



FINAL
ENVIRONMENTAL
ASSESSMENT

**Environmental Assessment for
Construction and Operation of Neutrinos at the Main Injector
Off-Axis Electron Neutrino (ν_e) Appearance Experiment
(NO ν A) at the Fermi National Accelerator Laboratory,
Batavia, Illinois, and St. Louis County, Minnesota**

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St. Paul, MN

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SUMMARY

Introduction. This Environmental Assessment (DOE/EA-1570) provides information and analysis of proposed U.S. Department of Energy (DOE) activities associated with constructing and operating facilities for a new neutrino physics research program called NO ν A. The NO ν A Collaboration is composed of almost 200 scientists and engineers from nearly 30 Universities and Laboratories around the world. The Fermi National Accelerator Laboratory (Fermilab) is the lead laboratory for the DOE, and the University of Minnesota is the lead collaborating university through a Cooperative Agreement with the DOE. The program would generate neutrinos at Fermilab in Batavia, Illinois, for analysis in proposed detectors at Fermilab and at a Far Detector Facility proposed to be built near the Ash River, in St. Louis County, Minnesota.

NO ν A activities at the Ash River site entail a wetlands action that requires a permit from the U.S. Army Corps of Engineers (USACE). Consequently, this EA incorporates a wetlands assessment, and the USACE is a Cooperating Agency in this EA. Information contained in this EA will be used by the DOE Office of Science (DOE-SC) and the USACE to determine if the proposed action is a major federal action significantly affecting the quality of the environment.

Purpose and Need. Neutrinos are uncharged, non-ionizing elementary particles that only rarely interact with ordinary matter. The study of the oscillation of neutrinos from one type to another is considered a good way to study important physics questions, such as the properties of the weak interaction, neutrino mass, the contribution of neutrinos to the Dark Matter in the Universe, and the relationship between matter and antimatter. Understanding these particles is an important goal of the worldwide physics community, and operation of the NO ν A facility would implement the DOE Office of Science mission.

Proposed Action and Alternatives. The major proposed actions of the NO ν A Project consist of the facility modification and construction at both the Fermilab site and in St. Louis County, MN (the Ash River site). The region between the two sites would not be affected by construction, operation, or decommissioning of the proposed action.

Proposed activities at Fermilab include an upgrade of the existing Fermilab accelerator complex with an increase of beam power in the Main Injector. A new underground cavern would be excavated at approximately 345 feet below grade adjacent to an existing tunnel. This new cavern requires a modest excavation of about 1,000 cubic yards of rock using conventional civil construction and mining techniques. The cavern would hold a new 222-ton "Near Detector" to monitor the neutrino beam as it leaves the Fermilab vicinity. Two temporary facilities would be employed aboveground. Early in the program a 90-ton prototype detector would be assembled in an existing Fermilab facility to provide development and optimization for the neutrino detector. To support the blending of approximately 4.2 million gallons of scintillation detector fluid a blending facility would be constructed at Fermilab or a commercial blender near Chicago would be contracted. A constituent in the blending operation would be pseudocumene, a toxic

organic liquid at approximately 5% of the total volume. Blended scintillation fluid would be transported by tanker truck from the blending facility to the Ash River site.

A proposed new NOvA “Far Detector” Facility would be constructed on a site near the US-Canadian border in St. Louis County, MN. Construction would entail a new building with dimensions 67 feet wide by 375 feet long, which would be sunk 40 feet below the existing grade into granite rock. Site preparation would include improvement to an existing logging road to facilitate all-weather access. A proposed 20,000-ton Far Detector would be constructed in part of the new building with components identical to the ones used in the Near Detector, but with dimensions, number and total volume scaled to the larger size.

The proposed action consists of four main activities: (1) excavation and construction; (2) scintillator blending, detector assembly and testing; (3) performance of the NOvA experiment, and (4) decommissioning. The schedule for the proposed action has construction/excavation and assembly starting in 2008. Construction and assembly would continue through 2013. Experiment performance would begin on parts of the devices during the construction period, but sustained operations would begin in 2013 and continue through at least 2019. Following achievement of experiment objectives, decommissioning would occur over a several-year period.

