FSO
Hersemann/jp
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Scott
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Bollinger
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FSO
Weis
1/10/14

JAN 10 2013

Ms. Victoria A. White
Chief Operating Officer
Fermilab
P.O. Box 500
Batavia, IL 60510

Dear Ms. White:

SUBJECT: NATIONAL ENVIRONMENTAL POLICY ACT DETERMINATION AT FERMI NATIONAL ACCELERATOR LABORATORY – PIONEERING HIGH ENERGY NUCLEAR INTERACTION EXPERIMENT FAST TIME OF FLIGHT DETECTOR TESTING

Reference: Letter, from V. White to M. Weis, dated December 18, 2013, Subject: National Environmental Policy Act Environmental Evaluation Notification Form for Pioneering High Energy Nuclear Interaction Experiment Fast Time of Flight Detector Testing

I have reviewed the National Environmental Policy Act (NEPA) Environmental Evaluation Notification Form (EENF) for the Pioneering High Energy Nuclear Interaction Experiment (PHENIX) Fast Time of Flight (TOF) Detector Testing. Based on the information provided in the EENF, I have approved the following categorical exclusion (CX):

Project Name	Approved	CX
PHENIX Fast TOF Detector Testing	12/30/2013	B3.6

I am returning a signed copy of the EENF for your records. No further NEPA review is required. This project falls under categorical exclusions provided in 10 *CFR* 1021, as amended in November 2011.

Sincerely,

Michael J. Weis
Site Manager

Enclosure:
As Stated

cc: N. Lockyer, w/o encl.
M. Michels, w/encl.
A. Kenney, w/o encl.
T. Dykhuis, w/encl.

bc: J. Scott, w/o encl.
R. Hersemann, w/encl.

S: CX- PHENIX TOF Detector Upgrade 123013.rh

File:

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: Pioneering High Energy Nuclear Interaction Experiment (PHENIX) Fast Time of Flight (TOF) Detector Testing
ES&H Tracking Number: 01114

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: Aria Soha (X4463)
Signature and Date Aria Soha 12/17/13

Fermilab ES&H Officer: Angela Aparicio (X3701)
Signature and Date Angela Aparicio 12/17/13

I. Description of the Proposed Action and Need

Purpose and Need:
PHENIX, the Pioneering High Energy Nuclear Interaction Experiment, is an exploratory experiment for the investigation of high energy collisions of heavy ions and protons; it is the largest of four experiments to take data at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL). PHENIX is designed specifically to measure direct probes of the collisions such as electrons, muons, and photons. The primary goal of PHENIX is to discover and study a new state of matter called the Quark-Gluon Plasma.

The purpose of this action is to test the sPHENIX/ePHENIX detector upgrades; both of these are upgrades to the PHENIX. The sPHENIX upgrade would address questions of the strongly coupled quark-gluon plasma discovered experimentally at RHIC and the ePHENIX is an upgrade to a detector that would be suitable for a future Electron Ion Collider at RHIC. These are needed for the ability to study the dependency of different observables on particle flavor, and are expected to be an important part of the physics programs for the second run of the RHIC (RHIC-II) and future eRHIC era at BNL. The experimenters intend to test two approaches to achieving a very fast time-of-flight detector; one using a Multi-Channel-Plate (MCP) Photomultiplier Tube (PMT) (MCP-PMT) and another using a multigap Resistive Plate Chamber (mRPC).

Proposed Action:
The MCP-PMT is a commericial photomultiplier tube (a Photonis 85012-XP) that has been modified to have a fused silica window, which improves the transmittance for UV light. The second technology, would use mRPC, consisting of anywhere from 6 to 24 flat plates of float glass in a gas volume, separated by 150-250 microns, and held at high voltages of up to 15 kV. The gas mixture to be used is R134A(95%), isobutene (4.5%) and SF6 (0.5%) The test is scheduled to run for 3 weeks, 24 hours per day at the Fermilab Test Beam Facility (FTBF).

Alternatives Considered:
The FTBF is one of two test facilities in the world (the other is CERN) that provide versatile test beams for experimenters to test their detectors and instrumentation; CERN would not have beam available for

testing until 2016. Not being able to run these tests would leave the experimenters unsure of how their equipment would react within a beam.

Alternative Gases Considered:
Replacement gases were considered, but so far the gas mixture described above was the only one found to give the ideal performance in efficiency and time response, while able to operate in avalanche mode at high voltages (12kV over an approximate 1 cm gap). Avalanche mode is necessary to maintain rate capabilities and prevent aging of the detector. R134a is the only known commercially available gas with good electron affinity that would avalanche at the voltages that would be run, while limiting the size of the avalanche, which would help with timing performance. The high voltage would be necessary for the timing performance. The other two gases would optimize quenching (absorption of photons and electrons to prevent a runaway cascade of avalanches).

II. Description of the Affected Environment

See section VI of this EENF.

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.

Chemical Use or Storage
The gas mixture to be used is R134A [1,1,1,2-Tetrafluorethane {CH2FCF3}] (95%), isobutane (4.5%) and SF6 [sulfur hexafluoride] (0.5%).

- 1,1,1,2-Tetrafluoroethane is a haloalkane refrigerant with thermodynamic properties similar to R-12 [dichlorodifluoromethane] but with less ozone depletion potential. Global Warming Potential (GWP) is 1320 and expected atmospheric lifetime is 14 years.
- Isobutane (C4H10) is a methylpropane with negligible ozone depletion potential and very low GWP (having a value of 3.3 times the GWP of carbon dioxide).
- Sulfur hexafluoride is an inorganic, colorless, odorless, non-flammable, extremely potent greenhouse gas which is an excellent electrical insulator; it is generally transported as a liquefied compressed gas and has a GWP of 23,900 and an expected atmospheric lifetime of 3200 years.

Air Emissions
The gas mixture would be vented outside of the building at a rate of 400 cubic centimeters per minute, which is less than 0.1 pounds per hour and therefore is exempt from air permitting according to 35 IAC Section 201.146 jjj1)A).

V. NEPA Recommendation

Fermilab staff has reviewed this proposed action and believe a Categorical Exclusion is appropriate. It is believed that the proposed action meets the description found in DOE's NEPA Implementation Procedures, 10 CFR 1021, Subpart D, Appendix B3.6 – *Small-scale research and development, laboratory operations and pilot projects* - which states:

"Siting, construction, modification, operation and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment."

Fermilab NEPA Program Manager: Teri L. Dykhuis
Signature and Date Teri L. Dykhuis 12/18/2013

VI. DOE/FSO NEPA Coordinator Review

Concurrence with the recommendation for determination:

Fermi Site Office (FSO) Manager: Michael J. Weis
Signature and Date 1/10/2014

FSO NEPA Coordinator: Rick Hersemann
Signature and Date Rick Hersemann 12/30/2013