Report to the Director on the Fermilab Environment

Calendar Year 2011

Annual report on environmental monitoring and surveillance activities including compliance with specific environmental requirements.

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1.0 Introduction

Fermilab is not only committed to environmental compliance but also to responsible environmental stewardship. Compliance, which can be defined as conformity to fulfill official requirements, affects many aspects 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 entities that include 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 the Laboratory's current and future impact on the environment.

Fermilab evaluates and manages the environmental impacts of site operations by using an Environmental Management System (EMS). Since 2007, the Laboratory has maintained registration for our EMS to International Standards Organization (ISO) 14001 requirements. ISO 14001 standards require an organization to meet a stringent set of criteria. The organization must have an infrastructure and management plan that facilitates meeting measurable environmental objectives. An important purpose of this report is to present the current status of certain objectives.

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

2.0 Summary of Significant Environmental Issues

Federal Sustainability Goals

In 2009 Executive Order (E.O.) 13514 Federal Leadership in Environmental, Energy and Economic Performance went into effect. The Order builds on environmental sustainability initiatives initially outlined in previous directives. This Order also commits the federal government to measure, manage and develop a strategy to reduce its own greenhouse gas (GHG) emissions. In addition Federal agencies must increase energy efficiencies, reduce fleet petroleum consumption, conserve water, and reduce waste. In response the Department of Energy (DOE) has developed a Strategic Sustainability Performance Plan (SSPP) in which the department describes its approach to meeting goals outlined in the Executive Order. The GHG emission reduction goals have long term targets that mature in 2020, with other related goals having shorter time frames.

In 2010 Fermilab first developed a Site Sustainability Plan (SSP). This plan outlines Laboratory initiatives that assist the DOE in meeting its goals in the SSPP. DOE requires that the SSP be updated annually. In 2011 Fermilab updated its plan. A summary of plan highlights is presented in Section 4.0, Sustainability. Additionally details of Fermilab's GHG inventory are presented in section 6.2, Greenhouse Gas Emissions.

Tritium Discharges

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 for tritium.

Additionally Fermilab monitors the sanitary effluent discharged from the site to the municipal waste water treatment plants of Batavia and Warrenville/Naperville. Fermilab began observing consistent measurable concentrations of tritium in the discharge to Batavia in 2005. The maximum activity observed was 4.1 pCi/ml . From 2006 through 2009 tritium was observed intermittently just above the detection limit of 1 pCi/ml. Beginning in 2010, consistent tritium concentrations again were observed in the discharge, with a maximum concentration of 7.5 pCi/ml. In 2011 only limited data was available due to operational problems with sample collection equipment however measurable tritium was recorded during periods when equipment was operable. The highest level recorded in 2011 was 5.7 pCi/ml.

Monitoring for radioactivity in water systems continues to be a significant component of Fermilab's routine environmental surveillance program. Additional information concerning levels of tritium is posted at a web link from the Laboratory's home page.

3.0 Ecological Issues

Ten National Environmental Research Park (NERP) projects were in differing stages of progress during 2011. The projects along with the name of the sponsoring institution are listed below:

- 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
- Bioenergy Experimental Plots at Fermilab, Argonne National Laboratory
- Evaluation of Biological and Chemical Management Practices for Emerald Ash Borer, Morton Arboretum
- Restoration Activities by Fermilab Natural Areas Intern, Fermilab Natural Areas
- Monitoring Potential Impacts of Canadian National Railroad Purchase of Elgin, Joliet, and East Rail Line: Fermilab Segment, Illinois Natural History Survey
- Assessment of the Mammalian Community across an Urban to Rural Gradient, Lincoln Park Zoo, Chicago Illinois.

- Disturbance and plant-microbial relationships: Does Widespread Agricultural Management Permanently Alter the Microbiome Associated with the Root-Zone of Native Plants, Virginia Polytechnic and State University
- Fermilab Natural Areas Stewardship Program, Fermilab Natural Areas

The Laboratory's Ecological Land Management Plan[2] was updated in 2011. 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 2011, 35 complaints were received, resulting in the transfer and re-release of 5 animals on site. Six animals were euthanized. Fermilab intensively manages the population of whitetail deer on site to preserve the ecosystem. DOE Fermi Site Office 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 201, 46 whitetail deer were removed.

