Fermilab

Report to the Director on the Fermilab Environment For Calendar Year 2009

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1.0 Introduction

Fermilab is not only committed to environmental compliance but also to responsible environmental stewardship. Compliance, which is defined as conformity in fulfilling official requirements, affects every aspect of the Fermilab facility. It affects the staff, funding, new technology, productivity, efficiency, and surrounding environment. To be compliant, Fermilab must adhere to environmental statutes and regulations administered by groups such as the U.S. Environmental Protection Agency, Illinois Environmental Protection Agency, U.S. Army Corps of Engineers, and the state Fire Marshal. These regulations ensure clean air and water, safe disposal of hazardous wastes, and the conservation and protection of resources, wildlife, and the surrounding environment. In addition, Fermilab has many programs dedicated to continually improving and correcting the Laboratory's future impact on the environment.

Fermilab's comprehensive environmental monitoring and surveillance program provides for the measurement and interpretation of the impact of Fermilab operations on the public and the environment.[1] Surveillance and monitoring tasks are conducted to confirm compliance with standards and permit limits as well as ensure early detection of an unplanned pollutant release. The location and frequency of sampling are based on established routines, operational considerations and process assessments as well as historic levels of pollutants found in each location. Sampling points are selected based on the potential for adverse impacts. Additionally, samples of effluents and environmental media such as soil and groundwater are collected on the site and at the site boundary. These samples are analyzed and results are compared to applicable guidelines and standards.

Fermilab's Environmental Management System (EMS) was recognized in 2007 by acquiring full ISO 14001 third-party certification. This certification was maintained in 2009 and included two surveillance audits by the registrar. An EMS is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating. In addition ISO 14001 standards require an organization to meet a stringent set of criteria; the organization must have an infrastructure and management plan that facilitates measurable environmental objectives. An important purpose of this report is to present the current status of these objectives.

Results of Fermilab's environmental monitoring and surveillance, compliance with all specific environmental regulations, environmental protection activities, and progress on environmental restoration, waste management and corrective action activities are discussed in this report. The report is arranged by environmental topic and specific environmental compliance requirement.

2.0 Summary of Significant Environmental Issues

Spill Control Containment and Countermeasure (SPCC) Compliance

Beginning in 2002, the US Environmental Protection Agency underwent a lengthy process to update and strengthen the regulations for SPCC (40 CFR 112). The focus of this regulation is on oil spill prevention, preparedness and proper response to spills. Historically Fermilab has had limited exposure under the existing SPCC rules with the issuance of an SPCC plan for the Giese Road electrical transformer. Changes to the regulations have required the lab to reevaluate additional sources of oil maintained on site to determine applicability to the new rules. In 2009 an ad hoc group of the Environmental Protection Subcommittee continued to work on bringing Fermilab in compliance with the requirements. Actions taken by the subcommittee included working with a consultant to formulate a new SPCC plan, the drafting of a related FESHM chapter and the development of training for individuals involved with oil handling on site.

Federal Sustainability Goals

In 2009 Fermilab continued with execution and development of Environmental Management Program (EMP) plans to meet the requirements of Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy and Transportation Management* and DOE's associated implementing orders. Fermilab uses EMPs to set measurable objectives and targets for significant environmental aspects associated with facility operations within the structure of our Environmental Management System.

EO 13423 outlines sustainability goals agencies are required to meet in these areas: energy efficiency; renewable energy; petroleum use; water conservation; environmentally preferable purchasing; pollution prevention and recycling; toxic chemical reduction; high performance existing buildings; new buildings; vehicle fleet management. Fermilab evaluated the sustainability goals against our list of environmental aspects and developed EMPs for goals relevant to current site operations. In April 2009 the DOE Chicago Office performed a third party audit and found our EMS to be in compliance with the requirements of the executive order, as required by DOE's Office of Health Safety and Security.

Tritium in Surface Water

In 2005 measureable tritium was detected for the first time in surface water discharges from the site at our permitted outfall locations (specifically Indian Creek). Subsequently Fermilab instituted measures to reduce the levels in accordance with our ALARA (as low as reasonably achievable) policy. Fermilab continues to monitor the surface water system and the outfalls for the presence of tritium. Fermilab's recently re-issued, site specific NPDES permit includes monitoring requirements for tritium at all six of our outfalls. Monitoring for radioactivity in on-site surface water continues to be a primary component of Fermilab's routine environmental surveillance program. Additional information concerning levels of tritium in surface water is posted at a link from the Laboratory's home page.

3.0 Ecological Issues

Thirteen National Environmental Research Park (NERP) projects were in differing stages of progress during 2009. The projects along with the name of the sponsoring institution are listed below:

- Assessment of the Impact of Biological Controls on Garlic Mustard (*Alliara petiolata*) and on Non-target Species in Forest Communities, Argonne National Laboratory
- Bird Surveys at Fermilab, Fermilab
- Feedbacks between Plants, Mycorrhizal Fungi, and Soil Nutrient Dynamics, Argonne National Laboratory
- Investigation of Carbon Dioxide and Nitrogen Fluxes in Terrestrial Ecosystems at Fermilab, Argonne National Laboratory
- Hydrologic and Plant Community Controls on Soil Carbon Accrual after Cessation of Agriculture, Argonne National Laboratory
- Bioenergy Experimental Plots at Fermilab, Argonne National Laboratory
- Management of Roundworm Infection in the raccoon Population, Wheaton College
- Evaluation of Biological and Chemical Management Practices for Emerald Ash Borer, Morton Arboretum
- Reintroduction of Barn Owls at Fermilab
- Investigation of the microbial associates of switchgrass (*Panicum virgatum*)
- Monitoring Potential Impacts of Canadian National Railroad Purchase of Elgin, Joliet, and East Rail Lines: Fermilab Segment.
- Restoration Activities by Fermilab Natural Areas Intern

The Laboratory's Ecological Land Management Plan[2] was updated in 2009. Existing prairie tracts were enriched with forbs and burned or mowed to discourage intrusion of brush, trees and exotic plants.

