Department of Energy
Fermi Site Office
Post Office Box 2000
Batavia, Illinois 60510

August 25, 2017

Michael J. Weis, Manager
Fermi Site Office

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DETERMINATION FOR THE PROTON IMPROVEMENT PLAN II (PIP-II) PROJECT

Fermilab submitted the attached Environmental Evaluation Notification Form (EENF) to the Department of Energy (DOE) Fermi Site Office (FSO) for the subject proposed action, which is a number of improvements and additions to the Fermi National Accelerator Laboratory (Fermilab) accelerator complex with the goal of providing maximum proton beam power capability of 1.4 megawatts (MW). The EENF is Fermilab's disclosure of environmental data associated with the PIP-II project.

The PIP-II project is necessary to implement the vision articulated in the May 2014 report from the Particle Physics Projects Prioritization Panel (P5) and in the Mission Need Statement issued for PIP-II by the DOE Office of Science, both of which highlight the opportunity for the U.S. to host a world-leading long baseline neutrino program of intensity frontier research. The PIP-II project would deliver 1 MW of beam power to the Long Baseline Neutrino Facility (LBNF) at Fermilab. The project would also support the long-term development of a broad multi-MW program at Fermilab as future resources become available.

DOE NEPA regulations identify a Class of Action for:

> Siting, construction or modification, operation, and decommissioning of low- or medium-energy (when the primary beam energy exceeds approximately 100 million electron volts and the average beam power exceeds approximately 250 kilowatts or where the average current exceeds 2.5 milliamperes) particle acceleration facilities, including electron beam acceleration facilities, and associated beamlines, storage rings, colliders, and detectors for research and medical purposes, within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). (10 CFR 1021 Subpart D, Appendix C, C11)

The regulations indicate that an environmental assessment (EA) is normally the appropriate level of NEPA review for this Class of Action. Preparation of an EA would also be consistent with FSO's experience with similar neutrino experiments and projects, i.e., the LBNF, the Neutrinos at the Main Injector (NuMI) and the NuMi Off-axis ν Appearance (NOνA) experiments. Therefore, my recommendation is that an EA be prepared on the PIP-II project.

Based on the information provided in the PIP-II EENF, the PIP-II project has the potential to impact human health and the environment, however, this is not a certainty. Most notably, the PIP-II project could have an effect on wetlands at Fermilab and could result in some limited activation of air, soil, and groundwater at Fermilab. If the EA establishes that impacts are

significant, an Environmental Impact Statement would need to be prepared. Otherwise, FSO could issue a Finding of No Significant Impact and the NEPA process would be complete.

Per DOE Order 451.1B, Section 5a(8), you have the responsibility and authority to officially determine that preparation of an EA is appropriate. You also have the responsibility, per Section 5a(2) to maintain a NEPA Compliance Officer and designate a Document Manager to take the lead in managing the EA process for the FSO. You have designated me for those roles for FSO. Since you are the authority responsible for this determination and designation, your signature on the approval line below is requested.

I will notify the DOE Office of General Counsel, Safety and Health, Office of NEPA Policy and Compliance (GC-54) and the DOE Office of Science, Environment, Safety and Health Division (SC-31.1) of your determination. As required by the DOE NEPA regulations (10 CFR 1021.301(c)), I will also notify the designated State and Tribal NEPA contacts.

Rick Hersemann

Rick Hersemann
NEPA Compliance Officer

Approve:

Michael J. Weis
Fermi Site Office Manager

8/25/2017
Date

Enclosure:
PIP-II EENF

cc: N. Lockyer, Fermilab, Directorate, w/o encl.
J. Lykken, Fermilab, Directorate, w/o encl.
M. Michels, Fermilab, ESHQ, w/o encl.
T. Dykhuis, Fermilab, ESHQ, w/encl.
S. Holmes, Fermilab, PIP-II Project Office, w/o encl.
P. Derwent, Fermilab, PIP-II Project Office, w/o encl.

FERMILAB ENVIRONMENTAL EVALUATION NOTIFICATION FORM (EENF) for documenting compliance with the National Environmental Policy Act (NEPA), DOE NEPA Implementing Regulations, and the DOE NEPA Compliance Program of DOE Order 451.1B

Project/Activity Title: Proton Improvement Plan (PIP)-II
ES&H Tracking Number: 01136

I hereby verify, via my signature, the accuracy of information in the area of my contribution for this document and that every effort would be made throughout this action 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 Fermilab to accomplish its mission, achieve environmental compliance, reduce risks to health and the environment, and prevent or minimize future Department of Energy (DOE) legacy wastes.

