

Report to the Director on the
Fermilab Environment
Calendar Year 2017



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Cover: Great blue heron and snake photo by Gene Oleynik, design by Eric Mieland.

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 for the laboratory and documents the compliance status of environmental requirements under the scope of Fermilab's Environmental Management System (EMS). Fermilab's EMS conforms to the core set of standards described in ISO 14001 (International Organization for Standardization). The EMS structure provides Fermilab a practical framework from which to assess and manage the environmental impacts of site operations.

The Fermilab site consists of 6,800 acres of mixed use land. The primary features on the site include the accelerator complex and associated building infrastructure, an interconnected industrial cooling water system, a housing complex for visiting researchers (the Village), row crop agriculture, and natural areas in various states of restoration. The natural areas consist primarily of tall grass prairie, forest, and wetlands. Fermilab is America's premier particle physics laboratory with a mission to drive discovery in particle physics, encouraging pioneering research by operating world-class accelerators and detector facilities. The laboratory takes pride in the ongoing stewardship of the site and works diligently to minimize the environmental footprint associated with operating the facility.

A core component of the EMS is the environmental monitoring and surveillance program. This program provides for the measurement and interpretation of the impact of Fermilab operations on the environment. Surveillance and monitoring tasks are conducted to confirm compliance with established standards and specific 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 at a particular location. Sampling points are selected based on the potential for adverse impacts. Additionally, effluent samples 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, progress on environmental restoration, and waste management and corrective action activities. The report is arranged by environmental topic and specific environmental compliance requirements.

2.0 Summary of Significant Environmental Issues

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. Low concentrations of tritium are regularly recorded 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 beginning in 2012. This body has evolved into the Tritium Task Force and is chaired by the Chief Safety Officer. The task force continues the work to identify, manage and mitigate to the extent possible tritium generated as a result of laboratory operations. Additional details concerning the management of tritium can be found in various sections of this report.

Federal Sustainability Goals

In December 2017 Fermilab issued the annual Site Sustainability Plan. This plan outlines the laboratory's progress towards achieving goals the Department of Energy (DOE) has committed to in its Strategic Sustainability Performance Plan, as required by Executive Order (E.O.) 13693. 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 2025, with other related goals having shorter time frames. Fermilab's sustainability progress is summarized in additional sections in this report

3.0 Ecological Stewardship

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 provides an ELM plan to deliver these recommendations to Fermilab. FESS Site Services and Roads & Grounds oversee the management of nearly 4,000 acres of natural areas, over half of which are being restored. These habitat communities include tallgrass prairie, oak savanna, open-water marsh, sedge meadow, buttonbush swamp, and floodplain forest, among others. The primary goal of ecological land management 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 200 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, a 501(c)(3) not-for-profit corporation.

Fermilab 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 2017, 32 reports of nuisance wildlife were received. One Cooper's hawk was taken to a rehabilitation center. Seven animals were euthanized on site.

Fermilab manages the population of whitetail deer on site by contracting annually with the U.S. Department of Agriculture Wildlife Services group. Population modeling using data from vegetation surveys, vehicle accident reports and aerial surveillance indicated that reducing the herd in 2017 was required. Sixty deer were taken in March of 2017.

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 its 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 GHG emissions. A summary of GHG emissions is further described in section 7.2.

The plan also addresses more broad ranging goals that include operating buildings more efficiently, reducing water consumption, waste reduction, reducing fossil fuel consumption for vehicle fleets, and improved energy consumption of computer data centers. Below is a summary of status in meeting DOE's goals.



Scope 1 & 2 Greenhouse Gas Emissions

Goal: Reduce direct GHG emissions by 50 percent by FY 2025 relative to FY 2008 baseline. Interim Target (FY 2017): -25.0 %

Baseline: 384,366.1 MtCO₂e

Current Performance: -61.7% (147,287.9 MtCO₂e)



Scope 3 Greenhouse Gas Emissions

Goal: Reduce indirect GHG emissions by 25 percent by FY 2025 relative to FY 2008 baseline. Interim Target (FY 2017): -9.0 %

Baseline: 29,502.4 MtCO₂e

Current Performance: -68.5% (9,304.4 MtCO₂e)



Energy Intensity

Goal: Reduce facility energy in goal subject facilities by 30 percent relative to FY 2015 baseline. Interim Target (FY 2017): -5.0 %

Baseline: 90,637.3 Btu/GSF

Current Performance: -15.6% (76,541.2 Btu/GSF)



Renewable Energy

Goal: Use 30 percent renewable energy as a percentage of overall facility electricity use by FY 2025. Interim Target (FY 2017): 10.0 %

