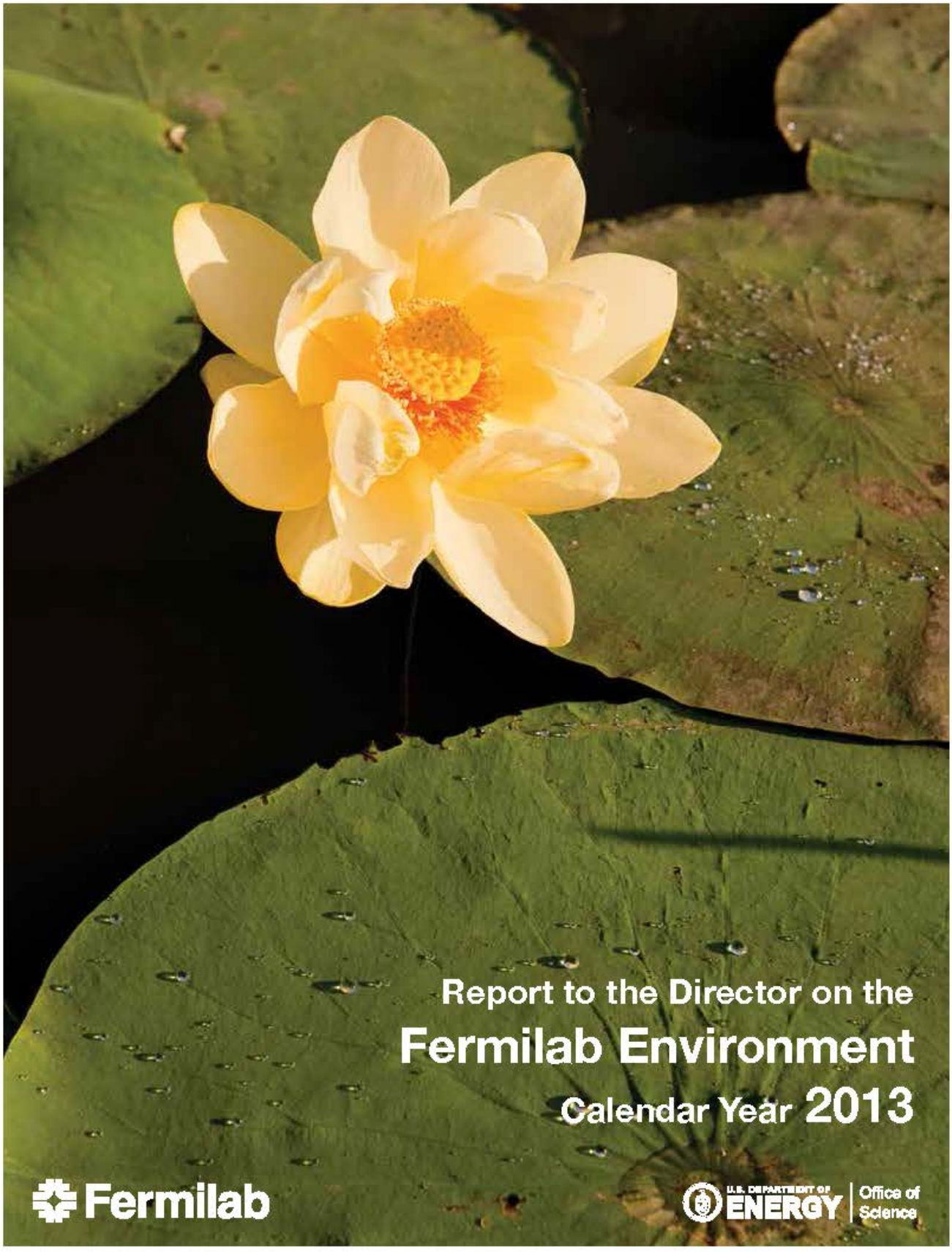

Report to the Director on the Fermilab Environment Calendar Year 2013

Fermilab

U.S. DEPARTMENT OF ENERGY | Office of Science

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1.0 Introduction

This Report to the Director on the Fermilab Environment documents the performance of Fermilab's environmental protection program. The report presents the status of environmental objectives and documents the compliance status of environmental requirements under the scope of Fermilab's Environmental Management System (EMS). The laboratory has maintained certification for the EMS to the ISO 14001 standard since 2007. The EMS provides Fermilab a practical framework from which to assess and manage the environmental impacts of site operations.

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. 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.

The Fermilab site consists of 6,800 acres of mixed use land. The primary features of the site include the accelerator complex including associated infrastructure, an interconnected industrial cooling water system, the Village, row crop agriculture and natural areas in various states of restoration consisting primarily of tall grass prairie, forest, and wetlands. Fermilab is America's particle physics laboratory, with a mission to drive discovery in particle physics encouraging pioneering research by operating world class accelerators and detector facilities. Fermilab has been operated by Fermi Research Alliance LLC, (FRA) since 2007.

2.0 Summary of Significant Environmental Issues

Federal Sustainability Goals
In 2013 Fermilab issued its Site Sustainability Plan. This plan outlines the laboratory's progress towards achieving goals the Department of Energy has committed to in its Strategic Sustainability Performance Plan, as required by Executive Order 13514. This Order commits the federal government to measure, manage and develop a strategy to reduce its own greenhouse gas (GHG) emissions. In addition agencies must increase energy efficiencies, reduce fleet petroleum consumption, conserve water, and reduce waste. The GHG emission reduction goals have long term targets that mature in 2020, with other related goals having shorter time frames. Fermilab's sustainability progress is summarized in additional sections in this report.

Sulfur hexafluoride (SF6) Release
Fermilab uses the electrical insulating gas SF6 in various pieces of experimental equipment. SF6 is a strong greenhouse gas. In 2013 a plan was initiated to recover gas no longer needed in the Pelletron, the laboratory's largest source of SF6. Due to a series of missteps and miscommunications the subcontractor performing the recovery inadvertently released 1,400 pounds of SF6 and recovered only 600 pounds of SF6. Subsequent to the incident Fermilab developed a series of lessons from the incident applicable to future SF6 operations and has shared our experience with other facilities and the Department of Energy.

Tritium Discharges
The generation of tritium is an expected outcome of operating the accelerator complex and it has been monitored throughout the history of the laboratory. Detectable amounts of tritium have been observed in surface water discharges from the site since 2005 and Fermilab maintains permits to release tritium from regulated points. Additionally Fermilab monitors the sanitary effluent discharged from the site to the municipal

waste water treatment plants of Batavia and Warrenville/Naperville. Over the past several years low concentrations of tritium have been observed in the discharge to Batavia.

In response to the persistence of observable tritium and the expectation that future operations will generate additional tritium, the Fermilab Director formed a Tritium Working Group in July 2012. The charge to the working group consisted of four primary tasks:

1) Identify tritium sources at Fermilab, with particular attention to those that could lead to tritium within the sanitary sewers;

2) Project tritium sources into the upcoming era in which beam power delivered to the neutrino production targets will rise;

3) Prepare and execute a public communications plan;

4) Establish longer term goals for tritium concentration in surface and sanitary sewer waters, and accompanying mitigation strategies and monitoring programs.