Fermilab carries out wildlife management to the extent necessary to protect the primary mission of the Laboratory and to preserve the Fermilab ecosystem. The Lab has a "nuisance animal" permit issued by the Illinois Department of Natural Resources (IDNR) that allows for the trapping and elimination of these nuisance animals. During 2009, two animals were euthanized. In addition, Fermilab intensively manages the population of whitetail deer on site to preserve the ecosystem. Fermilab contracts with the U.S. Department of Agriculture Wildlife Services Group to reduce the herd to an optimum number annually. This activity requires approval and permitting from IDNR; during 2009, 21 whitetail deer were removed

4.0 Environmental Management System (EMS)

Fermilab recognizes the importance of maintaining an Environmental Management System (EMS). An EMS is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency via an ongoing cycle that centers on planning, implementing, evaluating and improving performance. This process is used as means to continuously focus on the environmental aspects of Laboratory operations to ensure compliance with regulations and that the Laboratory is functioning in an environmentally responsible a manner. In addition, the EMS has been assimilated with the principles of Fermilab's Integrated Safety Management System (ISMS) to form a combined ES&H Management System that address facility operational liabilities that have the potential to impact individuals and/or the environment.

Fermilab's EMS was formally established in 2005 in accordance with DOE and executive order requirements. In addition, the Laboratory has had the EMS certified to ISO 14001 standards as of August 2007. To maintain certification the Laboratory is required to undergo semi-annual independent audits to demonstrate continuous conformance with the standard. These audits focus on segments of Fermilab operations to ensure that EMS elements are being properly addressed across the facility. In 2009 these surveillance audits were performed on the Accelerator Division in April, and on Computing Division and WDRS in October. No non-conformances to the 14001 standard were found during either audit.

In 2009 DOE also required and independent assessment of the EMS to establish whether the Laboratory was meeting federal sustainability goals as outlined in Executive Order 13423, *Strengthening Federal Environmental, Energy and Transportation Management*. This assessment was completed in June and Fermilab was found to be in compliance with the requirements.

As part of the EMS, Fermilab routinely evaluates its operations and seeks to improve environmental performance. The Laboratory's significant environmental aspects have been identified and were reviewed in 2009. In areas were change is desired, goals are established with measureable targets that seek to improve a particular aspect of operations. In 2009 eleven new environmentally related goals were established. The goals are formalized into specific Environmental Management Program plans and are developed with input from divisions and sections having the greatest influence over plan. They are functionally tied to these organizations. Examples of new goals include performing a biomass fuel source feasibility study for CUB operations, a goal to reduce potable water losses across the site, and a goal to perform an assessment of support facility energy consumption.

5.0 Environmental Monitoring and Surveillance

The goal of the Fermilab Environmental Monitoring Program is to assist Laboratory management in decision-making by providing data relevant to impacts that Fermilab operations have on the surrounding environment. This program includes effluent monitoring which is used to confirm compliance with permits, generally at a particular point. Environmental surveillance is conducted at various locations to intercept the pathway of potential pollutants to receptors such as plants, animals or members of the public. Fermilab collects environmental data for reporting purposes or whenever it is necessary or useful in conducting the business of the Laboratory. Line organizations have the responsibility to recognize and understand the environmental aspects of their operations and to conduct their work in an environmentally sound manner.

The pathways available for movement of chemical and radioactive materials from Fermilab operations to the public are the atmosphere, surface water, groundwater, and via the roadways (transportation of materials to and from the site). Environmental surveillance consists of collecting and analyzing samples of various media and by measuring penetrating radiation (e.g. muons) within and at the site boundaries.

Ground and surface waters are sampled at locations near operating areas, potential contamination sources and along potential transport pathways. In addition to air and water surveillance, samples of soil are collected and analyzed for radioactivity to ascertain whether there is build-up of radioactive materials in the environment due to long-term operations.

Surface water, air, groundwater, soil and sediment samples are analyzed for radionuclide concentrations. Surface waters are also monitored for potential chemical constituents. While levels of penetrating radiation are in some places measurable near operational areas on the site, the levels decrease rapidly with distance from the sources. External penetrating radiation and airborne emissions are commonly below instrument detection levels at the site boundary and must be estimated to provide information about the maximum potential radiation doses to offsite populations. The results of the environmental surveillance program are interpreted and compared with environmental standards where applicable. The Fermilab Environmental Monitoring Plan, which is maintained by the ES&H Section, provides more details.

5.1 Air Quality

Fermilab's Lifetime Operating Air Pollution permit issued by the Illinois Environmental Protection Agency (IEPA) under the Clean Air Act includes a *National Emissions Standards for Hazardous Air Pollutants* or NESHAPs element, which covers airborne radionuclides. In addition, the permit takes into account those criteria pollutants such as particulate matter, nitrogen oxides, carbon monoxide, volatile organic materials and sulfur oxides associated with the operation of various pieces of equipment.

Airborne radionuclides are normally released to the atmosphere from operating target stations. Measures to keep these releases as low as reasonably achievable (ALARA) are incorporated into the operating processes and procedures at these facilities. Monitoring is conducted at targeting areas where air emissions are considered a significant contributor to the overall transport of radioactive materials offsite. In addition, a small quantity of airborne radionuclides is contributed by the operation of the Magnet Debonding Oven. The air permit was revised to include the Main Injector as a source of radioactivation at Fermilab. The air permit application stated that total activity released from the Lab would average no greater than 2000 Curies in a year with a maximum of 9000 Curies in a year; current and planned operations are far below these levels.

