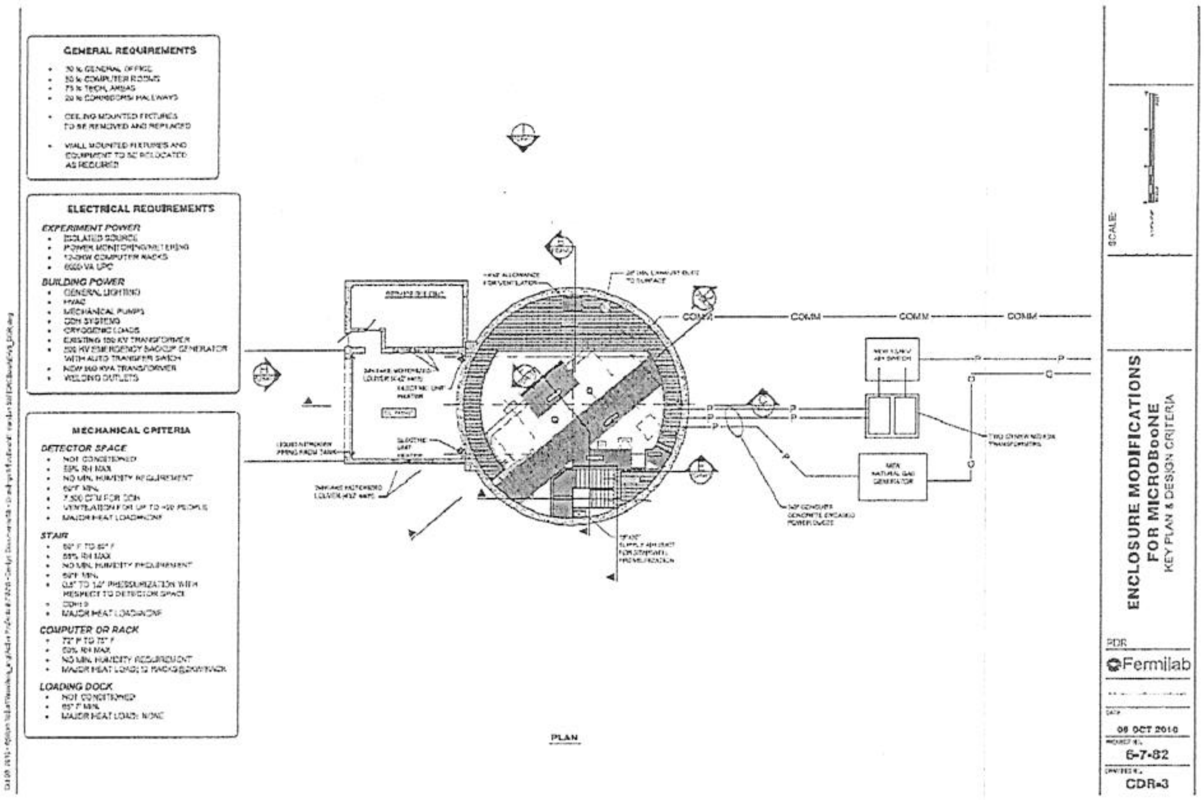

Figure VII.3 Plan view of the "cylinder and shed" facility showing the loading dock area, electronics room, and cylinder with stair column.