In February 2013 the working group issued a Phase 1 Report outlining progress towards the tasks. The report identifies potential sanitary system tritium sources, most notably a significant source at the Central Utilities Building. This source underwent mitigation measures that were completed in January. In addition future tritium source terms have been identified and a tritium website has been developed to inform stakeholders about tritium at Fermilab.

For a significant portion of 2013 the accelerator complex was shut down. This had a direct impact on tritium by reducing the concentrations found in surface water and in the sewer system. Upon start-up of the accelerators, in late fall measurable tritium was again detected in the discharges to the Batavia sanitary sewer. The working group remains focused on a clear understanding of tritium sources and additional investigations are planned for 2014.

3.0 Ecological Issues

The Director of Fermilab established the Ecological Land Management (ELM) Committee to recommend management practices based on sound ecological principles that enhance the natural resources of the Laboratory. The ELM committee, in conjunction with FESS Site Services and Roads & Grounds, oversees the management of nearly 2,500 acres of natural areas which include 1,000 acres of tall grass prairie plantings, oak savannas, open-water marshes, wetlands, and forests. The primary goal is to increase biodiversity of native flora and fauna while enhancing functional services of these ecological systems. This type of site stewardship includes prescribed burning, controlling invasive species, monitoring threatened & endangered species, surveying plants and wildlife and collecting seed from over 250 native species to spread into recently restored areas. Some of this work is carried out by trained natural areas volunteers that are provided by Fermilab Natural Areas 501(c)(3).

Fermilab manages wildlife resources to preserve the Fermilab ecosystem while still conducting the primary mission of the Laboratory. The Lab has a Nuisance Animal permit issued by the Illinois Department of Natural Resources (IDNR) that allows for the trapping and elimination of nuisance animals. During 2013, 25 complaints were received, resulting in the transfer and release of 11 animals on site. One animal was euthanized. Fermilab manages the population of whitetail deer on site to preserve the ecosystem by contracting annually with the U.S. Department of Agriculture Wildlife Services Group to reduce the herd to an optimum number. This activity requires approval and permitting from IDNR; during 2013, 46 whitetail deer were removed.

4.0 Sustainability

Fermilab is committed to minimizing the environmental impact of site operations. In response to goals established by the Department of Energy to improve the department's environmental footprint, Fermilab has developed a Site Sustainability Plan that documents the laboratory's contribution towards meeting the goals.

The primary emphasis of the plan is on the reduction of greenhouse gas (GHG) 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 and Fermilab's status in 2013 is provided below.

Goal #	DOE Goal	Fermilab Performance Status through FY2013	Planned Actions & Contribution	Risk of Non-attainment
GOAL 1: Greenhouse Gas Reduction and Comprehensive Greenhouse Gas Inventory				
1.1	28% Scope 1 & 2 GHG reduction by FY 2020 from a FY 2008 baseline (2013 target:17%)	67% reduction in FY2013 due to accelerator shutdown	Use RECs to meet this goal after shutdown ends in FY2014	Low
1.2	13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline (2013 target:4%)	Met goal for T&D losses using RECs	Must use credit for RECs to meet T&D portion of this goal	Medium (for non-T&D portions of this goal)
GOAL 2: Buildings, ESPC Initiative Schedule, and Regional & Local Planning				
2.1	30% energy intensity (Btu per gross square foot) reduction by FY 2015 from a FY 2003 baseline (2013 target:24%)	25% reduction in FY2013 due to implementation of accelerator upgrades	Use new ESPC and resume normal accelerator operations	Low
2.2	EISA Section 432 energy and water evaluations	Completed through ESPC PA process	Use ESPC PA process every 4 years	Low
2.3	Individual buildings metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (by October 1, 2015) 1 (2013 target: 90% and 50%, respectively)	All metering categories above 90% except natural gas	Will continue to implement natural gas metering on new buildings	Low (except for natural gas)
2.4	Cool roofs, unless uneconomical, for roof replacements unless project already has CD-2 approval. New roofs must have thermal resistance of at least R-30.2	Added over 13,000 sq. ft. in FY2013	Will continue to assess the cost-effectiveness of cool roofs	Low
2.5	15% of existing buildings greater than 5,000 gross square feet (GSF) are compliant with the Guiding Principles (GPs) of HPSB by FY 2015 (2013 target:11%)	No existing buildings meet 100% of GPs	In FY 2014, Fermilab will add two buildings compliant with GPs. Plan to have a total of four (26%) by the end of FY2015.	High (Financial risks)
2.6	All new construction, major renovations, and alterations of buildings greater than 5,000 GSF must comply with the GPs[3]	OTE Building designed as LEED	OTE completed in 2014; All new construction subjected to GP review	Medium

[1] Per NECPA (42 U.S.C Section 8253) the term "buildings" includes industrial, process, or laboratory facilities
[2] Secretary of Energy Chu, Installation of Cool Roofs on Department of Energy Buildings, Memorandum for Heads of Departmental Elements, June 1, 2010.
[3] DOE considers buildings meeting the following criteria as complying with GPs: Any building that achieves LEED-EB Silver or higher or LEED-NC Gold or higher; Any building that achieves a Green Globes-NC rating of four or a Green Globes CIEB rating of three; Any building that has been occupied for more than one year that achieves Living Status designation by the Living Building Challenge (although included as policy in the 2012 SSPP, these equivalencies are contingent upon OMB and CEQ approval).

Goal #	DOE Goal	Fermilab Performance Status through FY2013	Planned Actions & Contribution	Risk of Non-attainment
GOAL 3: Fleet Management				
3.1	10% annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline (2013 target:114% cumulative since 2005)	90% increase in alternative fuels	Plan to attain 100% by FY2015	Low
3.2	2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline (2013 2% annual reduction in fleet petroleum consumption target)	Goal is met	Continue current practices	Low
3.3	100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter (75% FY 2000 – 2015) [4]	Goal is met. 100% of purchases in FY2013 were AFV	Continue policy of purchasing AFV	Low
3.4	Reduce fleet inventory of non-mission critical vehicles by 35% by FY2013 relative to a FY 2005 baseline	Goal is met.	Continue to review the utilization of the existing fleet.	Low
GOAL 4: Water Use Efficiency and Management				
4.1	26% potable water intensity (Gal per gross square foot) reduction by FY 2020 from a FY 2007 baseline (2013 target:12%)	Exceeded goal	Maintain usage less than 2020 goal	Low
4.2	20% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY 2020 from a FY 2010 baseline (2013 target:6%)	Used 6.1% less than the baseline year	Use ESPC to investigate measures to retain more storm water	High
GOAL 5: Pollution Prevention and Waste Reduction				
5.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY 2015	Goal is met. 75% of waste diverted in FY2014	Continue recycling programs.	Low
5.2	Divert at least 50% of construction and demolition materials and debris by FY 2015	Goal is met. 86% of C&D waste recycled in FY2014.	Continue recycling programs	Low
GOAL 6: Sustainable Acquisition				
6.1	Procurements meet requirements by including necessary provisions and clauses (Sustainable Procurements / Biobased Procurements)	Awareness training and website instituted in FY2013	Continue to apply SA requirements where appropriate.	Low