The radiation doses potentially received by the offsite public due to Fermilab operations are calculated from data gathered through environmental surveillance of the onsite sources. Selected vent stacks are monitored directly with stack monitors and indirectly by taking soil samples in the vicinity of the stacks. The dose for the air pathway is calculated using a Gaussian plume computer simulation model called Clean Air Assessment Package-1988 (CAP-88PC2). This model was created by the USEPA to predict the movement of airborne radionuclides and its use is dictated by regulations governing hazardous air pollutants at 40 CFR 61. Maximum calculated concentrations off-site are predicted to be below the level that could be detected by direct monitoring.

Fermilab is not a significant source of chemical air pollution. The permits cover emissions caused by open burning conducted for prairie/land management and fire extinguisher and firefighter training, a magnet debonding oven, a fuel dispensing facility, a vapor degreaser, radionuclide emission stacks, a 2200 horsepower emergency standby diesel fuel fired generator, the Collider Detector at Fermilab (CDF) and the Main Injector Particle Production (MIPP) gas circulating systems, the operation of two natural gas-fired boilers, and in 2009 the permit was reissued to include one new natural gas-fired boiler at CUB and the Integrated Cavity Processing Facility (ICPA). Pollutant levels are estimated based on the knowledge of the processes that generate them and the characteristics of individual pollutants. The results are submitted to the Illinois Environmental Protection Agency in an annual air emissions report.

5.1.1 Radioactive Air Emissions

Operation of the debonding oven, when radioactive components are being burned, is a potential source of tritium. In 2009 the debonding oven did not burn any radioactive magnets The Anti-Proton Area stack, used in Colliding Beam operations, and the MiniBooNE and NuMI stacks are estimated to have released a total of approximately 124.0 Curies in 2009. These radioactive air emissions were approximately 1% of the annual average (2000 Curies) expected from operations as acknowledged in the current air pollution permit application on file with the Illinois Environmental Protection Agency (IEPA). No detectable levels of radionuclides reached the site boundaries. Doses to the public from emissions in 2009 continued to be well below the Environmental Protection Agency (EPA) standard of 10 mrem/year and also much less than the EPA's continuous monitoring threshold of 0.1 mrem/year. Using the CAP-88PC2 gaussian dispersion model, the highest dose equivalent to any member of the public was estimated to be 0.0323 mrem.

Fermilab's 2008 Radionuclide Air Emissions Annual Report was submitted to the DOE FSO in May 2009. The report is distributed by the DOE FSO to the USEPA and IEPA.

5.1.2 Non-Radioactive Air Emissions

The IEPA decided in late 1996 that the level of air emissions at the Laboratory did not warrant the issuance of a Federally Enforceable State Operating Permit (FESOP) and therefore issued a Lifetime Operating Permit to Fermilab in 1999. In 2000, the permit was revised to add a vapor degreaser to the previously permitted air pollution sources and in 2004 to add a 2200 horsepower emergency standby diesel fuel fired generator located at the Feynman Computing Center, and again in 2006 to include both the CDF and MIPP gas circulating systems. Last year, an application was submitted to IEPA to construct the Integrated Cavity Processing Facility (ICPA) at Industrial Building 4 and a new 11.55 mmBTU natural gas-fired boiler at CUB. The permit was re-issued in September 2009 and covers the magnet debonding oven, two 15 mmBTU and one 11.55 mmBTU natural gas-fired boilers at the Central Utility Building (CUB), a 12,000-gallon gasoline storage tank with a stage 1 and stage 2 vapor balance system, accelerator tunnel ventilation stacks, a vapor degreaser at Industrial Building 3, the standby diesel generator, the CDF and MIPP gas circulating systems, and the ICPA. Permit conditions require the monthly logging of fuel consumption for covered fuel combustion sources, solvent usage at the degreaser, and hours of operation at ICPA. Source operations were reviewed by Fermilab personnel again this year to ensure that permitted equipment continued to operate and be maintained in accordance with permit conditions. The Annual Air Emission Report for 2009, which provides an estimate of criteria pollutant emissions was submitted to the Illinois Environmental Protection Agency (IEPA) in March 2010.

5.2 Penetrating Radiation

Operation of the Fermilab accelerator and associated beamlines produce ionizing radiation such as neutrons and muons. Beamlines and experiments are designed so that most of the radiation is absorbed before reaching the ground surface and outdoor areas. The neutrons are absorbed by shielding. The remaining radiation that emerges above the surface presents a very small potential for radiation dose. Small muon fields have been measured in conjunction with the operation of the Fixed Target beamlines in the past. These beamlines were not operated in 2009. Since the removal of most of the Main Ring magnets from the Tevatron tunnel, the A0 beam absorber replaced the C0 beam absorber as the primary absorber. Unlike the C0 absorber, the Tevatron beam has to be bent down into the earth to be directed to the A0 absorber. Due to this beamline feature, the ground absorbs the muons emerging from the A0 absorber. Therefore, no muons are detected from its operation. Both the MiniBooNE and NuMI experiments have the potential to produce measurable muon flux; however, the 8 GeV energy protons used in MiniBooNE are too low in energy to produce muons that can escape the bulk shielding surrounding the experiment. The NuMI beamline bends the beam down so that the muons produced are absorbed deep underground as part of the beamline design.

Another potential source of exposure to ionizing radiation is the centralized radioactive materials storage area referred to as the Railhead. This source of penetrating radiation was monitored continuously in 2009 by a large ionization chamber located in the Railhead colloquially called a 'Hippo.' The Hippo measurements are supplemented by periodic onsite surveys. Based on measurements made in 2009, it is estimated that radioactive materials stored at the Railhead contributed a dose equivalent at the site boundary in 2009 which was approximately 0.33 mR/yr. The maximum radiation dose equivalent to an individual at the nearest offsite house was thus estimated to be 0.06 mR/yr. in 2009.