4.0 Sustainability

Fermilab is committed to minimizing the environmental impact of site operations. In response to departmental goals established by DOE to improve its environmental footprint, the Laboratory has developed a Site Sustainability Plan that documents Fermilab's contribution towards meeting the goals. The primary emphasis of the plan is on the reduction of greenhouse gas emissions. The plan also addresses more broad ranging goals that include operating buildings more efficiently, reducing water consumption, reduced fossil fuel consumption for vehicle fleets and improved energy consumption of computer data centers. An outline of the primary goals is provided below.

DOE/ Office of Science Goal	Fermilab Performance Status	Planned Actions & Contribution
28% Scope 1 & 2 greenhouse gas reduction by FY 2020 from a FY 2008 baseline	Cumulative reduction at the end of FY2011: -5.2% FY2008 Baseline: 354,804 MT CO_2e FY2020 Goal: 255,459 MT CO_2e	Renewable Energy Certificate (REC) purchases
30% energy intensity reduction by FY 2015 from a FY 2003 baseline	Increased from 94,947 BTU/gsf in FY2010 to 96,011 BTU/gsf in FY2011 (1.12%) Cumulative reduction from FY2003: 19.6% Baseline:119,446 BTU/gsf FY2015 Goal: 84,766 BTU/gsf	Rely on ESPC initiative to find sufficient ECMs to attain goal.
Individual buildings or processes metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (by October 1, 2015) where life cycle cost effective. The site *may* also report on potable water and chilled water as applicable.	Additional meters installed in FY11: 5 14 Advanced meters currently installed (83%) All natural gas meters are installed	Upgrade 3 meters to advanced status, bringing to 17 the total number of advanced electrical meters (100%).
Cool roofs, unless uneconomical, for roof replacements unless project already has CD-2 approval. New roofs must have thermal resistance of at least R-30.	Area of cool roofs in FY11: 16,913 Area of cool roofs installed to date: 26,659	Continue our current policy, including evaluation of cool roofs for new buildings.
7.5% of annual electricity consumption from renewable sources by FY 2013 and thereafter (5% FY 2010 – 2012)	Achieved with REC purchases for 7.95% of total <1% of total use is renewable on site.	Continue to purchase RECs for this goal while continuing to investigate RE technologies for use at Fermilab.

DOE/ Office of Science Goal	Fermilab Performance Status	Planned Actions & Contribution
10% annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline	FY05 baseline:31,621 GGE % increase: 49% Increase in FY11: 9.4%	Continue to pursue opportunities, but constrained by requirement to purchase hybrids and general fleet reductions.
2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline	FY05 baseline:79,102 GGE Cumulative decrease: 43% Decrease in FY11: 9.4%	Continue to pursue opportunities, but constrained by requirement to purchase hybrids and general fleet reductions.
75% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2000 and thereafter. Starting in FY 2015 100%	No vehicles purchased in FY11.	Unlikely to purchase vehicles in FY2012.
Reduce fleet inventory by 35% within the next 3 years relative to a FY 2005 baseline	FY11 Interim Goal has been met.	Cannot meet future interim goals without severely impacting the scientific mission.
13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline	FY2008 baseline: 22,288 CO2e FY11 reduction: -5.2%	Unlikely to be able to meet this goal without credit for RECs.
15% of existing buildings greater than 5,000 gross square feet (GSF) are compliant with the Guiding Principles (GPs) of HPSB by FY 2015	No. needed: 15 No. compliant: 0 No. added in FY11: 0	Continue the scheduled assessments and explore strategies to meet the GP.
All new construction, major renovations, and alterations of buildings greater than 5,000 GSF must comply with the GPs and where the work exceeds $5 million, each are LEED ® – NC Gold certification or equivalent	Buildings completed in FY2011 comply with the majority of the elements of the Guiding Principles	Continue to apply the Guiding Principles as applicable and cost effective.
26% water intensity reduction by FY 2020 from a FY 2007 baseline	Goal is met.	Maintain usage << 2020 goal.
20% water consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY 2020 from a FY 2010 baseline	Baseline (2010): 81 Mgal FY2020 Goal: 65 Mgal FY2011: 116 Mgal	Modify practices to retain more storm water.
Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY 2015	Goal is met.	Continue current program.
Divert at least 50% of construction and demolition materials and debris by FY 2015	Goal is met for Fermilab managed waste.	Manage sub-contractors to document recycling of C&D waste for sub-contracted jobs.
Procurements meet sustainability requirements and include sustainable acquisition clause (95% each year)	Training completed.	Modification of Procurement documents.
All data centers are metered to measure a monthly PUE (100% by FY 2015)	2 of 3 meet the goal.	Complete metering plan for remaining data center.
Maximum annual weighted average Power Utilization Effectiveness (PUE) of 1.4 by FY 2015	PUE = 1.5 – 1.7	Incremental upgrades and efficiency improvements
Electronic Stewardship - 100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY 2012	Working on implementing Windows 7 to enable PM.	Continue changeover.