[4] EPAct 1992 goal updated per Presidential Memorandum on Federal Fleet Performance on May 24, 2011. http://www.whitehouse.gov/the-press-office/2011/05/24/presidential-memorandum-federal-fleet-performance

Goal #	DOE Goal	Fermilab Performance Status through FY2013	Planned Actions & Contribution	Risk of Non-attainment
GOAL 7: Electronic Stewardship and Data Centers				
7.1	All data centers are metered to measure a monthly Power Utilization Effectiveness (PUE) of 100% by FY 2015 (2013 target: 80%)	Goal is met	Continue	Low
7.2	Maximum annual weighted average PUE of 1.4 by FY 2015 (2013 target:1.60)	Current PUE between 1.4 and 1.7	Plans underway to improve efficiency and use ESPC	Low
7.3	Electronic Stewardship - 100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY 2012	72%	Windows XP Operating system is being replaced in order to allow power management. New equipment is compliant.	Low
Goal 8: Renewable Energy				
8.1	20% of annual electricity consumption from renewable sources by FY 2020 (2013 target:7.5%)	Exceeded goal	Must use RECs to meet this goal while investigating cost effective RE	Low
Goal 9: Climate Change Adaptation				
9.1	Climate Change Adaptation - Address DOE Climate Adaptation Plan goals (See Appendix C)	Considering a plan to conduct a preliminary high-level assessment of potentially major site-specific vulnerabilities to climate change by 2015		

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 minimize environmental impacts. 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 to demonstrate 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 ESH&Q Management System to form a combined 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 the ISO 14001 standard since August 2007. ISO requires re-registration to the standard every three years. Fermilab successfully completed a comprehensive third party audit of the entire facility and became re-registered to the standard in July 2013.

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.

As part of the EMS, Fermilab routinely evaluates its operations and seeks to improve environmental performance. The Laboratory's significant environmental aspects have been identified and were reviewed in 2013. 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 Plan document areas of significant emphasis where the laboratory is pursuing change.

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 ESH&Q Section, provides more details.

6.1 Air Quality

Fermilab is not a significant source of chemical air pollution and is registered with the IEPA's Registration of Smaller Sources (ROSS) program. This is a relatively new program from IEPA and is available to facilities that emit only minor amounts of air pollution.

6.1.1 Radioactive Air Emissions

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 and in design efforts for new projects. 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. Fermilab has declared in its air permit application to the IEPA 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 (CAP88PC Version 4.0). 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.

In 2013 the accelerators and the experiments operated only during the last quarter of the calendar year. Operation of the debonding oven, when radioactive components are being burned, is a potential source of tritium. In 2013 the debonding oven burned nineteen radioactive cones, removed from the Booster Radio-Frequency (RF) Cavities. The Muon-Ring (formerly the Anti-Proton Area) stack, used in occasional muon production tests, Main Injector, SeaQuest experiment (E-906), the MiniBooNE and NuMI stacks are estimated to have released a total of approximately 24.7 Curies in 2013. These radioactive air emissions were approximately 1.2% of the annual average (2000 Curies) expected from operations as acknowledged in the air pollution permit application on file with the IEPA. No detectable levels of airborne radionuclides reached the site boundaries. Doses to the public from emissions in 2013 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-88PC Version 4.0, Gaussian dispersion model, the highest dose equivalent to any member of the public was estimated to be 0.0053 mrem.

Fermilab's 2013 Radionuclide Air Emissions Annual Report will be submitted to the DOE FSO in May 2014. The report is distributed by the DOE FSO to the USEPA and IEPA.

6.1.2 Non-Radioactive Air Emissions

In 2013 Fermilab continued to operate under the ROSS program. Registration for ROSS is required for facilities such as Fermilab that emit air pollution in very minor amounts. Even though Fermilab no longer operates under a Lifetime Operating Permit it continues to monitor the sources named in this permit. Managing the sources according to the former permit allows Fermilab to demonstrate compliance with the conditions under the ROSS program. This also allows for continuity in the event that Fermilab returns to being a permitted source. The sources Fermilab continues to monitor include the following:

1. Magnet debonding oven;
2. One 15 mmBTU and one 11.55 mmBTU natural gas-fired boilers at the Central Utility Building (CUB);
3. One 12,000-gallon gasoline storage tank with a stage 1 and stage 2 vapor balance system;
4. Various radionuclide emission stacks;
5. 2,200 horsepower standby diesel generator;
6. Cavity Processing Lab (CPL).

6.2 Penetrating Radiation

Operation of the Fermilab accelerator and associated beamlines produces 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. Only the Meson Test beamline (MTest) and Neutrino Muon beamline (E906) operated in a limited configuration in 2013. The maximum muon dose offsite due to the operation of MTest and E-906 was 0.026 mrems. 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 2013 by a large ionization chamber located in the Railhead colloquially called a 'Hippo.' The Hippo measurements are supplemented by a number of environmental dosimeters placed around the storage area and by periodic onsite surveys. Based on measurements made in 2013, it is estimated that radioactive materials stored at the Railhead contributed no directly measureable equivalent dose at the site boundary in 2013. The maximum penetrating radiation equivalent dose in 2013 to an individual at the nearest offsite house was thus estimated to be less than 0.026 mrems, and not directly measureable.

6.3 Surface Water Quality

Fermilab releases minor amounts of contaminants to surface water bodies. To manage these discharges the laboratory holds National Pollutant Discharge Elimination System (NPDES) permits that govern releases to surface water from stormwater runoff, cooling water, effluents from various onsite construction projects, and pesticide applications. 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 described in the Fermilab Environment, Safety, and Health Manual Chapter 8025.

6.3.1 Cooling Water System

Fermilab requires large amounts of non-contact cooling water that is circulated through various surface water bodies to dissipate heat. Fermilab's site-specific NPDES permit authorizes the treatment of the Industrial Cooling Water system (ICW) and the discharge of commingled cooling water and storm water runoff to surface waters through outfalls to Kress, Indian and Ferry Creeks. The outfalls are points that designate the location at which cooling water becomes Waters of the State. A Storm Water Pollution Prevention Plan required by this NPDES permit covers storm water discharges into cooling waters from designated solid waste management units (SWMUs), industrial activity areas, and services support areas. (Also see Section 7.12 National Pollutant Discharge Elimination System.)

In 2013 Fermilab contracted a state-licensed applicator to treat a limited number of ponds for algae and pond weeds by applying herbicide. An ongoing zebra mussel infestation of the ICW system pipes and pumping infrastructure was managed by FESS using a continuous feed of NaClO (sodium hypochlorite) solution at the Casey's Pond intake to the ICW system.