5.3 Surface Water Quality

Fermilab discharges liquid effluent to surface water bodies and to sanitary sewers. The Lab holds National Pollutant Discharge Elimination System (NPDES) permits that govern discharges to surface water from stormwater runoff, cooling water, and effluents from various onsite construction projects. In addition to monitoring for the physical and chemical parameters required by NPDES permits, samples of surface water are taken annually from selected water bodies and analyzed for radionuclides. These surface waters are sampled for radionuclides based upon their potential for contamination. Aqueous process wastewaters are directed to sanitary sewers and ultimately discharged to publicly owned treatment works (POTWs) in Batavia and Warrenville. Wastewater discharges are controlled by criteria set forth in the Fermilab Environment, Safety, and Health Manual Chapter 8025.

5.3.1 Radioactive Releases to Surface Water

Numerous sumps collect and drain water from building footings and from under beamline tunnels in the Tevatron, Main Injector, and the Experimental Areas. Water collected by these sumps often contains detectable concentrations of radionuclides (primarily tritium, ^{3}H) that have been leached by rainwater from radioactive soil near beam targets and absorbers or released accidentally to sumps from beamline cooling water systems. These sumps discharge to ditches and ponds onsite.

In addition, water is also collected from the NuMI tunnel system. NuMI water also contains measurable concentrations of tritium. The water collected consists primarily of groundwater that has infiltrated into the tunnel. This high-quality water is pumped from the tunnel and directed into the ICW system where it is used primarily for make-up water for the CUB cooling towers. Excess NuMI water and effluent from the towers is directed to the ICW pond system.

In 2005 measureable tritium was detected in surface water discharges from the site at our permitted outfall locations (specifically Indian Creek). Subsequently Fermilab instituted measures to reduce the levels in accordance with our ALARA (as low as reasonably achievable) policy. Fermilab continues to monitor the surface water system and the outfalls for the presence of tritium. Fermilab's recently re-issued, site specific NPDES permit includes monitoring requirements for tritium at all six of our outfalls. Monitoring for radioactivity in on-site surface water continues to be a primary component of Fermilab's routine environmental surveillance program.

5.3.2 Non-Radioactive Releases to Surface Water

Monitoring for non-radiological chemical constituents in surface water was limited to NPDES permit parameters (temperature, flow, pH, and chlorine) this year. Discharge Monitoring Reports for six different outfalls were submitted monthly to the IEPA. In 2009 there were no exceedances of discharge limits to waters of the state.

5.3.2.1 Cooling Water System

Fermilab's individual site specific NPDES permit authorizes the discharge of commingled cooling water and storm water runoff to surface waters through outfalls to Kress, Indian and Ferry Creeks. Due to the presence of the RCRA-permitted (Resource Conservation and Recovery Act) Hazardous Waste Storage Facility on-site, the NPDES permit also regulates storm water discharges from designated solid waste management units (SWMUs). The Storm water Pollution Prevention Plan required by this NPDES permit is periodically modified to reflect changes that occur as part of the RCRA Facility Investigation (RFI) of the SWMU sites. The NPDES permit dictates that water temperature, pH, flow, and tritium is to be monitored at all six outfalls; chlorine concentration is monitored at the Kress and Indian Creek outfalls. The monitoring results are reported to the IEPA on a monthly basis.

In 2007 Fermilab contracted services to treat cooling ponds for algae and pond weeds using a state licensed applicator which continued through 2009. The ongoing zebra mussel infestation of the industrial cooling water system pipes and pumping infrastructure is managed by FESS using a water treatment specialty company.

5.3.2.2 Releases to Sanitary Sewers

An Individual NPDES permit allows Fermilab to pre-treat and release effluent from the Central Utility Building (CUB) regeneration process to the City of Batavia sanitary sewer system. The pretreatment permit requires the collection and analysis of composite process effluent samples for specified metals on a quarterly basis. Samples are also collected and analyzed from each discharge for accelerator-produced radionuclides in order to confirm released radioactivity meet DOE guidelines. In 2009, 104,600 gallons of process wastewater were discharged to the Batavia sewer system. In 2009, all effluent discharges were in compliance with the pre-treatment permit. Effluents are also analyzed for tritium and other radionuclides. All effluents in 2009 were compliant with specified levels in the Department of Energy Derived Concentration Guide for radionuclides. A total of 2410.17 µCi of tritium and 54.24 µCi of ^{7}Be were released to the sanitary sewer from the CUB during 2009. No other radionuclides were detected.

Monitoring stations, located at the site boundary, sample sewer discharges to the municipalities of Batavia and Warrenville. The discharge at these locations is a mixture of all effluents contributing to that sanitary sewer system. Analytical results are compared to municipal discharge limits to track compliance. The monitoring stations were not operated continuously in 2009. The Batavia sewer sampler composited monthly samples for 10 months while the Warrenville sampler collected samples for 6 months.

Beginning with the August sample of 2005, composited during the month of July, tritium was first detected at the Batavia monitoring station. Detections continued for the remainder of 2005 with a maximum activity of 4.1 pCi/ml measured from a grab sample collected in September of that year. Tritium was intermittently detected just above the minimum detection limit of 1.0 pCi/ml from samples in 2006, 2007, and again in 2009. No tritium was detected in 2008 samples.