5.0 Environmental Management System (EMS)

Fermilab recognizes the importance of maintaining an Environmental Management System (EMS). The EMS is the organizational framework that enables Fermilab to reduce its environmental impacts and increase its operating efficiency. The system functions via an ongoing cycle that focuses on planning, implementing, evaluating and improving environmental 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 manner. In addition, the elements of the EMS have been coordinated 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. The EMS has also been certified to ISO 14001 standards since August 2007. ISO requires re-registration to the standard every three years. Fermilab successfully went through a comprehensive third party audit of the entire facility and became re-registered to 14001 in in June 2010.

To maintain certification, the Laboratory also undertakes 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 and have occurred every year since becoming registered. In 2011 semi-annual audits were performed on Particle Physic Division and the Facilities Engineering Section in February and on Technical

Division and the Business Services Section in August.

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 are annually reviewed. In areas were change is desired or required, goals are established with measureable targets that seek to improve a particular aspect of operations. The goals outlined in our Site Sustainably document areas of significant emphasis where the Laboratory is pursuing change. Additionally goals that fall outside of the scope of the Sustainability Plan may be documented in specific Environmental Management Plans (EMPs).

6.0 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.

6.1 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 when operating. 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.

6.1.1 Radioactive Air Emissions

Operation of the debonding oven, when radioactive components are being burned, is a potential source of tritium. In 2011 the debonding oven did not burn any radioactive magnets The Anti-Proton Area stack, used in Colliding Beam operations, Main Injector, and the MiniBooNE and NuMI stacks are estimated to have released a total of approximately 139 Curies in 2011. These radioactive air emissions were approximately 7% 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 2011 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-88PC3 Gaussian dispersion model, the highest dose equivalent to any member of the public was estimated to be 0.0326 mrem.

Fermilab's 2011 Radionuclide Air Emissions Annual Report was submitted to the DOE FSO in May 2012. The report is distributed by the DOE FSO to the USEPA and IEPA.

6.1.2 Non-Radioactive Air Emissions

Fermilab operates its air pollution sources under a Lifetime Operating Permit issued by the Illinois Environmental Protection Agency (IEPA). The permit Fermilab operated under in 2011, issued in September 2009, includes the following air pollution sources: 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, radionuclide emission stacks, a vapor degreaser at Industrial Building 3, a 2,200 horsepower standby diesel generator, the CDF and MIPP gas circulating systems, and the Cavity Processing Lab (CPL). Permit conditions require the monthly logging of fuel consumption for covered fuel combustion sources, solvent usage at the degreaser, and hours of operation at CPL. 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 2011, which provides an estimate of criteria pollutant emissions, was submitted to the IEPA in June 2012.

6.2 Penetrating Radiation

Operation of the Fermilab accelerator and associated beam-lines produce ionizing radiation such as neutrons and muons. Beam-lines 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 beam-lines in the past. Only the Meson Test beam-line (MTest) operated in a limited configuration in 2011. The maximum muon dose offsite due to the operation of MTest was 0.066 mrems. 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 beam-line 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 beam-line bends the beam down so that the muons produced are absorbed deep underground as part of the beam-line 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 2011 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 2011, it is estimated that radioactive materials stored at the Railhead contributed no directly measureable dose equivalent at the site boundary in 2011. The maximum penetrating radiation equivalent dose in 2011, to an individual at the nearest offsite house was thus estimated to be less than 0.066 mrems; and not directly measureable.

6.3 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 monthly 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.

6.3.1 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 due to losses 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 contains measurable concentrations of tritium and the primary source of the tritium comes from components within the tunnel. The water that is 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 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.