Fermilab Action Owner: Stephen Holmes (X3988)
Signature and Date Stephen D. Holmes 8/16/17

I. Description of the Proposed Action and Need

Purpose and Need:
The PIP-II Project would encompass a number of improvements and additions to the Fermilab accelerator complex with the goal of providing maximum proton beam power capability of 1.4 MW with an operational goal of 1.2 MW delivered to the neutrino production target at the initiation of the LBNF (Long Baseline Neutrino Facility) operations. This project is necessary to implement the vision articulated in the May 2014 report from the Particle Physics Projects Prioritization Panel (P5) and in the Mission Need Statement issued for PIP-II by the DOE Office of Science, both of which highlight the opportunity for the U.S. to host a world-leading long baseline neutrino program of intensity frontier research. The project would be structured to deliver, in a cost effective manner, more than 1 MW of beam power to LBNF. This project would support the long-term development of a broad multi-MW program at Fermilab as future resources become available. This project would be constructed in the inside of the existing Main Ring berm adjacent to the existing transfer Hall and Booster Ring Facilities (see Appendix VII). This project involves considerable new construction, including underground enclosures and surface facilities along with support utilities extended from existing systems. In all cases, the construction would be completed with a priority to minimize all environmental impact to the project area.

Proposed Action:
The primary element of the PIP-II project would be the construction and operation of a new proton linear accelerator housed in a 730 feet long underground enclosure. The new linac would have an adjacent 650 feet long surface gallery that houses supporting power supplies and related equipment. The linac would be connected to the existing booster accelerator by a transfer beamline that would be housed in a new underground enclosure that connects the end of the new Linac Tunnel to the existing Booster enclosure. Construction of this new Beam Transfer Line Enclosure and Booster Connection would necessitate the partial demolition of approximately 30 feet of the existing Booster enclosure as well as approximately 120 feet of the existing Main Ring enclosure. There would be three additional surface buildings: a High Bay Building that would house the warm front end components of the linac as well as provide access to the below grade Linac Tunnel, a Cryogenic Plant Building for supporting cryogenic equipment, and a Utility Plan Building. There would be new roadways located adjacent to the linac alignment and parking areas at the two surface buildings. There would also be a new utility corridor adjacent to the linac alignment that would extend through the project area and connect to the existing Central Utility Building and existing Fermilab infrastructure. Below are quantitative data that describe each of the proposed conventional elements of the PIP-II project.

Linac Tunnel: Underground concrete enclosure approximately 22 feet wide and 19,935 square feet to house accelerator components.

Beam Transfer Line/Booster Connection: Underground concrete enclosure that connects the Linac Tunnel to the existing Booster enclosure, approximately, 10 feet wide and 14,435 square feet and houses accelerator components.

Linac Gallery: Surface building would be located directly adjacent to the underground Linac Tunnel, approximately 50 feet wide and 650 feet long (32,905 square feet).

High Bay Building: Surface building would be located near the upstream end of the Linac Tunnel, approximately 21,275 square feet. The High Bay Building would house the warm front end accelerator components and provide a means of equipment access to the underground Linac Tunnel enclosure below.

Cryogenic Plant Building: Surface building would be located near the downstream end of the Linac Tunnel, approximately 23,245 square feet and would house cryogenic equipment.

Utility Plant Building: Surface building would house the mechanical equipment to support accelerator operations located near the upstream end of the Linac Tunnel, approximately 7,996 square feet.

Roadway and Parking Areas: A new road system would be built along the length of the new linac connecting the parking area at each of the new surface buildings to the existing Main Ring road. Total new paved or hardstand area approximately 80,000 square feet.

Utility Corridor: A new utility corridor would extend from the north end of the Linac Tunnel and connect to the Central Utility Building and other Fermilab infrastructure. Approximate length 1,900 linear feet.