5.4 Groundwater Quality

The Illinois Environmental Protection Agency (IEPA) publishes groundwater quality standards[3] and defines Class I groundwater as a non-degradable resource, which is to be highly protected. The water that is located in or near the dolomite aquifer 50 to 70 feet below the ground surface of Fermilab is classified as Class I groundwater according to criteria published by the IEPA[4]. Water in the overlying Quaternary deposits has been demonstrated to be Class II water and therefore has less stringent standards.

Ten monitoring wells at the Central Utility Building (CUB) Pipe and Clay Tile Field and eight at Meson Hill

were sampled as part of ongoing RCRA Facility Investigation (RFI) corrective actions at these locations. During 2006, the Meson and Neutrino Soil Activation Areas was removed from the RFI as a Solid Waste Management Unit; however, five wells in this region continue to be monitored under the lab's environmental surveillance program with the results reported to the IEPA annually for informational purposes. Four background monitoring wells, up-gradient to Fermilab operations, were not sampled in 2009, but were utilized, along with seventy-eight piezometers (pore-water pressure measuring apparatus), and three site-specific monitoring wells, to gather information on the direction of groundwater flow site-wide. These data are used in modeling the transport of potential contaminants from past and present operational areas of concern. Piezometers that had been installed as part of the NuMI site characterization were monitored to assist Fermilab in planning for groundwater protection at that facility. One location is used to monitor for NuMI operational impacts to the Class I aquifer. Fermilab continued in 2009 to analyze groundwater associated with this project that resides within the dolomite aquifer.

Twenty-four of 108 on-site groundwater monitoring locations were sampled during the year for radionuclide and/or chemical parameters. The remaining locations were available exclusively for potentiometric surface (water level) monitoring.

5.4.1 Groundwater Characterizations

No groundwater characterizations were conducted in 2009.

5.4.2 Monitoring Well Modification and Abandonment Activities

There were no monitoring well modifications or abandonment activities during 2009.

5.4.3 Radionuclides in Groundwater

The Department of Energy groundwater concentration guide and the Illinois Class I groundwater standard for tritium is 20 pCi/ml. Twenty-three samples were taken from six locations for analysis. Radionuclides were not detected in any Class I groundwater samples during 2009.

5.4.4 Chemicals in Groundwater

In 2009, semi-annual groundwater sampling events were conducted at two Solid Waste Management Units (SWMUs). Chemical analyses were performed on these samples as required by the Resource Conservation and Recovery Act Facility Investigation (RFI). (See Section 6.12.1 RFI Activities.)

6.0 Compliance with Specific Environmental Requirements

The sections below are a summary of Fermilab compliance with key environmental requirements.

6.1 Clean Air Act

Open burn permits to allow prairie/land management burning, maintenance of Meson Hill, and fire extinguisher training were renewed by the IEPA in 2009. The annual air emissions report for 2009 was submitted to the IEPA in March 2010 and the annual radionuclide emissions report was submitted to the USEPA in June 2010.

In 2009 an estimated 124.0 Curies were released in conjunction with the operation of the Fermilab Anti-Proton Areas stack (used in Colliding Beam operations) and the MiniBooNE and NuMI Project stacks. The magnet debonding oven, a potential source of tritium, did not operate in 2009. The CAP-88PC2 dispersion model calculated the maximum dose equivalent delivered to a member of the public (at the boundary of the lab) to be 0.0323 mrem/year due to 2009 Fermilab operations.

Fermilab is registered with the Clean Fuel Fleet Program (CFFP); one of several programs the IEPA has implemented to help improve air quality in the Chicago ozone non-attainment area.

6.2 Underground Storage Tanks

No compliance issues were identified in 2009. The three Underground storage tanks (USTs) in use at Site 38 were operated and maintained per current UST standards set by the USEPA (40 CFR 280) and the Illinois State Fire Marshall (Illinois Administrative Code, Title 41, Sections 170.510(a),170.510(b), 170.450, and 170.460). The Illinois State Fire Marshall conducted a Certification Audit of the Site 38 Fuel Dispensing Facility (January 2009) to determine compliance with state fire protection regulations listed above and found the facility compliant.

6.3 The Endangered Species Act of 1973

No compliance issues were identified in 2009.

6.4 Executive Order 11988, "Floodplain Management"

During 2009, the Main Injector Neutrino Upgrade project was constructed, which was previously reviewed for compliance with 11988. The project required some minor construction within the floodplain of Indian Creek, a tributary of the Fox River. The project incorporated compensatory flood storage greater than that lost, and will not impair the ability of the stream to store flood waters

6.5 Clean Water Act Section 404 (and Executive Order 11990, "Protection of Wetlands")

Pre-evaluation of Fermilab activities in wetlands continued to be accomplished through the NEPA and construction design review processes. The Lab continued to use task manager/construction coordinator training to instruct participants in how to ensure that potential work areas are screened for the presence of wetlands and to be aware of all aspects of environmental compliance management.

During 2009, four projects (DWS Loop to Wilson Hall, Main Injector Neutrino Upgrades, Batavia Road Gatehouse, and New Muon Expansion Project) required coverage under the NPDES General Storm Water Permit for Construction Activities. Storm Water Pollution Prevention Plans (SWPPP) were prepared and submitted to IEPA for all projects.

6.6 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

In 2009, the use of pesticides and herbicides at Fermilab was handled in accordance with FIFRA.

6.7 Illinois Department of Natural Resources "Rules for Construction and Maintenance of Dams"

Fermilab holds an Illinois Department of Natural Resources (IDNR) issued permit that classifies the Main Injector berm as a small *Class III* dam. The dam provides limited flood control to areas downstream from the Lab in the Indian Creek watershed. On a five-year cycle Fermilab is required to perform a comprehensive inspection and file a detailed report on the condition of this structure. The last comprehensive inspection was conducted in April of 2008. An inspection of the dam was conducted in April of 2009 and an "Owners Maintenance Report was transmitted to the IDNR by DOE. No non-routine action items were identified during the 2009 inspection.