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 2013 there were no exceedances of discharge limits from the site.

6.3.3 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 water contact with 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 2013 Fermilab continued to discharge measureable concentrations of tritium to surface waters off site. The concentrations measured were well below the DOE Order 458.1 Derived Concentration Standard of 1,900 pCi/ml. Releases depend on pond levels and the operational mode of the accelerator complex. Fermilab's site-specific NPDES permit includes monitoring requirements for tritium at all six outfalls. Monthly data from measurements taken at site boundary locations are made available to all through the Tritium at Fermilab website. Monitoring for radioactivity in surface water continues to be a primary component of Fermilab's routine environmental surveillance program.

6.3.4 Releases to Sanitary Sewers

Fermilab maintains an onsite piping system for the conveyance of sanitary effluent. This effluent is directed to the cities of Batavia and Warrenville/Naperville for treatment. In addition Fermilab operates three systems that require pretreatment prior to release to the sewers. These operations require wastewater pretreatment permits issued by IEPA. The permits are as follows.

1. Individual industrial wastewater pre-treatment permit that allows Fermilab to discharge wastewater effluent from deionized water regeneration 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 metal finishing wastewater from the Technical Division's Cavity Processing Laboratory 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. Discharges covered under this permit have not occurred since the permit was issued in 2011.

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 for metals are compared to municipal discharge limits to track compliance. Fermilab exceeded the limits for iron released to Warrenville in the months of August and September. Aging pipes are suspected to be the source of the occasional exceedances. These exceedances have been discussed with the municipalities.

Low levels of tritium have been detected in effluent discharged to the Batavia treatment works since August 2005. All discharges in 2013 were well below DOE Order 458.1 Derived Concentration Standards (total tritium 5 curies, concentration less than 9,500 pCi/ml) and are summarized below. No other isotopes were detected.

Total Tritium	**0.089 Curies**
Average Concentration	0.8 pCi/ml
Highest Concentration	2.3 pCi/ml
Total Sanitary Volume	28,915 kGal

In 2012 a focused effort was undertaken by the Tritium Working Group (see Section 2.0) to identify tritium sources discharging to the Batavia sanitary sewer system. These efforts resulted in the identification of a previously unidentified source that contributed a constant supply of ICW water containing tritium to the sewers at the Central Utilities Building. A plan was implemented in late fall to reroute this source away from the sewers. Testing continues to determine the impact of these changes to the system. The annual total tritium in 2013 was 0.445 Curies. The accelerator complex maintenance and improvements shutdown and the change implemented at the CUB have contributed to a decrease in tritium released in 2013.

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 dolostone bedrock aquifer, the upper surface of which is 50 to 80 feet below the ground surface in the Joliet Formation at Fermilab (Figure 6.4-1), as well as water in the overlying Batestown Member, is classified as the top of Class I groundwater. Water in the glacial deposits overlying the Batestown has been demonstrated to be Class II water requiring less-stringent standards.
The locations of groundwater monitoring wells are shown in Figure 6.4-2, with approximate screen depth intervals for wells related to sampling programs illustrated in Figure 6.4-1. In 2013 ten glacial and Silurian dolostone (Joliet Formation) monitoring wells at the Central Utility Building (CUB) Pipe and Clay Tile Field and eight glacial wells 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, sampling continues in the five Joliet Formation wells in this region. For informational purposes, and as a courtesy, the results are reported to the IEPA annually. Four background wells (Joliet Formation) were sampled to assess tritium levels at the upgradient (north) edge of the laboratory property and one Joliet Formation well was sampled to assess tritium levels near the NuMI Target Hall. An additional 124 wells with various screen depth intervals (Figure 6.4-2) are used as piezometers (pore-water pressure measuring apparatus) to gather information on groundwater flow directions site-wide. These data are used in conceptualizing the horizontal and vertical transport of potential contaminants from past and present operational areas of concern.

