Fermilab

Report to the Director on the Fermilab Environment For Calendar Year 2007

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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. 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 of planning, implementing, evaluating, and improving to achieve compliance with environmental requirements, prevention of pollution, and meeting of continuous environmental goals. 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, 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

Tritium in Surface Water

The strategy for managing surface water continued to be based on avoiding discharges of tritium into offsite waterways. When necessary, procedural changes made during 2006 were employed to restrict the movement of cooling water to the eastern lakes (i.e., Lake Law and A.E. Sea) by transferring it to Casey's Pond and the Kress Creek watershed. These actions limited the discharge from the eastern lakes to *waters of the state* for 6 of the 12 months of potential discharge Discharges from Casey's Pond to Kress Creek occurred during nine months of the year. Swan Lake (headwaters of Indian Creek) was maintained at a level low enough to restrict discharge during the entire year.

In addition to the above described efforts, the Accelerator Division completed a new project in 2007 to further address problems related to the humid environment in the Neutrinos at the Main Injector (NuMI) enclosure. A new dehumidification system was installed in the underground area in the vicinity of the NuMI target pile to reduce the amount of tritium created through activation of air. Less tritium in the air results in less tritium condensating on the walls of the NuMI enclosure that flows into the NuMI sumps where it is pumped into the industrial cooling water (ICW) system. The new equipment consisted of two stages of dehumidification, an evaporator, and a support chiller. Initially, two new high-efficiency desiccant dehumidifiers separate most of the tritiated water vapor from the NuMI target pile air. In the second stage, a cooling coil condenses that moisture into a tritiated water stream during desiccant regeneration. The condensed moisture is collected in a holding

tank below ground (a new tank replaced an existing one), pumped to a second new holding tank at the surface, processed through an electrically-powered evaporator, and discharged via a stack on the roof of the MI-65 service building. This is a new release point for radioactive air emissions and is continuously monitored, although the emissions are extremely small in terms of resultant off-site dose. A new chiller was installed in the MI-65 mezzanine to supply cooling water to the condensing coils. The condensate from the existing target pile chiller, which contains tritium and had been managed as a liquid radioactive waste at considerable cost, was also routed to the evaporator. This project now allows use of the water from the NuMI tunnel in the ICW system at reduced concentrations of tritium. In addition, by lowering enclosure humidity, it reduces the corrosion that beamline components have been experiencing due to compounds such as nitric acid and hydrogen peroxide that are produced through radiolytic decomposition of air and water molecules in the NuMI target chase.

Environmental Management System (EMS) Implementation
The laboratory began its efforts to become ISO 14001 certified in July 2006 by developing a request for proposals that was sent out to prospective registrars to perform the necessary third-party registration for certification. A contract was awarded to NSF International Strategic Registrations (NSF ISR) in late September to perform those duties. NSF ISR performed two audits of the lab's EMS in 2006, a Desk Audit in late October and a Readiness Review Audit in December. Findings that resulted from the December Readiness Review were addressed in a Corrective Action Request Plan completed in early 2007. Approval of this plan followed by a Registration Audit that was initiated in July 2007 resulted in the lab being recommended by NSF ISR for ISO 14001 registration. Fermilab was notified of its ISO 14001 standards registration in August of 2007 and was presented a plaque certifying this by a representative of NSF ISR during a recognition ceremony in October 2007.

3.0 Ecological Issues

Eleven National Environmental Research Park (NERP) projects were in differing stages of progress during 2007. 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
- Bat House Project at Fermilab, National Speleological Society
- Assessing Carbon Cycling in Restored Grasslands using Stable Isotopes, 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
- Ascomycete Fungi in Bison Dung from the Fermilab Bison Herd, The Field Museum
- Bioenergy Experimental Plots at Fermilab, Argonne National Laboratory
- Management of Roundworm Infection in the raccoon Population, Wheaton College
- Comparative Analysis of Soils in Urban Ecosystems, Northwestern University
- Floristic Characteristics Of Prairie Restoration Sites In The Greater Chicago Region, Governor's State University
- Evaluation of Biological and Chemical Management Practices for Emerald Ash Borer, Morton Arboretum

The Laboratory's Ecological Land Management Plan[2] was updated in 2007. 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 2007, one animal was destroyed, and four animals were released to Willowbrook Wildlife Center in Glen Ellyn, IL, for rehabilitation. 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 2007, 46 whitetail deer were removed.