6.3.2 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 2011 there were no exceedances of discharge limits to waters of the state.

6.3.2.1 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 2011 Fermilab contracted a state-licensed applicator to treat cooling ponds for algae and pond weeds. The ongoing zebra mussel infestation of the industrial cooling water system pipes and pumping infrastructure was managed by FESS using a water treatment specialty company in 2011.

6.3.2.2 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 to confirm released radioactivity meet DOE guidelines. In 2011, 87,580 gallons of process wastewater were discharged to the Batavia sewer system. All effluent discharges were in compliance with the pre-treatment permit as well as specified levels in the Department of Energy Derived Concentration Guide for radionuclides. Effluents are also analyzed for tritium and other radionuclides. A total of 105.2 µCi of tritium and 17.3 µCi of 7Be were released to the sanitary sewer from the CUB during 2011. 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 2011. A new sewer sampler was purchased for the Batavia sampler and installed in August. Samples were taken August through December for 2011. The Warrenville sampler took monthly composite samples for 10 months in 2011.

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 subsequent years. Beginning in 2010, consistent tritium concentrations again were observed in the discharge, with a maximum concentration of 7.5 pCi/ml. In 2011 only limited data was available due to operational problems with sample collection equipment however measurable tritium was recorded during periods when equipment was operable. The highest level recorded from the Batavia autosampler in 2011 was 5.7 pCi/ml.

6.4 Groundwater Quality

The Illinois Environmental Protection Agency (IEPA) publishes groundwater quality standards (35 IAC 620) and defines Class I groundwater as a non-degradable resource, which is to be highly protected. Water residing in or near the Silurian dolomite bedrock aquifer, the upper surface of which is 50 to 80 feet below the ground surface at Fermilab, as well as water in the overlying Quaternary Batestown Member, is classified as Class I groundwater according to criteria published by the IEPA (35 IAC 620.210). Water in the Quaternary deposits overlying the Batestown has been demonstrated to be Class II water requiring less-stringent standards.

In 2011 four background monitoring wells, up-gradient to Fermilab operations, provided samples

representative of the upper Class I aquifer, for chemical and radionuclide analyses. 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 were removed from the RFI as a Solid Waste Management Unit; however, under the lab's environmental surveillance program, monitoring continues in the five wells in this region. For informational purposes, and as a courtesy, the results are reported to the IEPA annually. Additionally, seventy-eight piezometers (pore-water pressure measuring apparatus), and three site-specific monitoring wells, are employed to gather information on groundwater flow directions site-wide. These data are used in modeling the transport of potential contaminants from past and present operational areas of concern. The piezometers installed as part of the NuMI site characterization were monitored to assist Fermilab in planning for groundwater protection at that facility. One well is used to monitor for NuMI operational impacts to the Class I aquifer. Fermilab continued in 2011 to analyze groundwater associated with this project that resides within the Silurian dolomite aquifer.

Twenty eight of 108 on-site groundwater monitoring locations were sampled during the year for radionuclide and/or chemical analyses. The remaining locations were available exclusively for piezometric head (water level) monitoring.

6.4.1 Groundwater Characterizations

No groundwater characterizations were conducted in 2011.

6.4.2 Monitoring Well Modification and Abandonment Activities

There were no monitoring well modifications or abandonment activities during 2011.

6.4.3 Radionuclides in Groundwater

The Department of Energy groundwater concentration guide and the Illinois Class I groundwater standard for tritium is 20 pCi/ml. Twenty five samples were collected from ten locations for radionuclide analysis. Tritium and accelerator-produced radionuclides were not detected in any Class I groundwater samples during 2011.

6.4.4 Chemicals in Groundwater

In 2011, 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.)

7.0 Compliance with Specific Environmental Requirements

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

7.1 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 2011. The annual air emissions report for 2011 was submitted to the IEPA in June 2012 and the annual radionuclide emissions report was submitted to the USEPA in June 2012.

In 2011 the annual air emissions for Criteria Air Pollutants (carbon monoxide, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic materials), were all less than 30% of the emissions allowed by Fermilab's Lifetime Operating Permit, and most were less than 10% of the allowable emission limits.

In 2011 an estimated 139 Curies were released in conjunction with the operation of the Fermilab Anti-Proton Source stack and the MiniBooNE and NuMI stacks. The magnet debonding oven, a potential source of tritium, did not operate in 2011. 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 0.0326 mrem/year due to 2011 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.