Baseline: 279,647.0 MWh

Current Performance: 14.3% (40,012.2 MWh)



Potable Water Intensity

Goal: Reduce potable water intensity by 36 percent by FY 2025 relative to FY 2007 baseline. Interim Target (FY 2017): -20.0 %

Baseline: 12.2 gal/GSF

Current Performance: -24.3% (9.2 gal/GSF)



Fleet Petroleum

Goal: Reduce fleet petroleum use by 20 percent by FY 2015 and thereafter relative to FY 2005 baseline. Interim Target (FY 2017): -20.0 %

Baseline: 82,267.0 GGEs

Current Performance: -65.9% (28,078.9 GGEs)



High Performance Sustainable Buildings

Goal: Ensure 15 percent (18 percent by GSF) of buildings meet the Guiding Principles for sustainable buildings by FY 2025. Interim Target (FY 2017): 15.0 %

Baseline: 103.0 Buildings

Current Performance: 6.8% (7.0 Buildings)



Fleet Greenhouse Gas Emissions/Mile

Goal: Reduce per-mile greenhouse gas emissions by 30 percent by FY 2025 relative to FY 2014 baseline. Interim Target (FY 2017): -4.0 %

Baseline: 0.6 GHG/Mile

Current Performance: -13.3% (0.4 GHG/Mile)

In FY 2017, Fermilab achieved success in meeting its sustainability goals. The following accomplishments are notable examples of sustainability progress which support Fermilab's ability to deliver on its mission.

- The laboratory's Sustainability Management Team was re-chartered and now includes Sustainability Goal Owners to build expertise in developing and delivering projects to meet Fermilab's sustainability goals.
- Fermilab utilized an Illinois public sector retro-commissioning & energy assessment program to complete four retro-commissioning and energy audit projects yielding a list of energy conservation measures totaling 9,124 MWh and 94,034 therms annually.

- Modernization of Fermilab’s Industrial Cooling Water system backbone through a Science Laboratories Infrastructure (SLI) project was substantially complete in FY 2017. Over 4 miles of new and replacement pipe infrastructure will significantly improve the reliability and efficiency of the ICW system.
- The Sustainability Management Team oversaw efforts to maximize waste diversion and communicate a message of environmental stewardship by deploying and monitoring 3-bin landfill/recycling/compost waste container groups at the Fermilab 50th anniversary public open house.
- Fermilab fleet management staff began using vehicle telematics to track and analyze fleet vehicle use and trip characteristic data.
- Fermilab installed its first two electric vehicle charging stations which will enable the charging of both fleet and personal employee vehicles under a new “Employee Electric Vehicle Charging” policy and procedure.
- Four new High Performance Sustainable Buildings (HPSB) were added to Fermilab’s portfolio, more than doubling the laboratory’s inventory of HPSB facilities in a single year.
- For the seventh year in a row, the Fermilab Grid Computing Center was awarded Energy Star status for its superior energy performance.
- Fermilab completed a climate change vulnerabilities screening which helped identify those assets and systems most vulnerable to the region’s most likely climate impacts.

5.0 Environmental Management System (EMS)

Fermilab’s EMS is the organizational framework that enables the laboratory to minimize environmental impacts due to operations. 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 facility is operating in an environmentally responsible manner. In addition, the elements of the EMS have been aligned with the principles of Fermilab’s ESH&Q management system to form a combined management system that addresses facility operational liabilities that have the potential to impact individuals and/or the environment.

Fermilab routinely evaluates operations and seeks to improve environmental performance. The laboratory’s significant environmental aspects have been identified and are reviewed annually. In areas where change is desired or required, goals are established with measurable targets that seek to improve a particular aspect of operations. The goals outlined in the laboratory’s Site Sustainably Plan document areas of significant emphasis where the laboratory is pursuing change.

Fermilab first received certification to the ISO 14001 standard for environmental management in 2007. During 2017, the laboratory transitioned towards EMS self-declaration to the standard. Self-declaration ensures full compliance to the standard through internal assessments and third-party audits. It is an allowable option granted by DOE. The laboratory's EMS was audited against the elements of the ISO 14001 standard in November 2017. The audit resulted in zero major nonconformances, three minor nonconformances, and six opportunities for improvement. A corrective action plan addressing the minor nonconformances was formulated and submitted.

6.0 Environmental Monitoring and Surveillance

The goal of Fermilab's Environmental Monitoring Program is to assist laboratory management in decision-making by providing data relevant to impacts that facility operations have on the surrounding environment. This program includes effluent monitoring which is used to confirm compliance with permits from various discharge points from the facility.