Affected Environment. The existing accelerator complex at Fermilab forms the infrastructure framework upon which the proposed NOvA Experiment would be built. The Fermilab site is located 61 kilometers (38 miles) west of downtown Chicago, Illinois. Its 6,800 acres straddle the boundary between eastern Kane and western DuPage counties in an area of mixed residential, commercial, and agricultural land use with a 2000 Census population of approximately 1,300,000 persons. The Fermilab facilities are a light-industrial setting supporting high-energy research, including underground accelerator rings and beam tunnels, and the Central Laboratory Area. At Fermilab, approximately 1,600 acres have remained in crop production, and about 1,000 acres have been planted in native prairie vegetation. The mixture of vegetation communities makes the Fermilab site a desirable refuge for many species of animals and many bird species use the site as a stopover during spring and fall migration.

The United States Environmental Protection Agency has designated the area within which Fermilab resides as a non-attainment area in the northeastern part of Illinois for the 8-hour ozone standard and the PM-2.5 standard (particulate matter having a median aerodynamic diameter less than 2.5 micrometers) where there are lower thresholds for air emissions of volatile organic compounds and nitrogen oxides.

The proposed location for the NOvA Far Detector Facility is a currently undeveloped parcel of land about 25 miles southeast of International Falls, MN and approximately 1 mile from the boundary of Voyageurs National Park. At closest approach, the detector building would be approximately 1,000 feet from the nearest point of the Ash River, which discharges into Lake Kabetogama about 2.8 miles away. According to the 2000

Census the population density in the vicinity of the site is approximately 1 person per square mile.

No prime farm land, scarce geological resources, surface water bodies, or floodplains are within the proposed 89.6-acre Far Detector site. The approximately 3-mile long, 18.9-acre access road corridor to the proposed site would follow an existing logging road and pass through a wetlands area just as it leaves St. Louis County Road 129. The proposed site has been primarily utilized for timber cutting operations in the past, and no old growth forest exists on the property. The majority of the site has been recently clear-cut and is devoid of tree cover. During recent biological surveys, five occurrences of federal or state threatened or endangered species or critical habitats were observed within 1.5 miles of the site, but none within the site boundary or access corridor.

Environmental Impacts of Proposed Action. Any environmental impact at Fermilab would affect sites that are in use or have been used for other purposes. Impacts on air quality, local traffic and noise levels associated with construction of the proposed NOvA facilities would be temporary. The proposed construction site at Fermilab is not known to contain sensitive biological resources or habitats that would be affected by construction. Labor staffing during construction would be a small fraction of the worker population accessing Fermilab under existing conditions. Effluents and wastes generated during construction would be minimized to the extent practicable and would be managed using existing facilities and procedures. Off-property impacts of the proposed action would be limited to the areas immediately adjacent to the Fermilab property boundary, where minority or low-income residents are not disproportionately congregated. Health and safety risks to workers and members of the public from construction activities are projected to be small.

Changes in work activities at Fermilab related to the operational phase of the proposed project are few. Increasing the Main Injector beam power would increase estimated radionuclide emissions and tritium in ground water. Such increases could be expected to marginally increase the potential estimated dose rate to workers with minimal offsite impacts. Increased beam power would also lead to increased activity and external dose rates from activated components. "Increased dose rates" refers to the potential for dose. DOE does not anticipate an actual increased dose to workers or the public, since engineered and administrative barriers would control exposure. Fermilab currently has an effective radiation exposure control program that would continue under the proposed action operations.