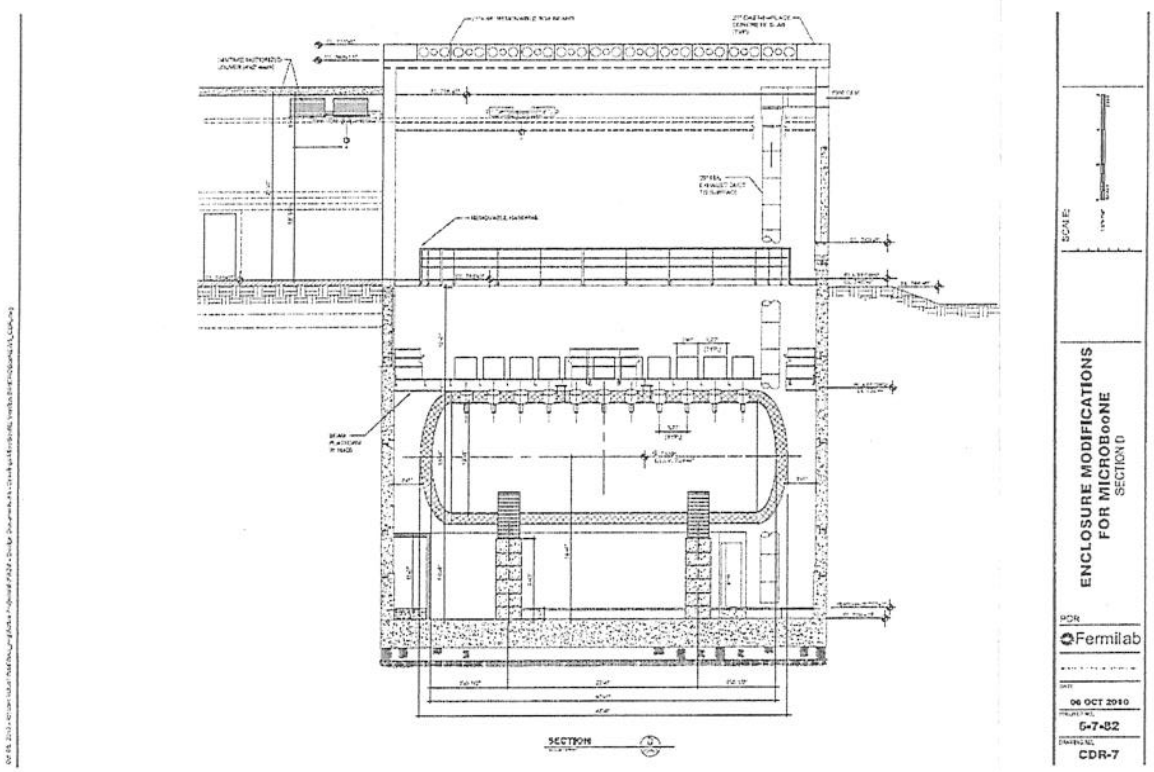

Figure VII.4 Elevation view (along beam line) showing MicroBooNE Detector in cylindrical pit.

B. Detailed Specifications for new enclosure

The following summarize specifications developed for the MicroBooNE "Cylinder and Shed" Facility:

1. The location of the liquid argon tank with the detector shall be "close" to the MiniBooNE detector center, approximately on the existing MiniBooNE beamline in both plan and elevation, but approximately 240' upstream of the MiniBooNE Facility.
2. It is proposed to house the detector tank, supporting refrigeration, readout electronics, and delivery area in the basic cylinder and an attached "Shed" structure at grade. The depth is the same as the existing MiniBooNE cylinder. The new facility would require three working elevations dictated by the refrigeration plant under the cryostat and the beamline center (See Figure VII.4.):
   - 706'0"/707'3", "Refrigeration Plant Level".
   - 732'4"/733'5", "Detector Readout Service Level".
   - 745', "Loading Dock Level/Electronics Room Level"
3. New taps to existing ICW (Industrial Chilled Water), natural gas, electric service, and DWS (Domestic Water Service) services in the nearby utility corridor are required. (See Figure VII.2.) There may be a need for an additional ICW line to create a "loop" so that ICW can be used for process chilling and then discharged back into the ICW system.
4. The insertion of the argon tank/detector shall be by an exterior movable crane through removable roof sections. A concrete "collar" section would be extended above grade to support the roof.