Environmental surveillance is typically conducted at 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 for the most likely movement of chemical and radioactive materials resulting from Fermilab operations to the environment include the atmosphere, surface water (including sewer systems), 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 routinely 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 Illinois Environmental Protection Agency (IEPA) Registration of Smaller Sources (ROSS) program. This is a relatively new program administered by IEPA and is available to facilities that emit only minor amounts of air pollution.

In addition, Fermilab monitors radioactive air emissions associated with operations. These emissions are kept as low as reasonably achievable (ALARA) and fall well below U.S. EPA emission standards.

6.1.1 Non-Radioactive Air Emissions

In 2017, 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 de-bonding oven;
2. One 15 mmBTU and one 11.55 mmBTU natural gas-fired boiler at the Central Utility Building (CUB);
3. One 12,000-gallon gasoline storage tank with a stage 1 vapor balance system
4. Various radionuclide emission stacks;
5. 2,200 horsepower standby diesel generator;
6. Cavity Processing Lab (CPL).

6.1.2 Radioactive Air Emissions

Airborne radionuclides are normally released to the atmosphere from operating target stations, accelerators and beamlines. Measures to keep these releases ALARA are incorporated into the operating processes and procedures at these facilities and in design efforts for new projects. Monitoring is conducted at areas where air emissions are considered a significant contributor to the overall transport of radioactive materials offsite. A small quantity of airborne radionuclides is emitted by the Magnet Debonding Oven when operating.

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 near the stacks. The dose for the air pathway is calculated using a Gaussian

plume computer simulation model called Clean Air Act Assessment Package-1988 (CAP88PC Version 4.0). This model was created by the U.S. Environmental Protection Agency (USEPA) to predict the movement of airborne radionuclides and its use is dictated by regulations governing hazardous air pollutants (40 CFR 61). Maximum calculated concentrations off-site are predicted to be below the level that could be detected by direct monitoring.

In 2017, the accelerator and the experiments operated throughout the calendar year, except for the standard annual maintenance shutdown that lasted anywhere from ten to twelve weeks for the different machines. Operation of the debonding oven, when radioactive components are being burned, is a potential source of tritium. In 2017, the debonding oven did not operate. The Muon Campus, started using proton beam for muon production. The Main Injector, SeaQuest experiment (E-906; ended in July), the BNB (Booster Neutrino Beamline) and NuMI stacks are estimated to have released a total of 208.9 Curies in 2017. These radioactive air emissions were approximately 10.4% of the annual average (2000 Curies) expected from operations as acknowledged in the air pollution permit application on file with the IEPA. Doses to the public from emissions in 2017 continued to be well below the USEPA standard of 10 mrem in a year and less than the USEPA's continuous monitoring threshold of 0.1 mrem in a 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 0.0419 mrem. Fermilab's 2017 Radionuclide Air Emissions Annual Report is submitted to the DOE Fermi Site Office (FSO) in May 2018. The report is distributed by the DOE FSO to the USEPA and IEPA.

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 (MTest), Meson Center (MCenter) and Neutrino Muon beamlines (E906) operated in 2017. The maximum muon dose offsite due to the operation of MTest, MCenter and E-906 was 0.088 mrem. Both the BNB and NuMI experiments have the potential to produce measurable muon flux; however, the 8 GeV energy protons used in BNB 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 2017 by a large ionization chamber located in the Railhead colloquially called a 'Hippo.' The Hippo measurements are supplemented by several of environmental dosimeters placed around the storage area and by periodic onsite surveys. Based on measurements made, it is estimated that radioactive materials stored at the Railhead contributed no directly measurable equivalent dose at the site boundary in 2017. The maximum total penetrating radiation equivalent dose in 2017 to an individual at the nearest offsite house was thus estimated to be less than 0.088 mrem, and not directly measurable.

6.3 Surface Water Quality

Fermilab releases minor amounts of contaminants to surface water bodies. As part of the management of these discharges the laboratory holds National Pollutant Discharge Elimination System (NPDES) permits that govern releases to surface water from storm water 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. Fermilab Environment, Safety, and Health Manual (FESHM) Chapter 8026 Surface Water Protection describes regulatory aspects and responsibilities of the surface water program.

Aqueous process wastewaters are directed to sanitary sewers and ultimately discharged to publicly owned treatment works (POTWs) in Batavia and Warrenville/Naperville. Wastewater discharges are controlled by criteria described in FESHM 8025 Wastewater Discharge to Sanitary Sewers.