6.8 The Migratory Bird Treaty Act

Fermilab possesses a permit (Class C Nuisance Wildlife Control Permit) issued by the IDNR (acting for U.S. Fish and Wildlife Service) that allows for the destruction of Canada geese nests in the vicinity of the Children's Center, if they become a safety hazard. The permit allows the Lab to destroy up to ten nests each year. During 2009, five nests containing a total of 20 eggs were destroyed.

During 2008, in response to a number of injuries due to aggressive Canada Geese, Fermilab contracted with a firm to use dogs to harass geese in order to displace them from populated areas on the site. This contract was extended during 2009, and the goose clearing activities were carried out during April and May. The firm holds a valid permit from the Illinois Department of Natural Resources to pursue the activity.

6.9 National Environmental Policy Act (NEPA)

Fermilab met the requirements of this Act by continuing to implement a program for reviewing all activities for compliance as set forth in the *Fermilab Environment, Safety and Health Manual* (FESHM) Chapter 8060 – *National Environmental Policy Review*. DOE formally determined 12 projects to be 'categorically excluded' (see definition below) from further NEPA review in 2009. These determinations included projects that were eligible for *American Recovery and Reinvestment Act (ARRA) of 2009* funding and subsequently the Lab received over 100 million dollars of ARRA funds. Eligibility depended upon the projects being "shovel ready" and the definition of this included the completion of all environmental impact reviews. In addition, the ES&H Section hosted a one day 'NEPA for Decision makers' workshop in December that was taught by an experienced and highly regarded NEPA practitioner and instructor (teaches NEPA courses throughout the country for Northwest Environmental Training Center) who formerly served as senior counsel for the USDA and DOE, assisting in the development of NEPA documents and defending their legal standing. The training was very well attended by Fermilab management, project managers, project engineers, environmental officers, and DOE personnel (who are the NEPA Decision makers). The training provided guidance on the specific questions that an *Environmental Assessment (EA)* should answer and how to quantify those answers without including unnecessary information; this training was needed to prepare the Lab for the EA development that will be necessary for proposed future projects such as Long Baseline Neutrino Project, Project X, etc.

Categorical exclusions (CXs) are categories of actions that do not individually or cumulatively have a significant effect on the human environment and for which, therefore, neither an *Environmental Assessment* nor an *Environmental Impact Statement* is required; DOE's CXs are listed in Appendices A and B to Subpart D of its

NEPA regulations found at 10 CFR Part 1021. In applying one of these CXs to a specific proposed action, DOE must determine that: (1) the proposed action fits within a class of actions listed in the regulations, (2) there are no extraordinary circumstances related to the proposal that may affect the significance of its environmental effects, and (3) the proposal is not connected to other actions with potentially significant impacts, related to other proposals with cumulatively significant actions, or an improper interim action. An Environmental Assessment is a concise public document for which a Federal agency is responsible that includes brief discussions of the need for the proposal, possible alternatives, environmental impacts of the proposal and alternatives, and a listing of agencies and persons consulted that serves to: (1) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; (2) aid an agency's compliance with the Act when no environmental impact statement is necessary; and (3) facilitate preparation of a statement when one is necessary.

6.10 National Historic Preservation Act (NHPA), Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act (NAGPRA) of 1990

Compliance with these Acts was accomplished through the NEPA review process that included an evaluation of all proposed land-disturbing projects in 2009 to assess any potential impacts on historic resources. No compliance issues were identified in 2009.

A DOE requested Cultural Resources Management Plan (CRMP) following guidelines outlined in DOE Publication DOE/EH-0501, was prepared and completed for Fermilab in 2002. The CRMP assures continued compliance with the above listed Acts by providing a comprehensive overview for the locations and status of all archaeological resources within the Fermilab site boundaries thereby facilitating future NEPA reviews.

Annually, a questionnaire on Federal archaeological activities is requested by the Department of the Interior. Fermilab submitted its responses in December of 2009.

6.11 National Pollutant Discharge Elimination System (NPDES)

The IEPA has issued Fermilab two National Pollutant Discharge Elimination System (NPDES) permits that were active in 2009. In addition, Fermilab holds two industrial wastewater pretreatment operating permits. The permits are as follows:

1. General (covers several facilities that have the same type of discharge and are located in a specific geographic area) construction NPDES permits covering: Domestic Water System Loop to Wilson Hall project, MiNu project; Batavia Road Guardhouse; and New Muon Laboratory Expansion.

2. Individual (specifically tailored to an individual facility) NPDES permit for combined storm water and non-contact cooling water discharges associated with industrial activities, there are six outfalls associated with this permit: Outfall 001 to Ferry Creek, Outfall 002 to Kress Creek, and Outfalls 003, 004, 005, and 006 to Indian Creek. Outfalls 004, 005 and 006 were added to the permit during the last permit renewal. Outfall 004 covers potential discharges from the MINOS pond and Outfalls 005 and 006 cover discharges from the Main Injector pond system.

3. Individual industrial wastewater pre-treatment permit that allows Fermilab to discharge wastewater effluent from operations occurring at the Central Utilities Building (CUB) to the city of Batavia sanitary sewer treatment works.

4. Individual industrial wastewater pretreatment permit that allows for wastewater from the Technical Division's Integrated Cavity Processing Apparatus in IB4 to be discharged to the city of Batavia sanitary sewer treatment works.

6.12 Resource Conservation and Recovery Act of 1976 (RCRA)

The Annual Hazardous Waste and Illinois Generator Non-Hazardous Special Waste Reports for 2009 were transmitted to the DOE Fermi Site Office in January and February 2010 respectively. DOE subsequently submitted these reports to IEPA.