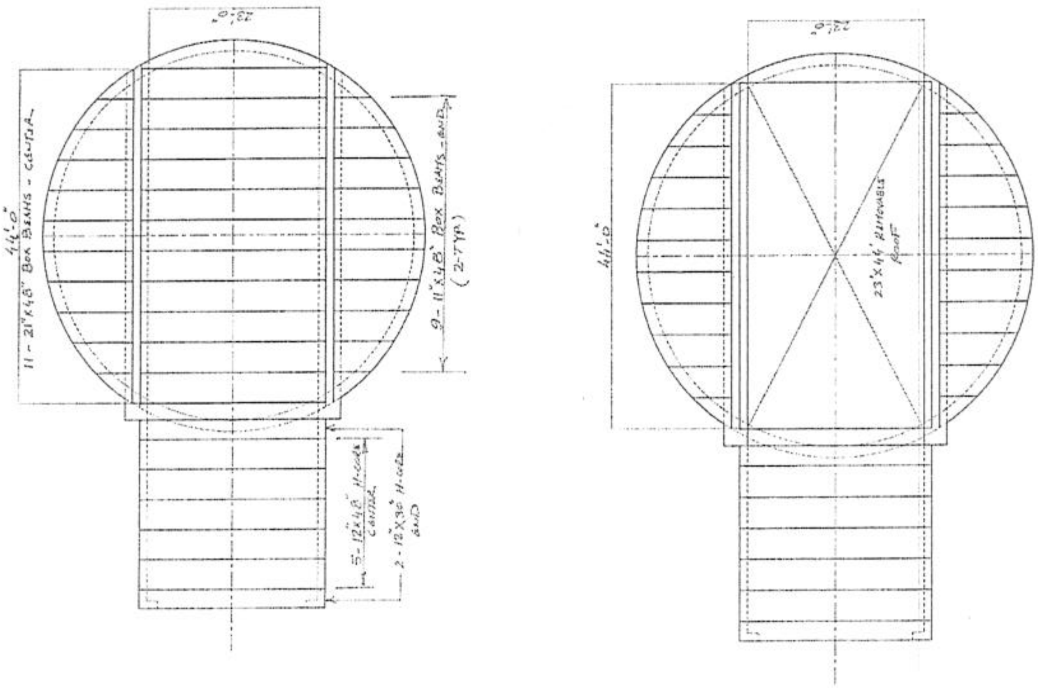

Figure VII.5 The new roof with the central removable slabs in place (left), and new roof with central slabs removed.

5. The existing MiniBooNE facility roof supports approximately 10 foot of earth shielding as a result of cosmic background reduction considerations for the MiniBooNE experiment. The proposed MicroBooNE facility design has no roof shielding; however, provision has been made so as not to exclude additional shielding at a later date. The pre-cast panel roof and/or the shielding system must be made weather tight.
6. There is a total of 1860 sq ft available at the elevation 706 level. About 410 sq ft would be used to provide an emergency exit passageway that is over pressurized to maintain an ODH-zero classification. The remaining approximately 1450 sq ft at elevation 706 would be available for refrigeration equipment and other support services for the liquid argon detector tank.