7.2 Greenhouse Gas Emissions

40 CFR Part 98 is the Greenhouse Gas Mandatory Reporting Rule (MRR) and was originally published in October 2009. Certain source categories (of which Fermilab is not one) and facilities that emit >25,000 metric tons of carbon dioxide equivalent (CO2e) must report emissions to US EPA annually. Fermilab emitted just over 5,000 MT CO2e in 2011, and therefore was not required to report. NOTE: Emissions are calculated based on the MRR, and many of Fermilab's greenhouse gas emission sources are exempt from reporting (such as emergency back-up power generators).

In October 2009, Executive Order (EO) 13514 took effect and directed Federal agencies to account, report and reduce greenhouse gas (GHG) emissions using 2008 as the baseline year. In support of the Department of Energy's (DOE's) effort to comply, EO 13514 was added to the Fermilab contract. As a result, GHG data for fiscal year 2011 was collected and submitted to DOE via the CEDR report.

There are no exempt sources for EO 13514 as in the MRR. GHGs are divided up into three categories: Scope 1, Scope 2, and Scope 3. Scope 1 emissions are direct emissions from activities directly controlled by Fermilab (boilers, emergency generators, fleet vehicles, and fugitive emissions). Scope 2 emissions are indirect emissions and for Fermilab include only purchased electricity. Scope 3 emissions are other indirect emissions such as employee air travel, wastewater treatment, electrical transmission and distribution losses, waste, ground travel, and employee commuting. Fermilab's baseline data is shown in Table 1 and 2011 data in Table 2 below (units are metric tons of carbon dioxide equivalent).

FNAL GREENHOUSE GAS EMISSION SUMMARY - 2008

GHG Scope	Emission Source	CO2e MT
SCOPE 1	STATIONARY SOURCES	5007.75
	MOBILE COMBUSTION - CNG, Diesel	655.12
	MOBILE COMBUSTION - E85, E10, Biodiesel	649.44
	FUGITIVE EMISSIONS	36425.74
SCOPE 2	PURCHASED ELECTRICITY	418987.19
SCOPE 3	AIR TRAVEL - Employees	2215.82
	CONTRACTED WASTEWATER TREATMENT	221.72
	T&D LOSSES	9020.01
	WASTE	158.08
	GROUND TRAVEL	168.94
	COMMUTING	5016.14
TOTAL		**478,526**

Table 2: FNAL GREENHOUSE GAS EMISSION SUMMARY - 2011

GHG Scope	Emission Source	CO2e MT
SCOPE 1	STATIONARY SOURCES	5328.68
	MOBILE COMBUSTION - CNG, Diesel	92.54
	MOBILE COMBUSTION - E85, E10, Biodiesel	895.29
	FUGITIVE EMISSIONS	15020.35
SCOPE 2	PURCHASED ELECTRICITY	351119.24
SCOPE 3	AIR TRAVEL - Employees	2245.87
	CONTRACTED WASTEWATER TREATMENT	204.51
	T&D LOSSES	9495.18
	WASTE	223.29
	GROUND TRAVEL	122.30
	COMMUTING	5016.14
TOTAL		**389,763**

Fermilab has committed to reduce Scopes 1 and 2 emissions by 28% by 2020, and Scope 3 emissions by 13% by 2020. Fermilab intends to use renewable energy certificates based on our purchased power consumption as a primary mechanism to reduce Scope 2 emissions. In 2011, Fermilab's total GHG emissions were 389,763 MT CO2e. The reduction is coincidental with Fermilab operations.

7.3 Underground Storage Tanks

The three Underground storage tanks (USTs) in use at Site 38 Fuel Dispensing Facility were operated and maintained per current UST standards established by the USEPA (40 CFR 280); per the Illinois State Fire Marshal (Illinois Administrative Code, Title 41, Sections 170.510(a),170.510(b), 170.450, and 170.460); and per the conditions specified in the IEPA Lifetime Operating Permit-NESHAPs. In 2011, the US-EPA conducted a Compliance Evaluation Inspection (March), and also the Illinois State Fire Marshall conducted a Certification Audit (July) to determine compliance with the applicable regulations listed above. Both inspections found the facility compliant. The UST tanks and system continue to be inspected on a semi-annual basis by a qualified subcontracted vendor. The inspection activity ensures that the internal and external leak detection and sensors are functioning properly. There were no compliance issues identified in 2011.