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 2017, 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 using a continuous feed of NaClO (sodium hypochlorite) solution at the Casey's Pond intake to the ICW system. Two new pumping stations came online in 2017 at Swan Lake and Andy's Pond to make the ICW system run more efficiently. In addition, a de-chlorination system was installed and feeds sodium bisulfite before ICW water leaves the site towards Kress Creek.

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. There were no releases above permit levels to surface water in 2017.

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, ^3H) 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 tunnel 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 Central Utilities Building (CUB) cooling towers. Excess NuMI water and effluent from the towers is directed to the ICW pond system.

Fermilab continued to discharge measurable 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. In 2017, detectable levels of tritium discharged to Kress Creek January through April, with the highest concentration at 2 pCi/ml. Indian Creek had tritium discharges eleven months of the year (highest concentration was 7.7 pCi/ml in January). In 2017, the Ferry Creek outfall (from A. E. Sea to Sea of Evanescence) had one month of a detectable level of tritium (January 1.6 pCi/ml). Monthly data from measurements taken at outfall and site boundary locations are made publicly available 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 operated two systems in 2017 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 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 (CPL) at Industrial Building 4 (IB4) to be discharged to the city of Batavia sanitary sewage treatment works.

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 occasionally exceeds

the limits for iron released to Warrenville. This did not occur in 2017. Aging pipes are suspected to be the source of the exceedances and their cause has 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 2017 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	0.54 Curies
Average Concentration	3.74 pCi/ml
Highest Concentration	5.64 pCi/ml
Total Sanitary Volume	36,697 kGal

Fermilab's Tritium Task Force Working Group continued to investigate sources of tritium into both the sanitary sewer system and the Industrial Cooling Water system. As part of this effort a concerted effort is being undertaken to investigate sources of tritium in the sanitary system in the southern sections of the system.

6.4 Groundwater Quality

The 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 or Henry Formation, is classified as the top of Class I groundwater. Water in the glacial deposits overlying the Batestown or lowermost Henry 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 2017 ten glacial and Silurian dolostone (Joliet Formation) monitoring wells at the CUB Pipe and Clay Tile Field 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 SWMU; however, under the laboratory'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 base-line tritium levels at the up gradient (north) edge of the laboratory property (BMW-1 through BMW-4) and one Elwood Formation well was sampled to assess tritium levels near the NuMI Target Hall (S-1426-2). 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.