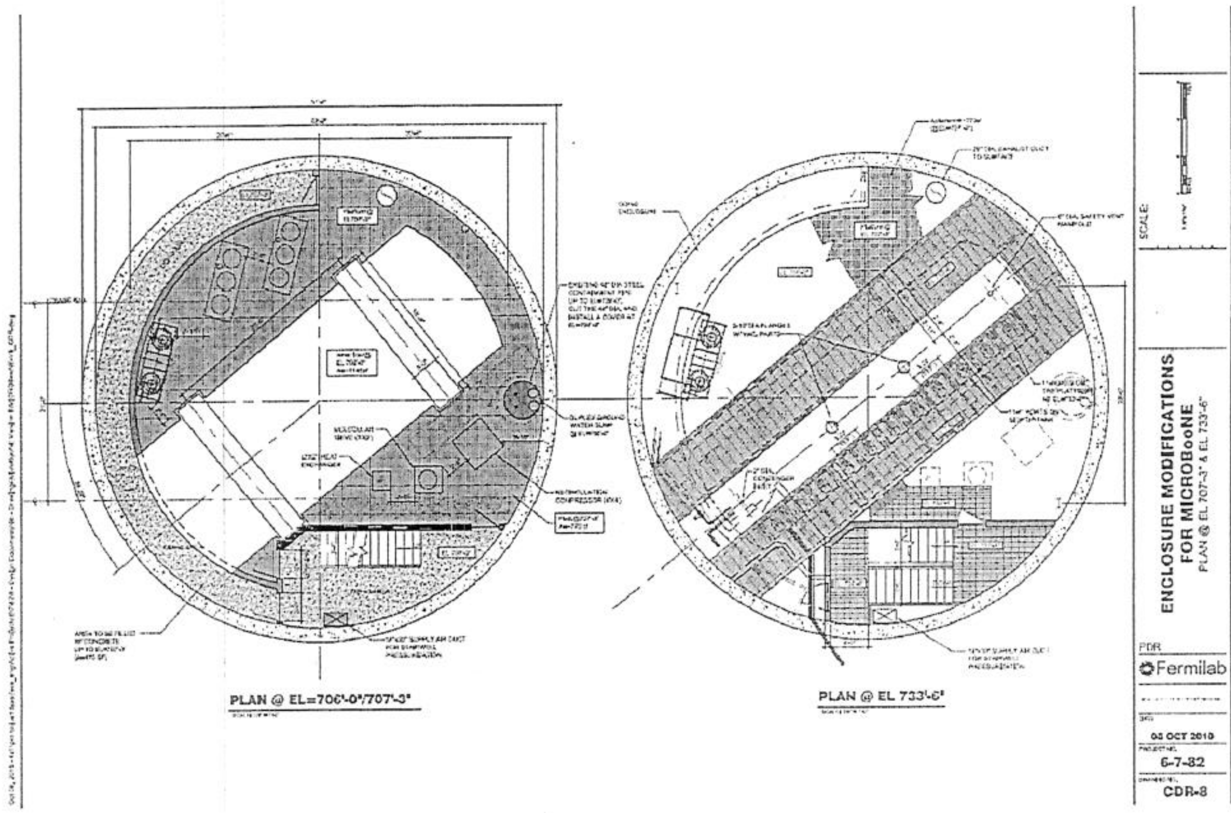

Figure VII.6 Plan views of the pit floor and the walkways at the top of the cryostat.

7. A five ton capacity crane would be provided to move refrigeration equipment between the loading dock level and the 706' elevation level. There would be a 15 ft pick height above elevation 745', and the hook would descend to elevation 706' requiring a total hook travel of approximately 54'.