The following volumes of non-radioactive waste were generated by Fermilab and managed for disposal by the Hazard Control Technology Team (HCTT) of the Environmental Protection Group in 2009.

4.2 m^3	Non-Routine Hazardous Waste (RCRA + TSCA)
5.8 m^3	Routine Hazardous Waste (RCRA + TSCA)
1.4 m^3	Non-Routine Non-Hazardous (Special) Waste
20.6 m^3	Routine Non-Hazardous (Special) Waste
6,982.3 m^3	Dumpster/Landfill Waste

6.12.1 RCRA Facility Investigation (RFI) Activities

As a condition of Fermilab's RCRA Hazardous Waste Management Part B permit, initially issued in September 1991, the IEPA required Fermilab to undertake a RCRA Facility Investigation (RFI). The purpose of the RFI was to investigate whether hazardous constituents had been released to the environment from identified solid waste management units (SWMUs) located onsite. In addition to requiring the reporting of newly identified SWMUs, RCRA also required that IEPA be notified of any changes to previously identified SWMUs. A total of two SWMUs continue to be addressed in accordance with the corrective action requirements of Fermilab's RCRA permit: the CUB Pipe and Clay Tile Field and Meson Hill. The Meson and Neutrino Soil Activation Areas was removed from the RFI as a SWMU as part of the RCRA Part B permit renewal process. Further investigation is not required at the Village Machine Shop, the Railhead Storage Yard, or the IB2 Industrial Building so long as institutional controls remain in place.

Village Machine Shop (SWMU# 5)

No new information was requested or generated at this unit during 2009.

IB2 Industrial Building

No new information was requested or generated at this unit during 2009.

CUB Pipe and Clay Tile Field (SWMU# 12)

At SWMU 12, the pipes and clay tiles, along with all chromate-contaminated soil and gravel, have previously been removed. Contaminated soil was disposed of properly and the surrounding soil was sampled and analyzed. On a semi-annual frequency, Fermilab continues to sample all monitoring wells installed at this unit. Monitoring wells at SWMU 12 were sampled during the 2nd and 4th quarters of 2009. Well MW7B was dry during the 2009 4th quarter round of sampling.

Meson Hill (SWMU# 13)

Closure activities for Meson Hill were completed in 1998. This included moving concrete, grading, installing a clay cap and a layer of topsoil, hydro-seeding, and a site inspection. Fermilab continues sampling all monitoring wells installed at this unit on a semi-annual frequency. Analysis of groundwater from the monitoring wells screened within the upper Quaternary deposits has shown elevated concentrations of total dissolved sulfate and associated total dissolved solids above the 99% confidence level and Class II groundwater standards.

An Assessment Monitoring Plan was developed, reviewed and accepted by the IEPA in 2001 as a result of the continued monitoring results of elevated concentrations of total dissolved sulfates and associated total dissolved solids, and implemented and reported to the IEPA during 2002. The plan was developed to determine the source of the increase, concentrations and extent of sulfate migration, and assess any potential threat to human health and the environment. Results from the study indicated natural conditions were the source of the detected sulfate concentrations and that there was no potential threat to human health and the environment.

A directive was received from IEPA in August 2002 requiring the replacement of the background monitoring well at the RCRA unit. A post closure modification request was developed and forwarded to IEPA detailing the investigation, installation and sample process for the proposed background-monitoring well. IEPA responded in January 2003 approving the post closure modification request with conditions and modifications. The new background monitoring well was installed on May 22, 2003. Sampling of this monitoring point began with the 2nd quarter 2003 semi-annual monitoring and continued through the 4th quarter 2004. New 99% confidence levels were proposed in a modification request for Fermilab's post-closure care plan during 2005. New 99% confidence levels were received from IEPA in a directive to Fermilab during 2006.

Monitoring wells at SWMU 13 were sampled during the 2nd and 4th quarters of 2009. Statistical analyses demonstrated no concentrations above the 99% confidence level or in excess of the Class II groundwater standard during either the 2nd or 4th quarters.

Railhead Storage Yard (SWMU #14)

No information was requested or generated at this unit during 2009.

Meson and Neutrino Soil Activation Areas

This region was removed from the RFI as a SWMU during 2006 as part of the RFI Part B permit renewal. On a quarterly schedule, Fermilab continues to sample five monitoring wells in this region for accelerator-produced radionuclides. The results of samples from the Class I groundwater along with flow directions in the upper dolomite bedrock are reported annually to IEPA for informational purposes. No radionuclides above detection levels were reported from these monitoring wells during 2009

6.13 Safe Drinking Water Act

During September 2005, Fermilab discontinued the use of onsite wells for domestic drinking water and secured a connection to the City of Warrenville public water supply. Fermilab retains four private wells at three sites (Site 29 [two wells], Site 53 [Buffalo Barn], and Site56). Private wells do not require any water treatment, sampling, or reporting.

6.14 Superfund Amendments and Reauthorization Act (SARA) TITLE III or Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA)

Under these regulations Fermilab is required to provide the EPA, State, and local officials with an annual accounting of hazardous, toxic, and extremely hazardous chemicals used or stored onsite in quantities greater than a given threshold. Fermilab prepared a Toxic Chemical Release Inventory Report (TRI) for the release of copper in 2009. The report was filed with the USEPA and IEPA in June 2010. Copper was the only chemical that breached the reporting thresholds. Fermilab released 71,580 pounds of copper in 2009. Nearly ninety per cent of the copper was released as scrap metal for recycling. As required by Section 312 of SARA Title III, Fermilab submitted a Tier II Emergency and Hazardous Chemical Inventory (2008) to state and local emergency services and disaster agencies in February 2010

6.15 Oil Spill Prevention

In 2009, the ad hoc group of the Environmental Protection Subcommittee continued to work to bring Fermilab into compliance with 40 CFR 112 – Oil Pollution Prevention, and the upcoming final amendments to the regulation (pushed back to November 2010). This US EPA regulation states that any facility that has the capacity to use or store more than 1,320 gallons of oil (petroleum, plant or animal oils and fats) must write and implement a Spill Prevention, Control and Countermeasures (SPCC) Plan that encompasses every oil source with the capacity of 55 gallons or more. A FESHM chapter and SPCC training for oil handling employees were developed. FESHM 8031 – Oil Pollution Prevention was approved in March 2010. Training employees began immediately following the FESHM chapter approval.