7.4 The Endangered Species Act of 1973

No compliance issues were identified in 2011.

7.5 Executive Order 11988, "Floodplain Management"

No flood plain issues were encountered during 2011.

7.6 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 2011, three projects (MI-8 Expansion, Cryo-Module Test Facility, and New Muon Expansion Project) continued under the NPDES General Storm Water Permit for Construction Activities. One new project (OTE IARC Building) obtained coverage under this general permit in FY2011. Storm Water Pollution Prevention Plans (SWPPP) were prepared and submitted to IEPA for all projects.

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

In 2011, the use of pesticides and herbicides at Fermilab were handled in accordance with FIFRA.

7.8 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 2011 and an "Owners Maintenance Report was transmitted to the IDNR by DOE. No non-routine action items were identified during the 2011 inspection.

7.9 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 goose nests if they become a safety hazard. The permit allows the Lab to destroy up to ten nests each year. During 2011, two nests containing a total of 5 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 2011, and the goose clearing activities were carried out during March and April. The firm holds a valid permit from the Illinois Department of Natural Resources to pursue the activity.

7.10 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires federal agencies to evaluate their proposed actions to determine the potential effects on the quality of the human environment, which includes many different aspects of the natural environment, the built environment, and human health (see examples below).

Natural environment
- water resources
- air quality
- biological resources
- soils, geology, and mineral resources
- visual, scenic, or aesthetic resources

Built environment
- traffic and transportation
- noise
- historic and cultural resources
- land use conflicts
- agricultural resources
- population and housing impacts
- recreation
- utilities and public services

Human health
- risk of damage from natural disasters
- risk of exposure to hazardous materials, wastes, and activities
- risk of contracting diseases)

In addition, the Council on Environmental Quality and DOE NEPA regulations as well as DOE Order 451.1 prescribe an evaluation process to ensure that the proper level of review is performed before a commitment of resources is made. During 2011, Fermilab met the NEPA requirements by continuing to implement a program to review all proposed activities and evaluate their potential effects; this program is set forth in the *Fermilab Environment, Safety and Health Manual* (FESHM) Chapter 8060 – *National Environmental Policy Review.* Most of the reviewed activities were considered minor actions requiring no formal documentation (found in 10 CFR 1021 Appendix A) or those fitting within the list of DOE preapproved Fermilab site wide categorically excluded routine maintenance activities. However, 7 projects/actions did need to be addressed by submitting environmental evaluation notification forms to DOE; DOE then formally determined that the projects were 'Categorically Excluded' (see definition below) per 10 CFR 1021 Appendix B or were within the scope of a previous environmental assessment. These determinations, including that for the Micro Booster Neutrino (MicroBooNE) Experiment, are posted on the DOE Fermi Site Office website.

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 (EA)* 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. An EA is conducted to determine whether the proposed Federal action would have a significant effect. An *Environmental Impact Statement*, which is a detailed public document, is necessary for those actions which are assumed to significantly affect the human environment.

7.11 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 2011 to assess any potential impacts on historic resources. No compliance issues were identified in 2011.

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 March of 2011

7.12 National Pollutant Discharge Elimination System (NPDES)

The IEPA has issued Fermilab two National Pollutant Discharge Elimination System (NPDES) permits that were active in 2011. In addition, Fermilab holds three industrial wastewater pretreatment operating permits issued by IEPA (also covered under NPDES regulations). The permits are listed below.

1. General NPDES Storm Water Permits for Construction Activities covers several facilities that have the same type of discharge and are located in a specific geographic area: In 2011 there were eight projects requiring such a permit to be in place as follows:

    - New Muon Lab Expansion
    - MI-8 Expansion
    - Cryo-module Test Facility (CMTF)
    - ICW Sectionalization Project
    - FCC and IASU Sanitary Sewer Project
    - A1 to CDF Paving Project
    - Industrial Area Site Upgrades Project

    The permit for one of the above projects, the FCC and IASU Sanitary Sewer Project, was received during the year. No permits were terminated during 2011.

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.

Pretreatment Permits

1. 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.

2. 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.