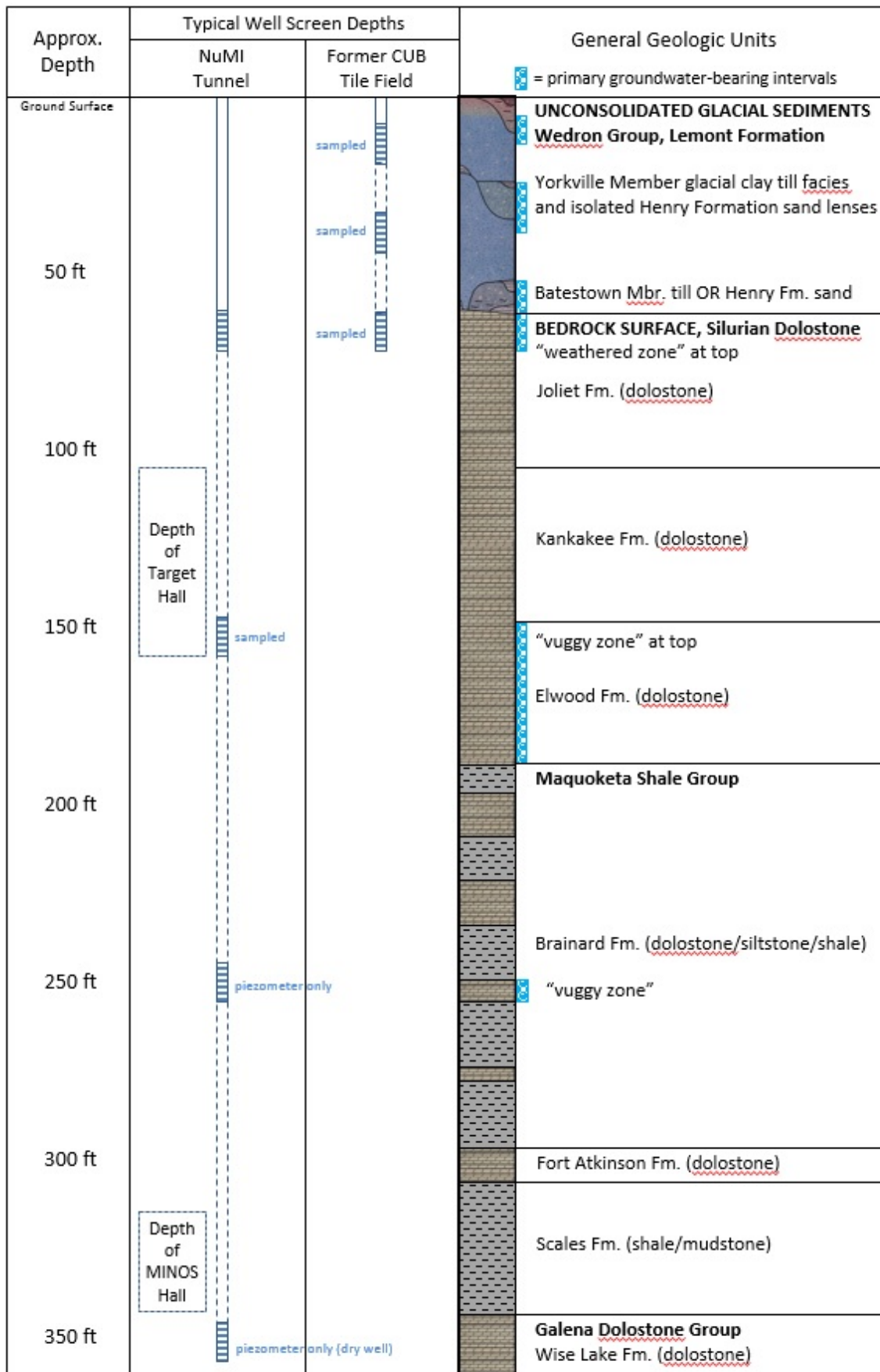


Figure 6.4-1. General Fermilab geologic section (based on NuMI Tunnel), with groundwater monitoring well screen depths and groundwater-bearing intervals. Sampling/piezometer status is for 2015.