4.0 Environmental Management System (EMS)

Executive Order (EO) 13148, *Greening the Government through Leadership in Environmental Management*, required each Federal agency to implement an Environmental Management System (EMS) at its facilities by December 31, 2005. DOE issued Order 450.1 to ensure execution of EO 13148 at all DOE facilities. 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 of planning, implementing, evaluating, and improving to achieve compliance with environmental requirements, prevention of pollution, and meeting of continuous environmental improvement goals. In addition, a comprehensive EMS will assimilate the principles of the Integrated Safety Management System (ISMS) into an Integrated ES&H Management System (IES&HM), addressing facility operational hazards that have the potential to impact individuals and/or the environment.

In April and July of 2005, DOE Chicago Office (CH), Safety and Technical Services, reviewed the implementation status and progress of the EMS at Fermilab. In September of 2005, Fermilab's EMS was evaluated by a three member assessment team comprised of individuals from the DOE Chicago Operations Office (CH), the DOE Argonne Site Office, and Argonne National Laboratory, to provide the Fermilab Site Office (FSO) with a basis for formally declaring that Fermilab had implemented the EMS related requirements contained in EO 13148 and DOE Order 450.1. The review team issued a positive recommendation to the FSO Manager concerning the EMS Self-Declaration Process for Fermilab. In December of 2005, the FSO Manager stated, in a letter to Ray Orbach, DOE Office of Science Director, that "Fermilab fully conforms to the EMS requirements of DOE Order 450.1."

During 2006, the EMS data questionnaire was developed by the Office of Management and Budget to monitor progress of federal agencies in EMS implementation. DOE chose the time frame for 2006 reporting to coincide with the fiscal year reporting that EPA will require by October 2008. EMS status information for Fermilab was submitted by the December 2006 deadline and used to generate the OMB Environmental Stewardship Scorecard for DOE.

In mid 2006, Fermilab decided that its mission would be improved by acquiring full ISO 14001 third-party certification. ISO 14001 standards require an organization to meet a stringent set of criteria; the organization must have an infrastructure and management plan that facilitates compliance with environmental laws and standards, to improve its environmental performance and to achieve measurable environmental objectives. The standards are not a government requirement but instead they signify an organization's commitment to best environmental practices.

The laboratory began its efforts to become ISO 14001 certified in July 2006 by developing a request for proposals that was sent out to prospective registrars to perform the necessary third-party registration for certification. A contract was awarded to NSF International Strategic Registrations (NSF ISR) in late September to perform those duties. NSF ISR performed two audits of the lab's EMS in 2006, a Desk Audit in late October and a Readiness Review Audit in December. Findings that resulted from the December Readiness Review were addressed in a Corrective Action Request Plan completed in early 2007. Approval of this plan followed by a Registration Audit that was initiated in July 2007 resulted in the lab being recommended by NSF ISR for ISO 14001 registration. Fermilab was notified of its ISO 14001 standards registration in August of 2007 and was presented a plaque certifying this by a representative of NSF ISR during a recognition ceremony in October 2007.

5.0 Environmental Monitoring and Surveillance

The goal of the Fermilab Environmental Monitoring Program (EMP) is to assist Laboratory management in decision-making by providing data relevant to impacts that Fermilab operations have on the surrounding environment. The EMP consists of effluent monitoring 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 chemicals 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 measuring penetrating radiation 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 normally 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 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 in 1991 by the IEPA 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, and the operation of several natural gas-fired boilers. 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 2007, the debonding oven did not burn any radioactive magnets (there were other magnets burned); therefore there was no release of tritium from this source. 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 57.88 Curies in 2007. These radioactive air emissions were approximately 2% 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 2007 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 0.0158 mrem.