3. Individual industrial wastewater pretreatment permit that allows for metal finishing wastewater from the Technical Division's village operations to be discharged to the City of Naperville Reclamation Plant.

7.13 Resource Conservation and Recovery Act of 1976 (RCRA)

The Annual Hazardous Waste and Illinois Generator Non-Hazardous Special Waste Reports for 2011 were transmitted to the DOE Fermi Site Office in January and February 2012 respectively. DOE subsequently submitted these reports to IEPA.

7.13.1 Regulated Waste Disposal and Reclamation

The following volumes of regulated waste including radioactive waste and non-radioactive waste were managed for disposal by Fermilab's Hazard Control Technology Team (HCTT) 2011.

Waste Material	Cubic Meters
Non-Routine Hazardous Waste (RCRA + TSCA)	8.8
Routine Hazardous Waste (RCRA + TSCA)	6.6
Non-Routine Non-Hazardous Special Waste	2.2
Routine Non-Hazardous Special Waste	64.0
De-Classified Special Wastes	8.5
Dumpster/Landfill Waste	6,882
Radioactive Waste (DOE regulated)	27.1

In addition the following volumes of waste were generated by Fermilab and managed for reclamation by the HCTT 2011.

Waste Material	Kilograms
Lead Acid Batteries	8,980
Mercury Containing Lamps	3,765
Used Oil	16,656
Ethylene Glycol and Water	1,130
Petroleum Based Parts Washer Solution	2,027
Non PCB Fluorescent Light Ballasts	317
Automotive Auto Filters	272
Universal Waste Batteries	185
Mercury Containing Equipment	13

7.13.2 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 2011.

IB2 Industrial Building

No new information was requested or generated at this unit during 2011.

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 monitoring wells installed at this unit. All ten monitoring wells at SWMU 12 were sampled during the 2nd and 4th quarters of 2011.

Glacial deposit wells MWS2, MWS3, and MWD1 produced 2nd quarter total chloride results of 273 mg/L, 214 mg/L, and 800 mg/L, respectively. Likewise, the same three wells produced 4th quarter total chloride results of 610 mg/L, 219 mg/L, and 640 mg/L, while the Class II Groundwater Quality Standard is 200 mg/L.

Bedrock wells MW6B and MW7B produced 2nd quarter total lead results of 0.008 mg/L and 0.052 mg/L, respectively, and during the 4th quarter, MW7B had a total lead concentration of 0.033 mg/L. The Class I Groundwater Quality Standard is 0.0075 mg/L.

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. All ten of the monitoring wells at SWMU 13 were sampled during the 2nd and 4th quarters of 2011.

Statistical analyses demonstrated no concentrations above the 99% Upper Confidence Limits during the 2nd quarter; however, during 4th quarter sampling, well G104 produced a dissolved N-Ammonia concentration of 0.41 mg/L. This is in excess of the 99% Upper Confidence Limit of 0.19 mg/L. The elevated concentration is attributed to agricultural and faunal activities. Additionally, during both the 2nd and 4th quarters well G107 samples had dissolved chloride concentrations of 253 mg/L and 294 mg/L, respectively. These concentrations exceed the Class II Groundwater Standard of 200 mg/L. Road-salt is the accepted origin.

Railhead Storage Yard (SWMU 14)

No information was requested or generated at this unit during 2011.

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 2011.

7.14 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.

7.15 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. In 2011, Fermilab prepared a Toxic Chemical Release Inventory Report (TRI) for the release of ethylene glycol. The report will be filed with the USEPA and IEPA in June 2012. Ethylene glycol is the only chemical that breached the reporting thresholds. Fermilab released 3,700 pounds of ethylene glycol that was shipped to Recycle Technologies Inc. in Wood Dale, IL for reclamation.

As required by Section 312 of SARA Title III, Fermilab submitted a Tier II Emergency and Hazardous Chemical Inventory (2011) to state and local emergency services and disaster agencies in February 2012.

7.16 Oil Spill Prevention

Fermilab's Spill Prevention Control and Countermeasures (SPCC) Plan is in compliance with 40 CFR 112 – Oil Pollution Prevention. This US EPA-enforced 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 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 describe the SPCC Plan. FESHM 8031 – Oil Pollution Prevention was approved in March 2010. 131 individuals were trained in 2011. Training must be repeated annually according to the regulation. Online refresher training was developed and implemented in 2011.