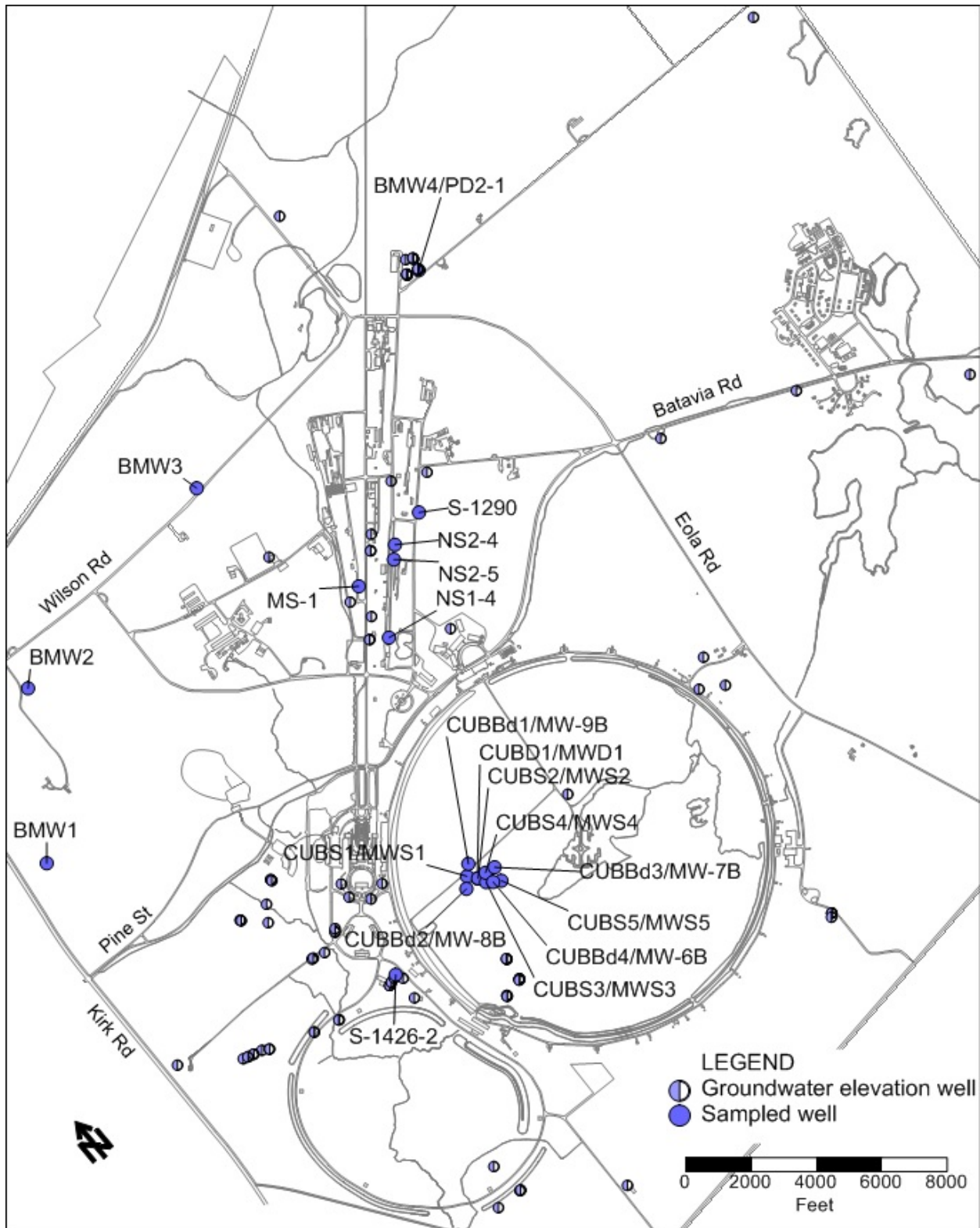


Figure 6.4-2 - Groundwater monitoring well locations in 2015. Sampled wells represented by labeled, filled circles. Wells used only for groundwater elevations represented by half-open circles. (Original DUSAF projection.)

6.4.1 Radionuclides in Groundwater

U.S. 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. Samples were collected from ten locations for radionuclide analysis. Tritium and accelerator-produced radionuclides were not detected in any Class I groundwater samples during 2017.

There are six “sump” wells at the Booster Neutrino Berm (BNB) that are routinely sampled for tritium. They are not true groundwater wells, but rather drain the north and south ends of the interior, interstitial space and exterior of the dual-liner system around the decay pipe via lateral pipes. Water in these sump wells originates from surface infiltration that makes its way through the damaged liner system near the north end, adjacent to MI-13A. In 2014 a permanent surface cover and drain system was installed over the north end of the berm to reduce the volume of infiltrating water into the decay pipe liner system. Tritium results in these wells in 2017 fluctuated between 2.2 and 12,900 pCi/ml and was either routed to MI Pond F or Casey’s Pond, or it was contained and shipped for disposal if the concentration exceeded 1,900 pCi/ml. Further measures to redirect water away from the MI-12/BNB area are being planned for 2017-2018. Tritium concentrations and infiltrating water volumes in the BNB sump wells will continue to be monitored to evaluate the potential impact to groundwater.

6.4.2 Chemicals in Groundwater

In 2017, semi-annual groundwater sampling events were conducted at one Solid Waste Management Unit (SWMU). Chemical analyses were performed on these samples as required by the Resource Conservation and Recovery Act Facility Investigation (RFI). (See Section 7.14.1 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 2017. The annual air emissions report for 2017 was not required due to Fermilab’s registration as a ROSS source. Fermilab’s 2017 Radionuclide Air Emissions Annual Report was submitted to the DOE Fermi Site Office (FSO) in May 2018. The report is distributed by the DOE FSO to the USEPA and IEPA.

In 2017, the actual annual air emissions for Criteria Air Pollutants (carbon monoxide, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic materials), were 3.6654 tons per year, much less than the maximum allowed for a ROSS site.

Doses to the public from radioactive emissions in 2017 continued to be well below the USEPA standard of 10 mrem/year, and also much less than the EPA's continuous monitoring threshold of 0.1 mrem/year. In 2017, an estimated 208.9 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 0.0419 mrem/year in 2017.

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 Reporting

Fermilab supports the Department of Energy's effort to advance GHG reduction at its facilities. In 2017 the laboratory submitted GHG emissions data to the department via DOE's Sustainability Dashboard.

GHGs are divided into three categories: Scope 1, 2, and 3. Scope 1 emissions are direct emissions from activities controlled by Fermilab (e.g., boilers, emergency generators, fleet vehicles, and fugitive emissions). Scope 2 emissions are indirect emissions and for Fermilab involve only purchased electricity. Scope 3 emissions are other indirect emissions such as employee air travel, electrical transmission and distribution losses, waste generation, ground travel, and employee commuting.

A three-year summary of Fermilab's emissions, including the 2008 baseline, are shown below. The performance status indicates that Fermilab has reduced Scope 1 and 2 emissions by 52.9% over the baseline year. The consumption of electricity is Fermilab's dominant source of Scope 1 and 2 emissions. Scope 3 emissions were reduced by 68.5%. The significant change from previous years was due to an adjustment to the transmission and distribution factor in FY 2017 to more closely reflect actual conditions. Due to this change, employee commuting has moved to Fermilab's most significant source of Scope 3 emissions.