Fermilab's 2007 Radionuclide Air Emissions Annual Report was submitted to the DOE FSO in May 2008. 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. The current permit covers the magnet debonding oven, three 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, and the CDF and MIPP gas circulating systems. Permit conditions require the monthly logging of fuel consumption for covered fuel combustion sources and solvent usage at the degreaser. 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 2007, an estimate of criteria pollutant emissions, was submitted to the Illinois Environmental Protection Agency (IEPA) in May 2008.

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 2007. 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 2007 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 2007, it is estimated that radioactive materials stored at the Railhead contributed a dose equivalent at the site boundary in 2007 of approximately 0.371 mrem. The maximum radiation dose equivalent to an individual at the nearest offsite house was similarly estimated to be approximately 0.066 mrem in 2007.

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. In November 2007, the IEPA issued DOE/Fermilab a draft NPDES permit that now includes reporting tritium at all of our outfalls; a final permit is yet to be issued. Monitoring for radioactivity in on-site surface water continues to be a primary component of Fermilabs 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, TSS, TDS pH, chlorine, chloride and sulfate) this year. Discharge Monitoring Reports for six different outfalls were submitted monthly to the IEPA. In 2007 there were no exceedances of discharge limits to waters of the state. Also in 2007 Fermilab contracted services to treat several cooling ponds for algae and pond weeds using a state licensed applicator. Two treatments to control an ongoing zebra mussel infestation of cooling water pipes and pumping infrastructure were performed by FESS.

5.3.2.1 Cooling Water System

An individual site specific NPDES permit authorizes the discharge of commingled cooling water and stormwater 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 stormwater discharges from designated solid waste management units (SWMUs). The Stormwater 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. Fermilab's site specific NPDES permit dictates that water temperature, pH, and flow be monitored at all three outfalls; chlorine concentration be monitored at the Kress and Indian Creek outfalls; and total dissolved solids, chlorides and sulfates be monitored at the Indian Creek outfall. The monitoring results are reported to the IEPA on a monthly basis.

The strategy for managing surface water continued to be based on avoiding discharges of tritium into offsite waterways. When necessary, procedural changes made during 2006 were employed to restrict the movement of cooling water to the eastern lakes (i.e., Lake Law and A.E. Sea) by transferring it to Casey's Pond and the Kress Creek watershed. These actions limited the discharge from the eastern lakes to *waters of the state* for 6 of the 12 months of potential discharge Discharges from Casey's Pond to Kress Creek occurred during nine months of the year. Swan Lake (headwaters of Indian Creek) was maintained at a level low enough to restrict discharge during the entire year.

In addition to the above described efforts, the Accelerator Division completed a new project in 2007 to further address problems related to the humid environment in the Neutrinos at the Main Injector (NuMI) enclosure. A new dehumidification system was installed in the underground area in the vicinity of the NuMI target pile to reduce the amount of tritium created through activation of air. Less tritium in the air results in less tritium condensating on the walls of the NuMI enclosure that flows into the NuMI sumps where it is pumped into the industrial cooling water (ICW) system. The new equipment consisted of two stages of dehumidification, an evaporator, and a support chiller. Initially, two new high-efficiency desiccant dehumidifiers separate most of the tritiated water vapor from the NuMI target pile air. In the second stage, a cooling coil condenses that moisture into a tritiated water stream during desiccant regeneration. The condensed moisture is collected in a holding tank below ground (a new tank replaced an existing one), pumped to a second new holding tank at the surface, processed through an electrically-powered evaporator, and discharged via a stack on the roof of the MI-65 service building. This is a new release point for radioactive air emissions and is continuously monitored, although the emissions are extremely small in terms of resultant off-site dose. A new chiller was installed in the MI-65 mezzanine to supply cooling water to the condensing coils. The condensate from the existing target pile chiller, which contains tritium and had been managed as a liquid radioactive waste at considerable cost, was also routed to the evaporator. This project now allows use of the water from the NuMI tunnel in the ICW system at reduced concentrations of tritium. In addition, by lowering enclosure humidity, it reduces the corrosion that beamline components have been experiencing due to compounds such as nitric acid and hydrogen peroxide that are produced through radiolytic decomposition of air and water molecules in the NuMI target chase.
The infestation of zebra mussels in the ICW system has previously been documented.