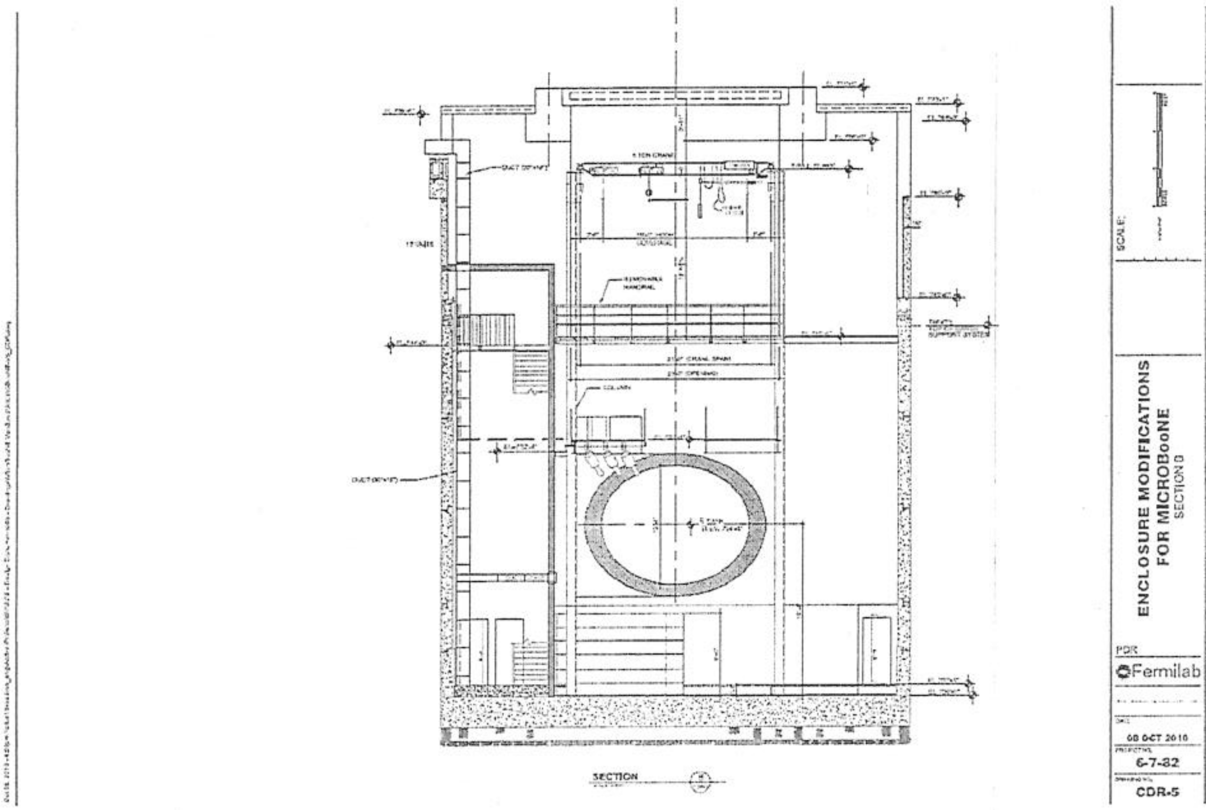

Figure VII.7 The emergency stair enclosure is shown on the left side of the pit, and the 5 ton crane is shown over the central portion of the pit.

8. The area of the "Loading Dock" at elevation 745' would be 21 ft x 25 ft which is 525 sq ft; crane coverage within this area would be approximately 16 ft x 22 ft = 352 sq ft at elevation 745' and the crane would also cover about 16 ft x 40 ft = 640 sq ft over elevation 706. There would be a paved road to the loading dock, and paved tube tanker parking for a pair of tube tankers.
9. There would be an enclosed, over pressurized access stairs from elevation 745 down to elevation 706. The elevation change up to grade would be 39' (63 steps) above elevation 706'. Emergency egress within the ODH zero stairway would therefore require a climb of about 5 stories.
10. The electronics room would have an area of about 335 sq ft. The electronics cable run from the detector tank to the electronics would be approximately 100'.
11. There would be four distinct HVAC regions.
    - (Area A) The electronics room.
    - (Area B) The loading dock.
    - (Area C) The over pressurized ODH "zero" exit stair column, and the emergency exit passage at el 706.
    - (Area D) The remaining spaces (the rest of the cylinder structure) would be designed with sufficient exhaust fans such that in the event of an ODH accident the conditions should not exceed ODH-1.

12. An Argon spill volume would be created with insulation under a grating built 15" above the 706 elevation floor.
13. The Argon spill vent (air-exchange) rate is 7500 CFM. The standard non-accident air exchange rate would be consistent with an occupancy of 20 people.
14. In the exit passage and stairs the ODH "zero" over pressurization would be between ½" and 1" H20 overpressure.
15. Building electrical power would require a 500 KVA transformer. Clean power would be provided by a 150 KVA transformer. The electrical service motor control center would be located on the west wall of loading dock area.
16. A natural gas emergency power generator rated at 50KW is required, with an automatic transfer switch. This emergency service is sized for cryogenics monitoring and, HVAC for ODH escape, etc.
17. Fire suppression with a sprinkler system, and fire alarms, would be provided. Mounting of the sprinkler pipes would be consistent with the removable roof requirement.
18. Conventional HVAC is specified for the four HVAC areas defined above:
    - Area A ---72F to 75F, 50% RH max, no min RH, (12 racks @25KW/rack)
    - Area B---not conditioned, 65F min.
    - Area C---60F to 80F, 55%RH max, no min RH, 60F min, ½" to 1" H2O overpressure.
    - Area D--- not conditioned, 55% RH max, no min RH, 60F min, standard air exchange for 20 people occupancy, 7500 cfm exhaust under ODH accident.
19. Process cooling water is required, 30 gpm, 2 degree working temperature drop. ICW loop would be created with discharge back to MINOS surface sump tank.
20. Cryogenic transfer piping to be mounted on the east wall of loading dock area.
21. Human occupancy expectation is 20 max during installation, approximately 0 during operations. The assumption is that there are no sanitary facilities provided in the structure, which means portable toilets are necessary.
22. Outside storage requirements – LN2 tank, tube trailers.