Fermilab is committed to assist DOE in meeting reduction goals of 50% for Scopes 1 and 2, and 25% for Scope 3 by 2025. Fermilab intends to use Renewable Energy Certificates (RECs) based on our purchased power consumption as a primary mechanism to reduce Scope 2 emissions.

Fermilab's Greenhouse Gas Emissions					
DOE Goal	Baseline	FY 2015	FY 2016	FY 2017	Performance Status (FY 2016)
50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline (metric tons equivalent CO ₂)	384,366	173,701	163,818	181,073	-52.9%
25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline (MT CO ₂ e)	29,502.5	17,840	17,456	9,304	-68.5%

7.3 Underground Storage Tanks and Fuels

There are three underground storage tanks (USTs) in use at Site 38 Fuel Dispensing Facility. And these were operated and maintained per current UST standards. An Illinois State Fire Marshall compliance inspection was conducted in November 2017 and our Underground Storage Tank Motor Fuel Dispensing Permit was approved. The UST system continues to be inspected on a semi-annual basis by a qualified subcontracted vendor, and on a daily, monthly, and quarterly basis by a Class A Certified Underground Storage Tank operator. The inspection activity ensures that the internal and external leak detection systems are functioning properly.

7.4 The Endangered Species Act of 1973

Impact to endangered species are considered as part of Fermilab's formal Environmental Review process for all projects, as required by the National Environmental Policy Act (NEPA). Questions that must be answered during the review process include defining a project's area and scope. If warranted the review will identify any threatened or endangered species within the area and the potential to impact protected species and their critical habitat. No compliance issues were identified in 2017.

7.5 Executive Order 11988, "Floodplain Management"

Impact to floodplains is also considered as part of Fermilab's environmental review process under NEPA. Project information, such as total project area or if filling is required are questions asked during a review. No flood plain issues were encountered during 2017. As part of the Surface Water Management Program (SWaMP), on-site streams were surveyed and mapped to collect data on sediment depth, field tile invert depths, and in-stream structures. Hydrologic analysis was used to determine runoff from rainfall events of return frequencies ranging from 1-year to 100-years, and durations of 1-hour to 48-hours. Hydraulic analysis was completed to create flood profiles and inundation maps for 2, 5, 10, and 100-year floods.

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

Evaluation of potential wetland impacts due to Fermilab activities continued to be accomplished through the NEPA, FESS Design, and FESS Comment and Compliance review processes. The laboratory 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. Several wetland delineation activities were conducted as part of the Surface Water Management Program (SWaMP) and in support of facility projects managed by FESS. In 2017, Clean Water Act Section 404 Regional Permits were received for the following projects: Lab 6 pond improvements and low-head dam removal, Eola Road culvert replacement, and Giese Road power pole replacement.

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

In 2017, 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 (IDNR) "Rules for Construction and Maintenance of Dams"

The Department of Energy holds an 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 Fermilab 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. No non-routine action items were identified during the 2017 annual inspection. 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

A Department of Energy memorandum of understanding (MOU) with the U.S. Fish and Wildlife Service (2013) 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. Ecological land management across the Fermilab site continues to provide ample habitat communities and stopover resources for migratory birds. Additionally, Fermilab maintains a proactive approach to protecting the Canada goose population onsite while ensuring the safety of employees and visitors. Fermilab contracts with a firm to use dogs to harass geese to displace them from more heavily used operational areas on the site. The firm holds a valid permit from the IDNR to pursue this activity, which was carried out during the spring nesting season. Fermilab also possesses a Nuisance Wildlife Control Permit issued by the Illinois

Department of Natural Resources that allows for the destruction of Canada goose nests if they become a safety hazard. The permit allows the laboratory to destroy up to seven nests each year. During 2017, 3 nests containing 10 eggs were destroyed.

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 2017, 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 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 or small-scale research and development projects and conventional laboratory operations. However, 8 projects/actions did need to be addressed by submitting environmental evaluation notification forms to DOE; DOE then formally determined that all 8 of the projects/actions 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 FSO 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 (EA) nor an Environmental Impact Statement (EIS) is required.

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 2017 to assess any potential impacts on historic resources. No compliance issues were identified in 2017. Fermilab follows a site-specific, DOE required Cultural Resources Management Plan (CRMP), following guidelines outlined in DOE Publication DOE/EH-0501. The CRMP assures continued compliance with the above listed Acts by providing a comprehensive overview for the locations and status of all cultural 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 February of 2017.