In 2007 Fermilab continued treatment of the ICW system to control zebra mussels. The treatment consists of the addition of EVAC™, a water treatment chemical, to the ICW system at the Casey's Pond Pump house. This procedure was approved by the IEPA by a letter, dated October 13, 2005, indicating that no modification of the NPDES permit is necessary to use the treatment. In October, approximately 45 gallons of the EVAC™ product was introduced into the ICW system, resulting in a nominal concentration of 1.0 ppm over 24 hours. The procedure resulted in no abnormal events.

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 2007, 71,400 gallons of process wastewater were discharged to the Batavia sewer system. In 2006, the regeneration process was re-designed to ensure that all

effluents leaving CUB are compliant. In 2007, all effluent discharges were in compliance with the pre-treatment permit. Effluents are also analyzed for tritium and other radionuclides. All effluents in 2007 were compliant with specified levels in the Department of Energy Derived Concentration Guide for radionuclides. A total of 138.3 µCi of tritium and 151.32 µCi of ^{7}Be were released to the sanitary sewer from the CUB during 2007. 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. In the past year, the Batavia sewer sampler revealed one exceedance each of the iron discharge limit of 5.0 mg/l and the manganese discharge limit of 2.0 mg/l. The maximum levels measured were 5.13 mg/l and 2.16 mg/l, respectively. These excursions were likely due to the aging pipe infrastructure and are of minimal impact to the Batavia treatment works. 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. There were three months in 2007 where the tritium activity measured exceeded the statistically determined detection limit of 1.0 pCi/ml, with a maximum detection of 1.2 pCi/ml.

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.

Four background monitoring wells that are up-gradient to Fermilab operations continued to be utilized in 2007 to obtain representative samples of the upper Class I groundwater for chemical and radiochemical analysis. Ten wells at the Central Utility Building (CUB) 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 Experimental Area was removed from the RFI as a Solid Waste Management Unit; however, four 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. Over forty piezometers (pore-water pressure measuring instrument) were used to gather information on the direction of groundwater flow site-wide. The information collected is 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 2007 to analyze groundwater issues associated with this project that involved construction within the dolomite aquifer.

Thirty three of 118 on-site groundwater monitoring locations were sampled during the year for radionuclide or chemical parameters. The remaining locations were available for water level monitoring.

5.4.1 Groundwater Characterizations

No groundwater characterizations were conducted in 2007

5.4.2 Monitoring Well Modification and Abandonment Activities

There were no monitoring well modifications or abandonment activities during 2007.

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. 34 samples were taken from 16 locations for analysis. Radionuclides were not detected in any samples taken during 2007 in Class I groundwater.

5.4.4 Chemicals in Groundwater

Two rounds of groundwater samples were collected for chemical analysis in 2007 at two Solid Waste Management Units (SWMUs) as required by the Resource Conservation and Recovery Act Facility Investigation (RFI). (See Section 4.12.1 RFI Activities.)

Four samples were taken from four background monitoring wells for chemical analysis in 2007. These wells monitor groundwater migrating into the bedrock aquifer beneath Fermilab. Chemical analysis of groundwater from monitoring well BMW1 showed total and dissolved sulfate slightly above the Class I Groundwater standard.