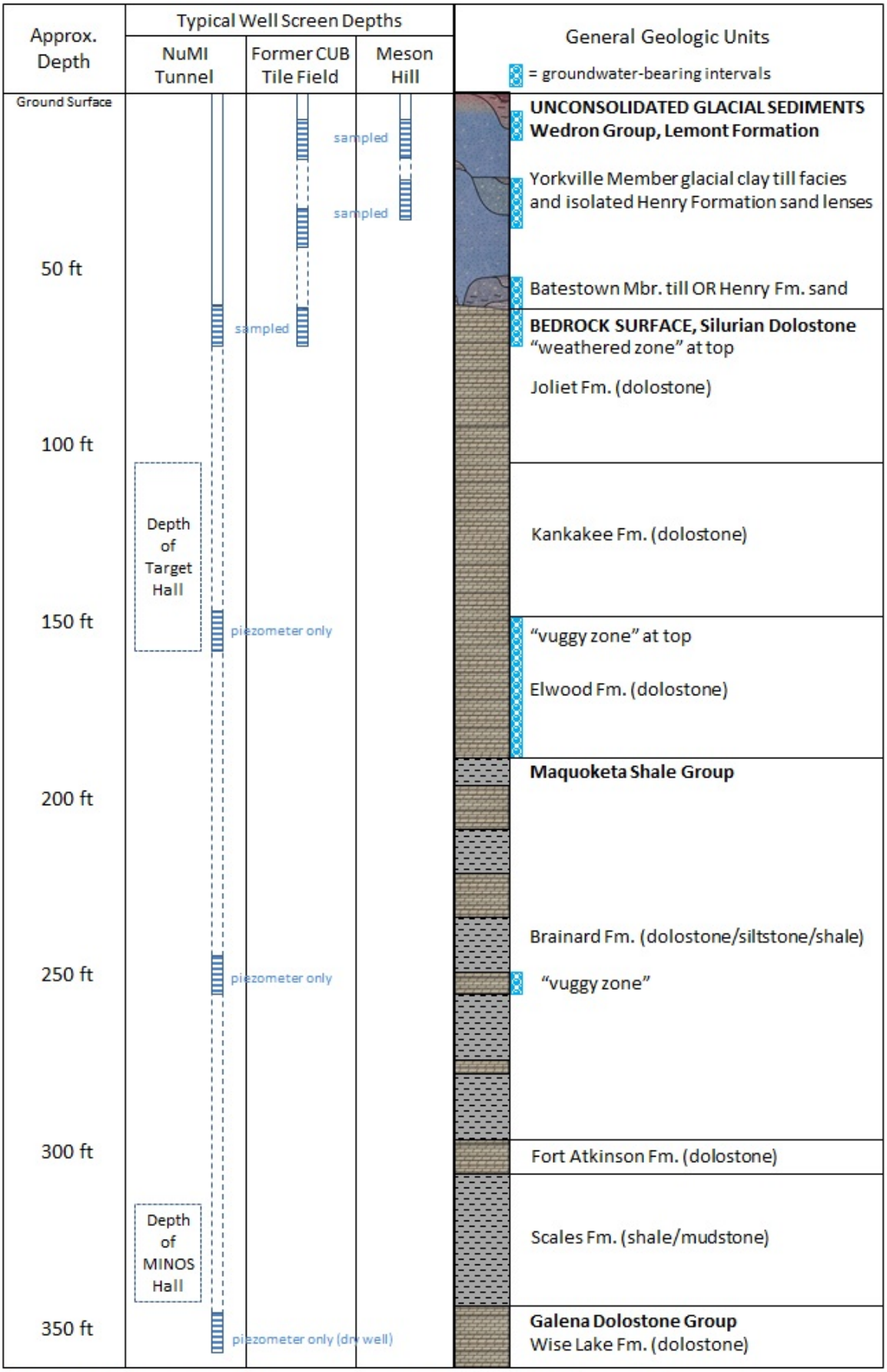

Figure 6.4-1. General Fermilab geologic section (based on NuMI Tunnel), with groundwater monitoring well screen depths and groundwater-bearing intervals. Sample/piezometer status is for 2013 only.

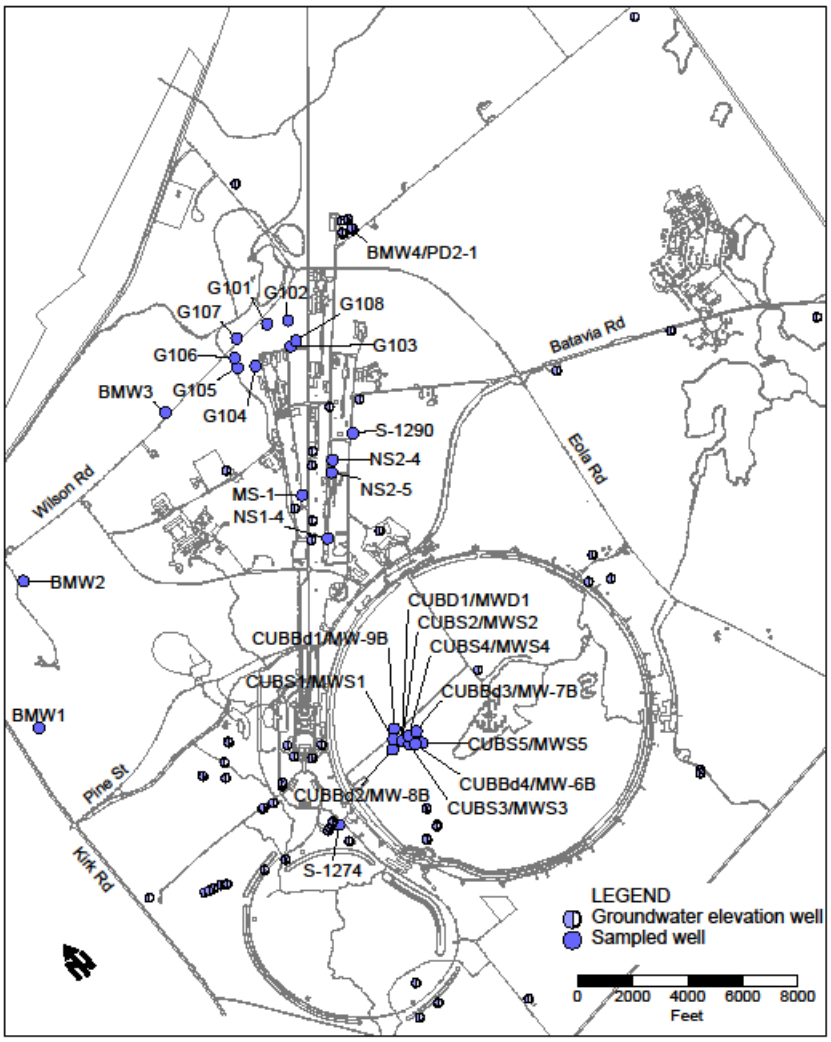

Figure 6.4-2 - Groundwater monitoring well locations. Sampled wells represented by labeled, filled circles. Wells used solely for groundwater elevation measurements represented by half-open circles. (Original DUSAF projection.)

6.4.1 Radionuclides in Groundwater

The Department of Energy policy on groundwater protection as expressed in DOE O458.1 is consistent with the Illinois Class I groundwater standard of 20 pCi/ml. Twenty six samples were collected from ten locations for radionuclide analysis. Tritium and accelerator-produced radionuclides were not detected in any Class I groundwater samples during 2013.

6.4.2 Chemicals in Groundwater

In 2013, 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 7.13.2 RFI Activities.)

7.0 Compliance with Specific Environmental Requirements

The following sections are a summary of Fermilab's 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 2013. The annual air emissions report for 2013 was not required due to Fermilab's registration as a ROSS source. The annual radionuclide emissions report was submitted to the USEPA in June 2014.

In 2013 the actual annual air emissions for Criteria Air Pollutants (carbon monoxide, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic materials), were 2.92 tons per year, much less than the maximum allowed for a ROSS site.

Doses to the public from radioactive emissions in 2013 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. In 2013 an estimated 24.7 Curies were released from various sources (see section 6.1.1 Radioactive Emissions). 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 0.0053 mrem/year in 2013.

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.

In 2013 Fermilab did not exceed reporting thresholds under the U.S EPA's Mandatory Greenhouse Gas Reporting Rule.

7.2 Greenhouse Gas Emissions Reporting under Executive Order 13514

In 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 2013 was collected and submitted to DOE via the Consolidated Energy Data Report. GHGs are divided up into three categories: Scope 1, 2, and 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 below. FY2012 and FY2013 emissions are also shown. The performance status indicates that Fermilab has made a 62.7% reduction in Scopes 1 and 2 emissions over the baseline year. A primary factor in the reductions over the past 2 years is due to the shutdown, upgrades and gradual restart of the accelerator complex. Scope 3 emissions have been reduced by more than 51%. Electrical transmission and distribution losses associated with purchased power are Fermilab's most significant source of Scope 3 emissions.

Fermilab's Greenhouse Gas Emissions

DOE Goal	Baseline	FY 2012	FY 2013	Performance Status (FY 2013)
28% Scope 1 & 2 GHG reduction by FY 2020 from a FY 2008 baseline (MT CO_2e)	384,366.1	171,274.7	143,423.3	-62.7%
13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline (MT CO_2e)	29,502.5	17,694.6	14,325.7	-51.4%

Fermilab is committed to assist DOE in meeting reduction goals of 28% for Scopes 1 and 2, and 13% for Scope 3 by 2020. Fermilab intends to use renewable energy certificates based on our purchased power consumption as a primary mechanism to reduce Scope 2 emissions

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. An Illinois State Fire Marshall compliance inspection was conducted on 11/26/2013, and our Underground Storage Tank Moor Fuel Dispensing Permit was approved. The UST system continues to be inspected on a semi-annual basis by a qualified subcontracted vendor. The inspection activity ensures that the internal and external leak detection probes and sensors are functioning properly. There were no compliance issues identified in 2013.