Because the Ash River site proposed for the Far Detector Facility is currently undeveloped, the proposed project would change the appearance and current use of the site. The project would include clearing, grading and excavation disturbing greater than 5 acres, and would comply with a permit issued for the discharge of storm water associated with construction activity under the National Pollutant Discharge Elimination System as implemented by the Minnesota Pollution Control Agency. The site design would minimize potential impacts to surface water. During construction there would be short-

term, localized impacts on air quality from vehicular traffic exhausts and earth-moving operations, similar to construction of any commercial facility of comparable size.

Construction of the access road would result in filling approximately 3.5 acres of wetlands, requiring a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and conformance with the requirements of the Wetland Conservation Act of Minnesota. Approximately 5.2 acres of banked wetlands would be purchased to mitigate impacts to existing wetlands due to excavation and construction at the Far Detector site. Under Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*, Federal agencies are required to consider the impact of proposed actions on wetlands and floodplains. The DOE requirements for compliance with Executive Orders 11988 and 11990 are found in Title 10, *Code of Federal Regulations (CFR)*, Part 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements." A wetland assessment is included in this EA, and satisfies all the requirements of 10 *CFR* 1022. The wetlands permitting process has not been completed due to a U.S. Army Corps of Engineers requirement to first have NEPA documentation in place.

Concerns over the potential for archeological resources to be present in the project area at the Ash River site led DOE and the University of Minnesota to coordinate with the Minnesota State Historic Preservation Office and several Native American Tribes with interests in Northern Minnesota. As a result of the consultation under Section 106 of the National Historic Preservation Act, DOE prepared an Analysis of Effects Report. Subsequently, a programmatic agreement was negotiated to perform an archeological survey of the project area in the spring of 2008, prior to construction. The survey would include further investigation of historical resources, including both architectural and cultural resources. The parties to the agreement include the Minnesota State Historic Preservation Officer, the Bois Forte Band of Minnesota Chippewa Tribal Historic Preservation Officer (THPO), the White Earth Band of Minnesota Chippewa THPO, and the DOE. Other invited signatories include the University of Minnesota and the National Park Service, Voyageurs National Park.

Design criteria would be defined to minimize the visual impact of any portion of the Far Detector building that might be visible from Voyageurs National Park. The Far Detector building, which would have an above-ground height of approximately thirty-seven feet or approximately two stories, would not include any windows facing north to minimize reflected sunlight. An earthen berm with native grasses would surround much of the Far Detector building up to the roof line. Exterior colors for all buildings would be muted grays and browns. All north facing building walls would be in neutral colors to decrease contrast and visibility. Native plants and trees would be planted to soften the outlines of all buildings. In addition, the NOvA Project would work with the National Park Service to design additional measures to screen or soften the appearance of the site buildings.

With 100% secondary containment of liquid scintillator and other liquids at every stage of the assembly and installation process, there should be no impact to ground water at the Ash River site during assembly, installation and operation. The adhesive that would be

used to assemble the detector modules contains methyl methacrylate (MMA), a volatile organic compound and a federal hazardous air pollutant. The health and safety plan developed for the project would detail the proposed ventilation controls intended to comply with occupational and environmental concentration standards. Site workers and contractors would conduct work under a University of Minnesota site health and safety plan and procedures for installation and assembly operations.

Some impacts to employees would be expected from the installation and assembly or operation of the NO_vA experiment. The multiple shipments of materials via truck, tanker or rail car on and between the project sites are subject to routine traffic accidents and accidental spills. Based upon traffic accident statistics, one accident and one injury are expected during materials transportation. Nine accidents and two injuries are expected during worker commutes. Not transportation fatalities are expected. Occupational Safety and Health Administration (OSHA) reportable cases would be approximately 19, or about 1-2 per year of project schedule.

The spill of methyl methacrylate (MMA) or pseudocumene in an accident during delivery from the distributor to the NO_vA Project in a wetland or other sensitive area could impact exposed sensitive species. While an accident during transport has a calculable probability of *occasional* (approximately 0.03~0.04), the probability that an accident would occur that also causes a spill at an environmentally sensitive area would be several orders of magnitude less (1E-04).