6.0 Compliance with Specific Environmental Requirements

Below is 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 2007. The annual air emissions report for 2007 was submitted to the IEPA in April 2008 and the annual radionuclide emissions report was submitted to the USEPA in June 2008.

In 2007 an estimated 61.9 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 burn any radioactive magnets in 2007. 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 0.0158 mrem/year due to 2007 Fermilab operations. This approximate 64% decrease from the 2006 maximum dose equivalent of 0.0245 mrem/year was due to further improvements made to the NuMI ventilation stacks that reduced air emissions from the EAV1 stack significantly and a longer than usual annual shutdown, along with several short NuMI beamline shut downs during which NuMI did not operate.

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 2007. 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 280.80) 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 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 2007.

6.4 Executive Order 11988, "Floodplain Management"

No compliance issues were identified in 2007.

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 2007, Fermilab maintained a permit for the NuMI construction project that was issued as a requirement of Section 404 of the Clean Water Act although all activities associated with this permit are finished. The renewal of Fermilab's existing sitewide NPDES permit at the end of 2007 resulted in the *de facto* closure of the NuMI permit. An additional Section 404 permit, that covered construction of the access road from the Lederman Center west to the MiniBooNE parking lot, expired during 2006.

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

In 2007, 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 2003. Only minor maintenance issues were discovered then and all of those were addressed at that time. In addition, a visual examination of the Class III dam is conducted annually by the Lab. No non-routine action items were identified during the 2007 examination.

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 2007, five nests containing a total of five eggs were destroyed.

6.9 National Environmental Policy Act (NEPA)

Fermilab met the requirements of this Act by continuing to implement a program of reviewing all activities for compliance as set forth in the Fermilab Environment, Safety and Health Manual (FESHM) Chapter 8060. FESHM Chapter 8060 – NEPA Review Procedure – was revised in 2003 to clarify when NEPA review was required and specifically what the review should entail; the approach to determining NEPA applicability was refined and several definitions were improved upon. DOE approved five projects for Fermilab as being categorically excluded (CXs) from further review in 2007 and an Environmental Assessment was completed for the proposed NuMI Off-Axis v Appearance Experiment.

Categorical exclusions 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 2007 to assess any potential impacts on historic resources. No compliance issues were identified in 2007.

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.

Fermilab submitted its annual questionnaire on 2007 Federal archaeological activities to the Department of the Interior in January of 2008.

6.11 National Pollutant Discharge Elimination System (NPDES)

The following three IEPA issued National Pollutant Discharge Elimination System (NPDES) permits were active for Fermilab in 2006. The four permits are the following:

1. General (covers several facilities that have the same type of discharge and are located in a specific geographic area) NPDES permit covering non-coal mine discharges associated with the NuMI tunnel construction project. Fermilab has petitioned the IEPA for closure of this permit and incorporation of the associated outfall into its Individual NPDES permit (see item #3).

2. Individual (specifically tailored to an individual facility) NPDES permit for combined stormwater and non-contact cooling water discharges associated with industrial activities; there are three outfalls linked with this permit (Outfall 001 to Ferry Creek, Outfall 002 to Kress Creek, and Outfall 003 to Indian Creek).

3. Individual NPDES 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.

6.12 Resource Conservation and Recovery Act of 1976 (RCRA)

The Annual Hazardous Waste and Illinois Generator Non-Hazardous Special Waste Reports for 2007 were transmitted to the DOE Fermi Site Office in January and February 2008 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 (HCT) Team of the Safety and Environmental Protection Group in 2007.

40.0 m^3	Non-Routine Hazardous Waste (RCRA + TSCA)
4.2 m^3	Routine Hazardous Waste (RCRA + TSCA)
9.8 m^3	Non-Routine Non-Hazardous (Special) Waste
46.0 m^3	Routine Non-Hazardous (Special) Waste
7685.1 m^3	Dumpster/Landfill Waste

6.12.1 RCRA Facility Investigation (RFI) Activities

As a condition of Fermilabs RCRA Hazardous Waste Management Part B permit that was 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 are still being 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 Experimental Area 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, and the IB2 Industrial Building so long as institutional controls remain in place.