Fermilab continues to increase utilization of alternative fuels. Fermilab has reduced petroleum usage by 9% in the past year. 77% of Fermilab vehicles use alternate fuels (approximately 44,000 gallons of E85 and 19,600 gallons of biodiesel), with several medium and heavy-duty vehicles operating on biodiesel fuels.

7.4 The Endangered Species Act of 1973

Impact to endangered species is considered as part of Fermilab's environmental reviews under NEPA. The project area and impact to protected species to critical habitat are questions explicitly asked on the environmental review form that all projects must complete prior to construction. No compliance issues were identified in 2013.

7.5 Executive Order 11988, "Floodplain Management"

Impact to floodplains is considered as part of Fermilab's environmental reviews under NEPA. Project information, such as total project area or if filling is required, are questions explicitly asked on the environmental review form that all projects must complete prior to construction. No flood plain issues were encountered during 2013

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.

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

In 2013, the use of pesticides and herbicides at Fermilab were handled in accordance with FIFRA. Fermilab adheres to the principles of Integrated Pest Management in order to minimize pollution and adverse environmental impacts.

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

The Department of Energy 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. Fermilab reports to IDNR annually on the condition of the dam, and on a five-year cycle Fermilab is required to perform a comprehensive inspection and file a detailed report on the condition of this structure. A comprehensive inspection was conducted in April of 2013 and an "Owners Maintenance Report" was transmitted to the IDNR by DOE. No non-routine action items were identified during the 2013 comprehensive inspection

7.9 The Migratory Bird Treaty Act

Fermilab maintains a proactive approach at protecting the Canada Goose population onsite. Fermilab contracts with a firm to use dogs to harass geese in order to displace them from heavily populated areas on the site. The firm holds a valid permit from the Illinois Department of Natural Resources to pursue this activity, which was carried out during March and April. Fermilab also possesses a Nuisance Wildlife Control Permit issued by the IDNR 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 2013, only 2 nests containing a total of 6 eggs were destroyed.

For some background, the U.S. legislature passed the Migratory Bird Treaty Act of 1918 (MBTA) to protect birds from the high demand for feather plumes for women's hats during the time period. MBTA applies to over 1,000 species of birds, including the ubiquitous American robin. Migratory species are those whose individuals migrate between countries by "normal ecological processes." Because the law prohibits a broad range of activities, the interpretation of what constitutes a violation fluctuates. Thus, inadvertently affecting migratory birds during construction or other activities could have serious repercussions. However, the courts have usually held to a narrower interpretation and in the early 2000s, guidance was passed that directed agencies to outline a plan to avoid harming migratory birds and to take proactive steps to conserve bird populations. A Department of Energy memorandum of understanding (MOU) with the U.S. Fish and Wildlife Service was finalized in 2006 and provides a number of measures designed to "protect and conserve" migratory bird habitat to the fullest extent practicable. Fermilab addresses this MOU by evaluating migratory bird impacts during the normal course of conducting environmental reviews under NEPA to avoid or minimize impacts to even the most common birds as much as reasonable.

7.10 National Environmental Policy Act (NEPA)

Compliance with this Act 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 prior to carrying out those actions.

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 2013, 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 categorically excluded administrative 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, 16 projects/actions did need

to be addressed by submitting environmental evaluation notification forms to DOE; DOE then formally determined that all 16 of 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 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.

An Environmental Assessment (EA) is currently being prepared for the Long Baseline Neutrino Experiment (LBNE) project. Sub-contractors have been retained to prepare the document and assist DOE in the overall process and to provide information and analysis from the Far Site in South Dakota. The EA will analyze potential impacts at both Fermilab and the Sanford Underground Research Facility in South Dakota. The Proposed Action and 2 Alternative Actions are being considered. Impacts from the project as well as cumulative impacts resulting from other reasonably foreseeable actions are included in the Assessment.

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, as well as with DOE Order 450.1 was accomplished through the NEPA review process that included an evaluation of all proposed land-disturbing projects in 2012 to assess any potential impacts on historic resources. No compliance issues were identified in 2013.

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. In anticipation of updating the CRMP, an *Archaeological and Architectural Assessment of Historic Properties within the Fermi National Accelerator Laboratory* was conducted by Midwest Archaeological Research Services (MARS) and published in November of 2013. On 12/20/2013, DOE sent the Assessment to the Illinois Historic Preservation Agency (IHPA) for their approval prior to incorporation in Cultural Resources Management Plan, which is scheduled to be updated in 2014. Reconnaissance and/or survey of 87 potential historic properties was conducted to determine National Register of Historic Places (NRHP) eligibility of the properties. It was concluded that adverse impact to the Pioneer Cemetery must be avoided and recommended that Phase II testing or assessment be conducted for 22 properties to evaluate their status for NRHP status. It was also concluded that 64 historic properties do not appear to be eligible for inclusion on the NRHP or are outside Fermilab boundaries. IHPA has requested interior photos of the four historic properties (FB 29, 58, and the barns of FB 65 and 67) that MARS concluded have the potential to be listed on the NRHP due to their architecture. In addition, IHPA has requested that comments be sought on the Assessment from the Kane and DuPage County Historic Preservation Commissions and the Illinois Barn Alliance.

The Illinois Historic Preservation Agency (IHPA) accepted a Recordation, based upon review of an archaeological Phase I reconnaissance report, for Site 11Due524, where in 2012 a limestone well was discovered and a barn was razed due to structural instability prior to recording as an archaeological. In addition, a Site Correction Form was filed for Site 11Du219, in which the dimensions of the farmstead were corrected to include the existing barn and a well inadvertently found by Fermilab maintenance crew during landscape work. Both of these sites were determined by IHPA to be ineligible for listing on the National Register of Historic Places. Additionally, IHPA concluded, for the two archaeological sites designated as Tadpole (11K18) and Frog (11K19) on which Phase II archaeological testing was conducted in fiscal year 2012, that for both that "no historic properties are affected" and therefore IHPA has no objection to the undertaking, associated with the Long Baseline Neutrino Experiment (LBNE) that is planned. Additionally, a National Register of Historic Places (NRHP) evaluation of Section 21 of Winfield Township (including one structure - water tank; and six buildings - 37, 37A and 39 Shabbona Street and 31, 31A and 33 Blackhawk Boulevard) and Farm Book 50 was conducted in anticipation of demolishing these sites. The IHPA concluded for both that "no historic properties are affected." Finally, Phase II testing was conducted in order to determine NRHP eligibility of three farmsteads (11-Du-551, 11-K-1226, and PS71) in anticipation of construction plans for the proposed LBNE that has the potential to

impact these sites. The IHPA concluded that “no historic properties are affected.”

Annually, a questionnaire on Federal archaeological activities is requested by the Department of the Interior. Fermilab submitted its responses in February of 2014.