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 work to ensure the oil sources owned by their organizations are in compliance (provided with secondary containment, inspected as required, etc.).

Due to changes in oil sources, the SPCC Plan needed to be re-certified by a Professional Engineer as meeting the requirements of the regulation. The P.E. certification occurred in December 2010, and in January 2011 the plan was approved by the Fermilab Directorate (Chief Operating Officer and ES&H Director) and the DOE-Fermi Site Office Manager.

7.17 Toxic Substance Control Act (TSCA)

Beginning in 1993, the Accelerator Division conducted a phased cleanup of polychlorinated biphenyl (PCB)-contaminated soil resulting from past management practices at the transformer yards associated with various Tevatron service buildings. The soil cleanup activities were completed in 2002. Although the soil at all locations met the applicable cleanup standard, 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. Groundwater that could be collected from the excavations was properly disposed of prior to closing them. However, because some contaminated water potentially remained in the ground, these locations could not be declared "clean" at that time. Additional groundwater sampling activities conducted in July 2003 failed to detect groundwater at B1, but confirmed the presence of contamination at levels slightly above the standards at B4.

When PCB-contaminated groundwater is encountered during an owner-conducted cleanup, EPA regulations require the owner to consult with the Agency, which then decides, 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." EPA granted this request on February 23, 2010, but attached some conditions to its approval. Fermilab was required to place a notice to the deed identifying the location of the contaminated groundwater and indicating that its use is restricted. Fermilab assisted DOE-FSO in accomplishing this (completed in June). EPA's approval also requires that the Agency be notified 10 days prior to any excavation in the vicinity of the contaminated groundwater and, if groundwater is encountered, it must be sampled, with results reported to EPA. Several internal mechanisms have been created to ensure that these requirements are met, including placing signs at the affected locations, adding the locations to the Geographic Information System, and modifying ES&H review procedures. In 2011 Accelerator Division continued its program to phase out use of PCBs when opportunities arise.

8.0 Pollution Prevention and Waste Minimization

Fermilab continued to make progress minimizing waste prior to generation and reducing pollution in 2011. In 2011, Fermilab recycled 797 tons of material through a combination of office/ residential type recycling, Business Services Section recycling of scrap metals, wood, tires, etc., and construction waste recycling. This number does not include electronics. Fermilab recycles or donates for reuse, 100% of used computer equipment. Approximately 1093 pieces of computing equipment including servers, printers, laptops, monitors, etc. were recycled in 2011. Another 174 were donated for reuse through DOE's computers for learning program.

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 87 tons of construction waste was recycled from all projects (large and small) in 2011, 82% of the material placed in the dumpsters.

There were no new purchases of vehicles in FY 2011. The fleet was reduced by 15% or 24 vehicles to an inventory of 195 vehicles.

All printers connected to a server were set to duplex print by default in 2011, reducing paper use.

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 2011. 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.

9.0 Metals Release Suspension

In 2011, the DOE Office of Science reviewed the materials and radiological clearance operations at Fermilab. The review was intended to evaluate how Fermilab has implemented the Secretarial policies, review what improvements were made within the recycling program since the suspension went into effect and what the financial impact to the site was as a result of the suspension. The overall goal of the review was to determine if Fermilab could make adjustments in its current practices that improve the management of scrap metal, while maintaining compliance with the suspension. The review team found that Fermilab is in compliance with the current DOE policy relating to the Secretarial mandates dealing with the suspension on metals recycling, and provided Fermilab with a number of helpful recommendations to improve management of the scrap metal program.

The review team recommended that Fermilab adhere to the strict Federal regulation definition of a Radiological Area in application of the scrap metal recycling suspension.

Fermilab, with concurrence from the Site Office, has instituted a corrective action plan that addressed the recommendations of the team.

As of May 1, 2012, materials that have been determined to not be radioactive that originate from a posted Radioactive Materials Area are no longer subject to the suspension and can now be designated as 'Group 1' on the Material Move Request (MMR). Materials that originate from radiological areas remain subject to the metals recycling suspension until further notice.

10.0 Conclusion

The operations at Fermilab during 2011 had no significant adverse impact on the environment or on public safety.

Footnotes

[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 following the link to the Ecological Land Management Committee under *Nature/Ecology*.