Excavation: The method for construction for the underground enclosures would be a conventional cut and cover excavation process, similar to other underground enclosures previously constructed on the Fermilab site. An earth berm would be constructed over the underground enclosures for radiation shielding. It is expected that the excavation would remove approximately 247,000 cubic feet of earth during the excavation process. The excavated material would be stockpiled on the construction site and would be used to construct the earth berm after the underground enclosures are completed. It is expected that the earth removed in the excavation process would be approximately the same as that needed to construct the earth berm used to shield the underground enclosure. Excess excavated material, if any, would be removed from the project site and taken to existing stockpiles located in other parts of the Fermilab site. The stockpiles shown on the drawing are temporary and would exist only during construction; the material would be used to backfill and create the berm.

It should be noted that there are existing wetlands in the area of the project site. An existing Wetlands Delineation of the project area would be updated to specifically identify the extent of these wetlands. Every effort would be made to avoid the impact on these existing wetlands and minimize unavoidable impacts during both the construction period as well as during operation of the new facility. Wetland delineation of the project area and project plans would be submitted to the U.S. Army Corps of Engineers to determine if a permit would be required under Section 404 of the Clean Water Act.

Alternatives Considered:
Several alternatives to the current PIP-II design were considered, as described in the Analysis of Alternatives Report (AoA) required for DOE Critical Decision-1 (PIP-II doc 107). This report considers both alternative technologies and alternative physical locations. An alternative to the proposed siting would be based on construction of a new 400 MeV pulsed linac at the end of the existing 400 MeV linac- incorporating either superconducting or room temperature technologies. Either implementation would require physical relocation of the existing linac, upstream by about 50 m, to accommodate the added length while keeping the Booster injection point fixed. As described in the AoA report this siting is disfavored because it precludes the most straightforward path to an eventual capability of >2 MW to LBNF – utilization of exiting (Linac and Booster) enclosures for the PIP-II linac and for an eventual new Rapid Cycling Synchrotron is not possible due to the inadequate shielding for anticipated intensities, with no practical option for increasing this shielding. Thus, this siting is incompatible with the long-term evolution of the Fermilab complex envisioned in the Particle Physics Projects Priority Panel (P5) report. Further details are provided in the

AoA. As a result of these, and other, arguments the Department of Energy/Office of High Energy Physics selected a superconducting linac, situated on the Tevatron infield, as the preferred alternative for PIP-II.

Not pursuing the PIP-II Project at all was also not accepted as a viable alternative. The PIP-II project provides a direct response to the clear vision provided by the high energy physics community in the 2014 report from the P5I as well as from the DOE Office of Science in the Mission Need Statement. A minimum proton beam power capability of 1 MW, with future upgrade capability to >2 MW, is required for LBNF, and would be provided by the PIP-II project. Failure to undertake this project would not meet the stated need.

II. Description of the Affected Environment

The proposed action would involve the excavation of 247,000 cubic feet of material and the construction of underground enclosures and surface facilities located inside the existing Main Ring berm adjacent to the existing transfer Hall and Booster Ring Facilities (see Appendix VII). Additional environmental effects are highlighted in Section III.

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. Comments on checked items in section III.

Wetland/Floodplains

There are some existing wetlands located in the area of the project site that would be affected by the construction and operation of this project. The project would work with the US Army Corps of Engineers to determine if a permit would be required under section 404 of the Clean Water Act.

Clearing or Excavation

The affected area would be greater than 1 acre; therefore, a Storm Water Pollution Prevention Plan would be developed during the final design phase.

Demolition or decommissioning
Construction of the underground enclosure for the beam transfer line and connection to the existing Booster Ring would necessitate the demolition of approximately 30 linear feet of the existing Booster Ring enclosure as well as approximately 120 linear feet of the existing Main ring enclosure. Demolition would include reinforced concrete, perimeter drain tile and excavated materials. It is possible that some of these materials would be activated at low levels. Radiation survey, sampling and monitoring would be required during excavation and demolition activities and would be provided by Fermilab personnel. Activated materials would be segregated and disposed of by Fermilab personnel in accordance with established Fermilab policies and procedures. Any activated earth would be stockpiled separately and be the first material to be used as backfilled around the new underground construction. No other hazardous waste is anticipated during demolition or decommissioning activities. Decommissioning of any existing Main Ring or Booster Ring equipment would be completed prior to the start of construction by Fermilab personnel in accordance with established Fermilab policies and procedures.

Chemical use or storage
Helium gas would be required for the Cryogenic Plant operation. Storage facilities for both helium and liquid nitrogen would be provided as part of this project. No other gases or chemicals would be required, used or stored as part of this project. It is estimated that annual consumption would be approximately 1,200 liters of helium (15% of the helium inventory) and 1000 liters of liquid nitrogen.