7.12 National Pollutant Discharge Elimination System (NPDES)

The IEPA has issued Fermilab three National Pollutant Discharge Elimination System (NPDES) permits that were active in 2013. In addition, Fermilab holds three industrial wastewater pretreatment operating permits issued by IEPA (also covered under NPDES regulations and are described under Releases to Sanitary Sewers). The permits are listed below.

1. Illinois General NPDES Storm Water Permit for Construction Activities is required for all projects that disturb greater than one acre. In 2013 there were four projects requiring such a permit to be in place:

    a. NoVA Near Detector

    b. Liquid Argon Test Facility

    c. Muon Campus Project

    d. OTE IARC Building

2. An individual (specifically tailored to an individual facility) NPDES permit covers combined storm water and non-contact cooling water discharges associated with industrial activities. Six outfalls are 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 storm water overflow discharges from the Main Injector pond system. 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. A new permit was issued in April 2014 from the IEPA.

3. Illinois NPDES General Permit for Pesticide Application Point Source Discharges covers pesticide applications performed by Fermilab personnel. This includes any algae or weed control applications near ditches or ponds. This is a newer permit for the IEPA and Fermilab received coverage in July 2012.

7.13 Resource Conservation and Recovery Act of 1976 (RCRA)

RCRA governs the management of hazardous waste. Fermilab maintains a permit under RCRA to manage for disposal or reclamation hazardous waste generated at the laboratory. Radioactive waste is not governed under RCRA and is managed following DOE requirements. Fermilab does not treat, or dispose of regulated waste on site. All wastes are properly disposed though licensed waste handling, transport or disposal facilities. An annual Hazardous Waste Report is transmitted to IEPA and radioactive waste summaries are provided to DOE Fermi Site Office.

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) in 2013.

Waste Material	Cubic Meters
Non-Routine Hazardous Waste (RCRA + TSCA)	9.7
Routine Hazardous Waste (RCRA + TSCA)	7.6
Non-Routine Non-Hazardous Special Waste	2.2
Routine Non-Hazardous Special Waste	12.0
De-Classified Special Wastes	11.0
Dumpster/Landfill Waste	6,260
Radioactive Waste (DOE regulated)	125

In addition the following volumes of waste were generated by Fermilab and managed for reclamation by the HCTT 2013

Waste Material	Cubic Meters
Non-Routine Hazardous Waste (RCRA + TSCA)	9.7
Routine Hazardous Waste (RCRA + TSCA)	7.6
Non-Routine Non-Hazardous Special Waste	2.2
Routine Non-Hazardous Special Waste	12.0
De-Classified Special Wastes	11.0
Dumpster/Landfill Waste	6,260
Radioactive Waste (DOE regulated)	125

7.13.2 RCRA Facility Investigation (RFI) Activities

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 groundwater from monitoring wells installed at this unit. All ten monitoring wells at SWMU 12 were sampled during the 2nd and 4th quarters of 2013.

The following table summarizes the 2013 results at SWMU 12 from wells with results above either the Class I or Class II Groundwater Quality Standards.

Glacial deposit wells MWS2, MWS3, and MWD1 produced 2nd quarter total chloride results of 80 mg/L, 184 mg/L, and 760 mg/L, respectively. The same three wells produced no 4th quarter total chloride because all of the wells were dry. The Class II Groundwater Quality Standard is 200 mg/L.

Glacial Deposit Monitoring Wells		2Q13	4Q13
PARAMETER	Class II GW Quality Standard	Well CUBD1 MWD1	Well CUBD1 MWD1
INORGANIC (mg/L)			
Chloride, Total	200	870	1300
Lead, Total	0.1	U	U

Grey Shading = Above the Class II GW Quality Standard
U = Undetected

Bedrock Monitoring Wells		2Q13	4Q13
PARAMETER	Class I GW Quality Standard	Well CUBBd4 MW6B	None
INORGANIC (mg/L)			
Chloride, Total	200	48	
Lead, Total	0.0075	0.011	

Grey Shading = Above the Class I GW Quality Standard
U = Undetected

Bedrock well MW6B produced 2nd quarter total lead result of 0.011 mg/L, and during the 2nd and 4th quarters glacial well MWD1 had total chloride concentrations of 870 mg/L and 1300 mg/L, respectively.

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 2013.

The following table summarizes the 2013 results at Meson Hill from wells with results above either the Class II Groundwater Quality Standards or site-specific 99% Upper Confidence Limits from the background well (G108).

	Criteria		2Q13	4Q13	
PARAMETER	Class II GW Quality Standard	99% Upper Confidence Limit	Well G106	Well G103	Well G107
INDICATOR, Filtered (mg/L)					
Ammonia (as N), Dissolved	N/A	0.19	U	U	U
Arsenic, Dissolved	0.2	0.01	U	U	U
Cadmium, Dissolved	0.05	0.004	U	U	U
Chloride, Dissolved	200	477	8	122	306
Iron, Dissolved	5.0	0.83	0.15	0.07	0.07
Lead, Dissolved	0.1	0.01	U	**0.03**	U
Manganese, Dissolved	10.0	0.198	U	0.031	U
Mercury, Dissolved	0.01	0.0004	U	U	U
Sulfate, Dissolved	400	468	403	63	17
Total Dissolved Solids (TDS)	1200	1715	937	628	807
INDICATOR, Unfiltered (mg/L)					
Cyanide, Total	0.6	0.20	U	U	U
Phenols, Total Recoverable	0.1	0.023	U	U	U
Total Organic Carbon (TOC)	N/A	5.7	1.6	1.2	U
Total Organic Halogens (TOX)	N/A	0.075	U	U	U
INORGANIC, Unfiltered (mg/L)					
Chromium, Total	1.0	N/A	NS	U	0.205
Iron, Total	5.0	N/A	NS	0.12	1.12
Lead, Total	0.1	N/A	NS	U	U
Sulfate, Total	400	N/A	NS	59	19
Chloride, Total	200	N/A	NS	142	NR

Bold = Outside the 99% Upper Confidence Limit of Background Levels
Grey Shading = Above the Class II GW Quality Standard
U = Undetected
NR = Not reported
NS = Not sampled
N/A = Not applicable

The elevated concentration of dissolved sulfate during the 2nd quarter is attributed to agricultural activities. The elevated concentration of Dissolved Lead during the 4th quarter is attributed to an analytical laboratory reported value within the error range slightly above the detection limit of 0.01 mg/L, primarily due to the undetected level found in the same sample's total lead analysis. The elevated concentration of dissolved chloride in well G107 during 4th quarter is attributed to road-salt due to its proximity to Wilson Road and is on the opposite side of the road from Meson Hill.

Railhead Storage Yard (SWMU 14)

No information was requested or generated at this unit during 2013.

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 2013

7.14 Safe Drinking Water Act

Fermilab's domestic water is purchased from the City of Warrenville. In addition, Fermilab retains four private wells at three sites (Site 29 [two wells], Site 53 [Buffalo Barn], and Site 56 [Horse Barn]). Private wells do not require any water treatment or sampling. Estimates of water withdrawn from these wells are reported annually to the Illinois State Water Survey.