Fermilab has more than 600,000 gallons of oil on site including more than 350 oil-filled transformers. All the Division/Section/Center Environmental Officers worked to ensure the oil sources owned by their organizations were in compliance (i.e provided with secondary containment). Only a few oil sources were not in compliance with the secondary containment requirements. All were remedied with the exception of three emergency back-up generators, one at each of the following locations: D0 Assembly Building, C4 Pump House, and AP50. Being more than twenty years old, these generators have single-walled diesel fuel tanks, and do not comply with the SPCC regulations. Funding to bring these generators into compliance was a problem as replacing the generators costs ~$55,000 per generator. In December 2009 a Field Work Proposal was submitted to the Department of Energy (DOE) requesting $180,000 to replace all three generators, and in April 2010 was denied.
The SPCC Plan was finalized and certified by a Professional Engineer as meeting the requirements of the regulation (including the upcoming amendments) in November 2009 with provisions that Fermilab bring the three generators into compliance. In February 2010 the plan was approved by the Fermilab Directorate (Chief Operating Officer and ES&H Director) and the DOE-Fermi Site Office Manager. The generators are scheduled to be replaced entirely or provided with new double-walled fuel tanks before August 1, 2010.

6.16 Toxic Substance Control Act (TSCA)

Over the course of several years (1993 – 2002), Fermilab conducted a cleanup of Polychlorinated Biphenyl (PCB) contaminated soil resulting from past management practices at the transformer yards associated with various Tevatron service buildings. Groundwater that had seeped into the excavations after the 2002 remedial activities at B1 and B4 service buildings was found to be above the standard for unrestricted release. This water was properly disposed of prior to closing the excavations and very little water reentered the pits before they were backfilled. Consequently, although these locations met the standard for soil cleanup, they could not be declared “clean” at that time. Further groundwater sampling activities were conducted in July 2003. No remaining groundwater was detected at B1, so remediation there was declared complete. Conversely, groundwater samples collected at B4 again indicated contamination at levels slightly above the standards.

When PCB-contaminated groundwater is encountered, EPA regulations dictate that the owner will consult with the Agency and that the Agency decide, based upon risk, what further remediation, if any, is necessary. To obtain such a decision, Fermilab prepared a report on the results of its groundwater investigation and DOE transmitted it to the EPA on September 22, 2003. In the report, Fermilab concluded that the remaining contamination was very low-level and sufficiently localized that it did not pose any significant environmental threat. The Lab therefore, requested that the Agency classify the residual PCBs as "disposed in place." Discussions among EPA, Fermilab and the DOE Fermi Site Office staff have taken place intermittently, with EPA occasionally requesting additional information. It is believed that the Agency now has everything it needs to make a decision.

Accelerator Division continued its program to phase out use of PCBs when opportunities arise. Small PCB capacitors were removed from two quadrupole power supplies in the Linac. This reduced the PCB inventory by 38.4 pounds. Further reductions are planned.

7.0 Pollution Prevention and Waste Minimization

Fermilab continued to make progress minimizing waste prior to generation and reducing pollution in 2009. Over one thousand metric tons of a wide variety of materials was recycled. This includes several new recycling initiatives also begun in 2009.

Fermilab has expanded its program to recycle comingled glass, plastic and metal containers across 100% of the occupied buildings on site. In 2009, we recycled 349 tons of material through a combination of curbside, paper, metals, batteries, and construction waste recycling. Accelerator Division also initiated a program to recycle used transparencies.

Approximately 54,250 pounds of electronics and 40,000 pounds of monitors from Fermilab, and 21,500 pounds of electronics and 38,000 pounds of monitors from Argonne National Laboratory were recycled in FY2009. Approximately another 8,000 pounds of computers were sent to DOE's computers for learning programs or otherwise re-utilized.

Permanent dumpsters dedicated to recycling construction and demolition debris were staged on site. This was done to improve the recycling of materials from small-scale construction projects. Fermilab time and materials (T&M) contractors have been directed to use these dumpsters for waste generated from projects. Approximately 50 tons of construction waste was recycled from all projects (large and small) in 2009.

Twenty four new fuel efficient vehicles were added to the Fermilab fleet, ten of which were gas-hybrid and 14 were E 85 fuel.

A metals moratorium issued by the Secretary of Energy in July 2000 on the recycling of scrap metals from posted radiological or radioactive materials areas remained in effect throughout 2009. Measures were continued throughout the year at Fermilab to separate materials subject to this moratorium. Due to this, materials that were considered non-radioactive according to Fermilab's DOE-approved release criteria and which had been recycled prior to the moratorium continued to be accumulated.

8.0 Conclusion

The operations at Fermilab during 2009 had no significant adverse impact on the environment or on public safety.

[1] Details of the Fermilab Environmental Monitoring Program (FEMP) can be found on the ES&H home page.
[2] Fermilab Annual Ecological Land Management Plan can be found on the Fermilab website by clicking *About Fermilab* and then *Nature/Ecology*.

[3] 35 IAC 620

[4] 35 IAC 620.210