IB2 Industrial Building

No new information was requested or generated at this unit during 2007.

Village Machine Shop (SWMU# 5)

No new information was requested or generated at this unit during 2007.

CUB Tile Field (SWMU# 12)

The CUB Tile Field has previously been removed along with all chromate-contaminated soil and gravel. The soil was properly disposed of and the surrounding soil sampled and analyzed. Fermilab continues to monitor all of the CUB Tile Field wells semi-annually. Monitoring wells at SWMU 12 were sampled during the 2nd and 4th

quarters of the calendar year. Well MW7B was dry during the 2nd quarter round of sampling and Wells MWS3, and MW7B were dry during the 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, placing topsoil on the clay cap, hydroseeding the top of the hill, and a site inspection. Fermilab continues sampling of 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 second quarter 2003 semi-annual monitoring and continued through the fourth 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 2007. Statistical analyses demonstrated concentrations of total organic carbon in monitoring wells G102 and G108 above the 99% confidence level during the 2nd quarter sampling, while monitoring wells G102, G103, and G106 showed concentrations of dissolved ammonia above the 99% confidence level during the 4th quarter sampling. Concentrations of total dissolved sulfate and total dissolved solids in monitoring well G101 exceeded the Class II groundwater standard during the 4th quarter.

Railhead Storage Yard (SWMU #14)

No information was requested or generated at this unit during 2007.

Meson/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. Fermilab continues to sample five monitoring wells in this region on a quarterly schedule for accelerator-produced radionuclides. The results of samples from the Class I groundwater along with flow directions in the upper dolomite are reported annually to IEPA for informational purposes. No radionuclides were reported in these monitoring wells above detection levels during 2007.

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 no water treatment responsibilities, however, one drinking water well remains in place at Site 29. This is considered a private residential well, and therefore no treatment, sampling, or reporting are required on this source.

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 filed a Toxic Chemical Release Inventory Report (TRI) for 2007 with the USEPA and IEPA in June 2008. Copper was the only toxic chemical processed or used at Fermilab at threshold activity levels defined by SARA Title III Section 313. As required by Section 312 of SARA Title III, Fermilab also submitted a Tier II Emergency and Hazardous Chemical Inventory (2007) to state and local emergency services and disaster agencies in February 2008.

6.15 Oil Spill Prevention

There are no above-ground fuel storage tanks at Fermilab. Above-ground oil inventory at Fermilab consists primarily of a number of oil-filled electrical transformers ranging in volume from 4 to 17,300 gallons. Transformers are considered to be "oil-filled operational equipment" and are subject to regulation by U.S. EPA under Spill Prevention, Control and Countermeasures (SPCC) rules at 40 CFR Part 112. Potential on-site oil spill sources are located such that surface water discharge spillways can be effectively used to prevent the oil from leaving the site and reaching *waters of the state* as defined in the regulations. The only exception is the transformer at Giese Road (1695 gallons) near Indian Creek. This transformer is located adjacent to Indian Creek, which is classified as *waters of the U.S.,* and therefore has reasonable potential to spill into regulated waters. The Giese Road transformer and others on site utilize secondary containment to protect all surface water on the site. In accordance with 40 CFR 110-112, Fermilab maintains an SPCC plan (SPCC) for the Giese Road transformer. This plan is periodically reviewed and revised as necessary. Some organizations also maintain local spill control plans to cover specific sources.