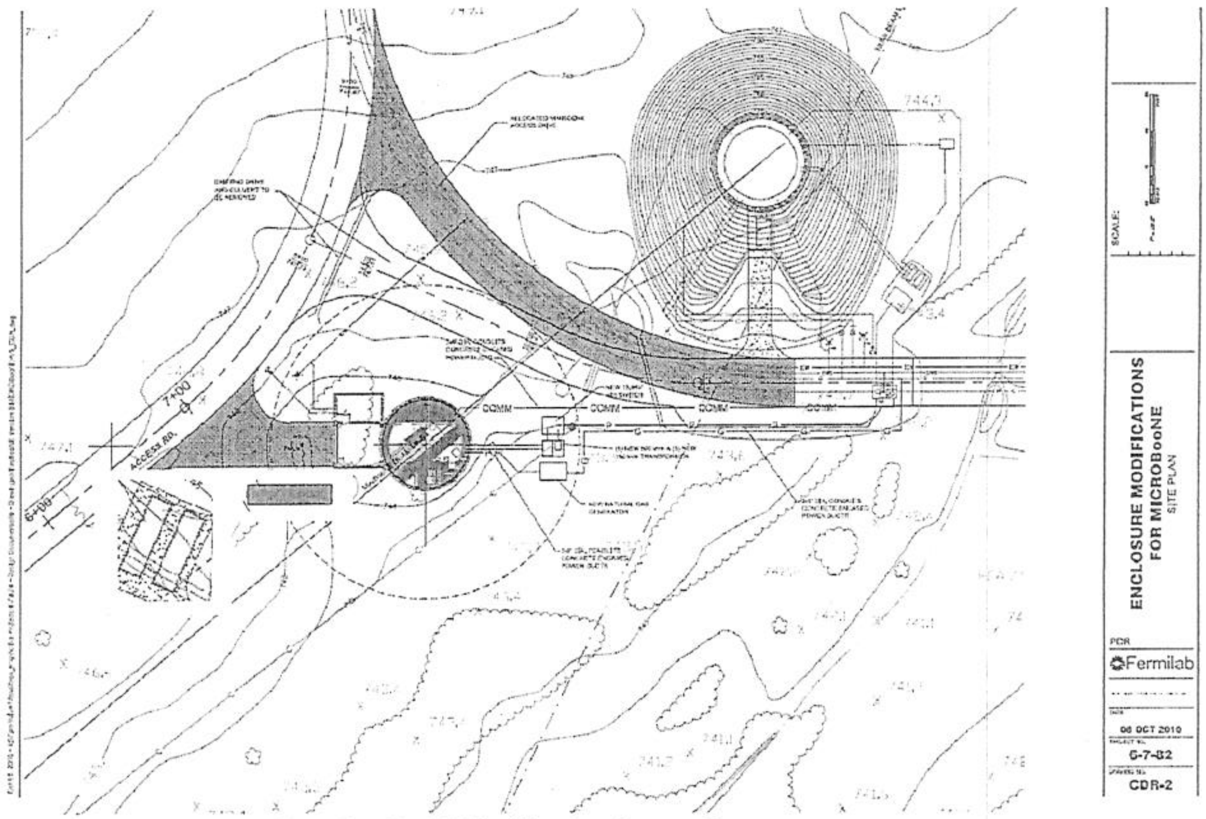

Figure VII.8 A plan view of the MicroBooNE Facility showing outside storage areas.

23. The new roof would be designed with easily removed precast beams, and only a central slot needs to be opened to deliver or service the argon detector tank.
24. Radiation interlocks not necessary; ODH alarms, etc. are necessary.
25. Standard lighting specifications.

C. *Documentation*

The latest drawings for this exercise are in DocDB as Doc 1121.

The final design based upon this "Cylinder and Shed" Facility may begin after the agreement on the specifications given above.

Appendix B – Map of Project indicating Wetland Boundary