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 USEPA, State, and local officials with an annual accounting of hazardous, toxic, and extremely hazardous chemicals used or stored onsite in quantities greater than their respective reporting thresholds as defined in SARA Title III Section 313. Fermilab exceed the reporting threshold for 1,2,4, trimethylbenzene and copper in calendar year 2013, a Toxic Chemical Release Inventory (EPA Form R) will be submitted for these chemicals in July 2014.

As required by Section 312 of SARA Title III, Fermilab submitted a Tier II Emergency and Hazardous Chemical Inventory (2013) to state and local emergency services and disaster agencies in February 2014.

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 Fermilab ES&H Manual (FESHM) chapter and SPCC training for oil handling employees describe the SPCC Plan. FESHM 8031 – Oil Pollution Prevention was approved in March 2010. 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 was re-certified by a Professional Engineer as meeting the requirements of the regulation. The P.E. certification occurred in July 2013, and was approved by the Fermilab Directorate (Chief Operating Officer and ESH&Q Director) and the DOE-Fermi Site Office Manager the same month. Facilities Engineering Services Section provided the P.E. certification

7.17 Toxic Substance Control Act (TSCA)

As required by the TSCA regulations, 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 laboratory 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 in June of 2010. 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 ESH&Q review procedures.

During the shutdown in 2012, Accelerator Division continued its program to phase out the use of PCBs, when opportunities arise. Several small PCB capacitors were removed from Linac quadrupole power supplies and Booster modulators and were replaced with non-PCB capacitors. This reduced the PCB inventory by 784 pounds. Further reductions are planned for the future.

8.0 Pollution Prevention and Waste Minimization

Fermilab continues to make progress minimizing waste and reducing pollution. In FY2013, Fermilab recycled 817 tons of material through a combination of office/ residential type recycling and recycling of scrap metals, wood, tires, etc. 75% of waste material generated was diverted to recycling. This amount does not include electronics.

Fermilab recycles or donates for reuse 100% of used computer equipment. Approximately 74,848 pounds of computing and electronic equipment including servers, printers, laptops, monitors, cellphones, PDAs, TVs etc. were recycled. Another 69,380 pounds 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 310 tons of construction waste (86% of the total waste generated) was recycled from T&M and FESS projects (large and small) in 2013.

Other notable pollution prevention measures include:

- Several surrounding municipalities dispose of their fall leaf refuse on Fermilab's agricultural fields. In 2013, 17,500 cubic yards (roughly 793 tons) were spread on the fields as a soil amendment after composting.

- It is common practice at Fermilab for project engineers, technicians, and physicists to reuse or reconfigure old equipment for new experiments. Here are some noteworthy examples:
    - In 2013, Accelerator Division refurbished and repurposed many items from the retired Tevatron for use at the new Muon Campus, including helium screw compressors and vessels, thermostatic expansion engines, cryogenic valve boxes, about 1,400 feet of piping, liquid nitrogen dewar tank, and heat exchangers.
    - The Muon g-2 experiment plans to repurpose a 50-foot-wide superconducting electromagnet from Brookhaven National Laboratory. It was shipped by truck and sea barge in June and July 2013 at a substantial savings over the construction of a new magnet.

- The laboratory is implementing a comprehensive managed print services initiative and all printers were inventoried throughout the site. Unless there was a stated need, personal printers were removed from individual areas. To a greater extent, departments now are sharing printers that are on networked services. Printers are defaulted to double-sided printing and black/white ink. There is now a select, limited choice of new printers, all of which are EPEAT registered.

- Grid Computing Center received the Energy Star Award for the fourth consecutive year. The cold aisle containment installed at the Grid Computing Center last fall resulted in a 14% reduction in energy used for cooling. The Grid Computing Center (GCC) became the first Fermilab building to attain 100 percent of the Guiding Principles for High Performance and Sustainable Buildings, a federal mandate to dramatically increase the efficiency and sustainability of federally owned buildings.

- The new Illinois Accelerator Research Center building was built in 2013 and designed to LEED-NC Gold certification.

- 100% of Fermilab's facilities were evaluated for energy efficiency through an Energy Savings Performance Contract.

- Fermilab launched a sustainability website in April 2013. The website highlights Fermilab's sustainable work done in eight areas: electronics stewardship, energy and water conservation, greenhouse gas reduction, green purchasing, high performance sustainable buildings, land stewardship, pollution prevention, and transportation. There is also a section called, "For Employees" where links for useful tools and information are located. The "Green at the Roots" page displays stories of employees' 'home-grown' efforts to make their work more sustainable or environmentally friendly.

- Fermilab was added to Argonne's GreenRide Connect and car pool parking spots were added in the Wilson Hall parking lots to encourage carpooling.

- The fleet management team at Fermilab has a fleet monitoring program that minimizes idling time and promotes efficient driving, which both lead to less fuel use. They also continually evaluate the fleet size to insure the appropriate number of vehicles. Only alternative fuel vehicles are purchased.
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9.0 Radiological Clearance of Property and Metals Release Suspension

Fermilab has operated an active scrap metal recycling program for many years. The program includes policies and procedures to ensure that the DOE secretarial mandates regarding the moratorium and suspension on the release of scrap metals from departmental sites is not violated. Historically, as a general operating principle, Fermilab has not released radioactive metals as scrap. Beginning in 2000, to comply with the suspension directive, the laboratory began holding non-radioactive scrap metals originating from radiological areas (as defined 10CFR 835). This material has been accumulating since the suspension became effective. Direct impacts as a result of the suspension include the loss of scrap revenue, the costs associated with the management and storage of this material and the potential future cost of disposal if it cannot be scrapped.

In April 2011, members of the Office of Science visited Fermilab to identify issues or areas of improvement to help meet the secretarial mandates. While 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, they were able to provide Fermilab with a number of helpful recommendations to improve management of the scrap metal program. These improvements include more effective use of the Vehicle Scrap Monitor, reorganization of the Railhead, enhancement of the Material Move Request Form (MMR) and down-posting of buildings as appropriate.

In 2013 Fermilab continued to operate a metals recycling program that has a rigorous material screening process, and has incorporated all of the ongoing improvements that have been made since 2000. The MMR is used to clearly identify and document which metals are eligible for recycling. These metals are then subjected to multiple hand held radiation surveys and must pass successfully through the vehicle scrap monitor before leaving the site. "Recycling Packages" are created for metals from posted Radioactive Material Areas. Recycling packages also include a precise description of the metals to be released, with pictures, area surveys of the building where the metals were removed, and a summary of the timeline that tracks the location of the materials for the duration that they were on site. In 2013, 643 metric tons of various metals met Fermilab's release requirements and were recycled.

10.0 Conclusion

The operations at Fermilab during 2013 had no significant adverse impact on the environment or on public safety.