Fermilab also has various indoor oil-containing systems that have the potential to release oil to the site's network of ICW ponds in the event of a failure. One such incident occurred in August 2004, when a heat exchanger associated with a Central Helium Liquefier (CHL) Coldbox-2 failed and released oil to a drainage ditch and, eventually, Bull Rush Pond. The oil was confined in the pond and clean-up efforts were subsequently carried out in the pond and the ditch. Subsequently, a similar failure occurred in a heat exchanger at EØ service building in the Main Ring in May 2006. The oil was very light and dispersed so quickly that no cleanup was required, but the vulnerability of these systems was again apparent. Fermilab continued to implement corrective actions in response to the 2004 incident. The following actions were taken in 2007:

1. Efforts to enter data into the database that was created for use in developing a comprehensive inventory of oil and glycol-containing devices with potential to release into the ICW system disclosed some technical problems with it. Once the database is repaired, the inventory will be completed and each system will be analyzed for vulnerabilities and steps will be taken to reduce risk.
2. The new oil level sensor installed during the 2006 shutdown in the Rotoflow skid serving the nitrogen reliquefier has continued to perform well. CHL personnel would like to install similar instrumentation for better monitoring of oil levels in the Rotoflow skid serving Coldbox-1, but the configuration of this equipment makes this difficult. The problem is under study and additional sensors may be installed during a future shutdown. Additional actions taken in 2007 include replacement of both heat exchangers in the Rotoflow skid serving Coldbox-1 and the installation of a "Snout" oil trap in the last of a series of manholes that collect CHL's ICW effluent before discharge to the Bullrush Pond drainage system.

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 been held intermittently by phone; the most recent of which produced an EPA request for additional hydrogeological information. This was provided in October 2005 and Fermilab continues to await a response.

7.0 Pollution Prevention and Waste Minimization

The moratorium, issued by the Secretary of Energy in July 2000, on recycling of scrap metals from posted radiological or radioactive materials areas, remained in effect throughout 2007. Measures continued to be taken 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.

Fermilab continued to make progress minimizing waste prior to generation and reducing pollution in 2007. Again this year, the Lab was the recipient of several awards demonstrating commitment towards sustainability and environmental stewardship. Notable practices and a summary of the awards received are as follows.

SciBooNE Experiment

The SciBooNE project was the recipient of two awards from the DOE. The Office of Science awarded SciBooNE its *Best in Class Noteworthy Practices Award* and DOE Headquarters awarded the experiment its *P2 Star Award*. The awards were won due to the projects exemplary approach to using reused and recycled materials to construct the experimental apparatus.

Federal Electronics Challenge

Fermilab won a bronze level award for efforts to dispose excess electronics in a environmentally sound manner. Along with Argonne, Fermilab also participated in the Federal Electronics Reuse and Recycling Challenge. For the second year in a row the DOE has won the top award for greatest participation by a federal agency.

Resource Conservation

The Chicago Wilderness Consortium selected Fermilab for an Excellence in Conservation Award for our ongoing natural areas restoration efforts and our commitment to protect biodiversity.

Recycling and Waste

In 2007 over 2.5 million pounds of a wide variety of materials were recycled. An effort was also begun to expand recycling across the site to include recyclable glass, plastic, and metal cans. The goal of this effort will be to provide this service to all major areas and buildings on site in the coming year. Wilson Hall was the first location where expanded recycling was successfully implemented.

Batavia Environmental Expo

Fermilab participated in the 2nd annual Batavia Environmental Expo. The theme of the 2007 expo was reducing waste and carbon dioxide emissions. Our exhibit consisted of three presentations: (1) *Electronics Recycling* at Fermilab; (2) a long term carbon sequestration project occurring on site; and (3) a video presentation of our prairie restoration efforts.

Change a Light Campaign

Fermilab employees were encouraged to participate in the 2007 National Energy Star Change a Light Campaign. The goal of the campaign is to get Americans to change light bulbs at home from energy intensive incandescents to efficient compact fluorescents. Employee participation helped the Office of Science win top honors among DOE Offices for most participants.

8.0 Conclusion

The operations at Fermilab during 2007 had no significant adverse impact on the environment or on public safety.

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[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