Air Emissions
A permanent 250 kilowatt diesel generator would be provided as part of this project to supply emergency power for this facility. No other operational air emission sources are anticipated as part of this project. During construction, various gasoline and/or diesel powered vehicles, excavation equipment, cranes, etc. would be used for excavation, backfilling, material movement and general construction activities.

Liquid Effluents
The new buildings provided in this project would require new connections to the sanitary and storm sewers. Additionally, existing sanitary and storm sewers would be rerouted as necessary. Sanitary waste and any maintenance discharge from the utility plant would be directed to the existing onsite sanitary sewer system which is connected to the Batavia publicly owned treatment works (POTW). Surface storm water and sump pump discharges would be directed to the onsite cooling water system.

Waste
Typical construction and demolition waste is anticipated. Recycling of waste material would follow Fermilab procedures. Detailed information on types and quantities of demolition waste would be determined in the detailed design phase.

Radioactive exposure or radioactive emissions
During demolition activities where activated materials are anticipated, all personnel involved in these activities would be provided with appropriate radiation badging in accordance with established Fermilab policies and procedures. Tunnel shielding would be designed for the maximum design proton beam power

capability. In addition, an interlock system integrated with beam controls would be installed at all access points to the machine areas.

Radioactivation of soil and groundwater
The primary element of the PIP-II project is a new proton linear accelerator. It is anticipated that operation of this new accelerator may result in low level irradiation of the soil and groundwater adjacent to the accelerator enclosure similar to previous experience with the Main Ring and Main Injector accelerator enclosures.

This would be monitored in accordance with existing established Fermilab policies and procedures. Although there is no indication that acceleration operations would produce any tritium in the groundwater, the project would follow all requirements of the Fermilab tritium monitoring and mitigation efforts and plan.

Disturbance of pre-existing contamination
Adjacent to the project site there is an existing Central Utility Building (CUB) Pipe and Clay Tile Field which is a Solid Waste Management Unit (SWMU 12). In addition, there are several groundwater monitoring wells in the area of SWMU 12 and adjacent to the existing Main Ring underground enclosure. The location and extent of SWMU 12 and all of the groundwater monitoring wells is well documented and all have been located and identified. All of these areas are beyond the limits of the project and would not be disturbed or affected by any construction or operational activity associated with this project.

New or modified permits
At this time, it is anticipated that some existing wetlands would be affected by the construction and operation of this project. The project would work with the US Army Corps of Engineers to determine if a permit would be required under section 404 of the Clean Water Act. In accordance with the Illinois Environmental Protection Agency (IEPA) requirements, a National Pollutant Discharge Elimination System (NPDES) permit would be required.

V. NEPA Recommendation

Fermilab has reviewed this proposed action and determined that it does not fit in the classes of actions, predetermined by DOE in 10 CFR Part 1021, Subpart D, Appendix A and B, that do not individually or cumulatively have a significant effect on the human environment (categorical exclusion). It is believed that the proposed action meets the description found in 10 CFR 1021, Subpart D, Appendix C11 that requires an Environmental Assessment (EA) as follows.

C11 Particle Acceleration Facilities
Siting, construction or modification, operation and decommissioning of low- or medium-energy (when the primary beam energy exceeds approximately 100 million electron volts and the average beam power exceeds approximately 250 kilowatts or where the average current exceeds 2.5 milliamperes) particle acceleration facilities, including electron beam acceleration facilities, and associated beamlines, storage rings, colliders, and detectors for research and medical purposes, within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible).

Therefore, this project would require a NEPA determination from DOE at the EA level and all aspects of the project would be thoroughly evaluated during that process and subsequent development of Preliminary Safety Assessment Documents (PSAD) and SAD. Therefore, this EENF is conceptual, and is intended only to provide the formal notification that an EA would be prepared.

Fermilab NEPA Program Manager: Teri L. Dykhuis
Signature and Date Teri L. Dykhuis 8/16/2017

VI. DOE/Fermi Site Office (FSO) NEPA Review

Concurrence with the recommendation for determination:

FSO NEPA Compliance Officer: Rick Hersemann
Signature and Date Rick Hersemann 8/22/2017

VII. Appendix

Drawing of Proposed Action – on next page.