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 2017. These permits are as follows:

1. *Individual NPDES permit for Non-Contact Cooling Water and Storm Water*

This 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 ICW holding tank and Outfalls 005 and 006 cover storm water overflow discharges from the Main Injector pond system. The 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 monthly. A new permit was issued in April 2014 from the IEPA. A Compliance Evaluation Inspection Report was last conducted in November 2016 by the IEPA. No findings were reported.

2. *General NPDES Storm Water permit for Construction Activities*

This permit is required for all projects that disturb greater than one acre. In 2017 there were four projects.

- a. SBN Near Detector
- b. SBN Far Detector
- c. SLI UUP Project
- d. Muon Campus Project

3. *General NPDES Permit for Pesticide Application Point Source Discharge*

This permit applies to facilities that apply pesticides that may impact waters of the State.

Additionally, Fermilab holds two industrial wastewater pre-treatment operating permits issued by IEPA (also covered under NPDES regulations and are described under Section 6.3.4, Releases to Sanitary Sewers).

7.13 Regulated Waste

Resource Conservation and Recovery Act (RCRA): Federal RCRA regulations govern the management of hazardous waste. Fermilab maintains a permit under RCRA to manage for disposal or reclamation hazardous waste generated at the laboratory. Fermilab does not treat or dispose of regulated waste on site. Radioactive waste is not governed under RCRA and is managed following DOE requirements. All wastes are properly disposed through 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.

RCRA Investigation Summary: On April 27, 2017, the U.S. Environmental Protection Agency performed an unscheduled RCRA inspection on Fermilab's Hazardous Waste Storage Facility (HWSF) located at Site 55. The purpose of the inspection was to evaluate Fermilab's compliance with its Part B Permit for the storage of hazardous waste. The inspection resulted in no violations of any of the specific RCRA requirements that were under evaluation.

Radioactive Waste: Fermilab's Hazard Control Technology Team (HCTT) is responsible for the overall management of Low Level Radioactive Waste (LLRW). This includes all transportation related activities associated with shipping LLRW from Fermilab to designated DOE approved disposal facilities. In October 2017 Fermilab disposed of a radioactive horn and a radioactive target at the Nevada National Security Site.

Tritiated Water: During 2017, 19,890 gallons of tritiated water were generated for disposal. The primary source of tritiated water requiring disposal results from a below ground collection system used to capture water associated with a compromised liner surrounding the Booster Neutrino Beam Absorber at M112. Accumulated water is pumped to surface holding tanks where it is sampled for tritium. Water with tritium concentrations above DOE's release criteria of 1,900 picocuries per milliliter is characterized as low-level radioactive waste. It is solidified and disposed of in an approved landfill. Water below release criteria concentrations is reclaimed for use via discharge into Fermilab's Industrial Cooling Water System.

Regulated Waste Disposal and Reclamation: The following volumes of regulated waste including radioactive waste and non-radioactive waste were managed for disposal by the HCTT in 2017.

Waste Material	Cubic Meters
Non-Routine Hazardous Waste (RCRA + TSCA)	6.3
Routine Hazardous Waste (RCRA + TSCA)	6.2
Non-Routine Non-Hazardous Special Waste	56.8
Routine Non-Hazardous Special Waste	43.0
Radioactive Waste (DOE Regulated)	160.5

Additionally, 77,673 kilograms demolition waste was managed for disposal from the NOvA Prototype Detector and 101,778 kilograms from the Site 56 Horse Barn.

The following volumes of waste were generated by Fermilab and managed for reclamation/recycling by the HCTT.

Recycled/Reclaimed	Kilograms
Non-PCB Capacitors	537
Non-PCB Fluorescent Light Ballasts	1,149
Mercury Containing Lamps	13,333
Mercury Containing Equipment	4
Alkaline Batteries	720
Lead Acid Batteries	5,670
Universal Waste Batteries	213
Safety Kleen Solvent	1,078
Used Oil	15,921
Oil Filters	272

7.14 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 monitoring wells installed at this unit.

In April 2017, Fermilab submitted a proposal to IEPA to reduce the amount of sampling at SWMU 12. In October 2017 IEPA provided a response stating the approval to remove the five shallow water table wells from future monitoring requirements. As a result, only the four bedrock monitoring wells and the one deep till monitoring well were sampled in 4th quarter 2017, while all 10 wells were monitored in the 2nd quarter. Additionally, the IEPA required submittal of a work plan for the installation of four new monitoring wells in the deep till zone.

The following table summarizes the 2017 results at SWMU 12 from wells with results above either the Class I or Class II Groundwater Quality Standards.

Glacial deposit well MWD1 produced 2nd and 4th quarter total chloride results of 880 mg/L and 980 mg/L, respectively. The Class II Groundwater Quality Standard is 200 mg/L.

Glacial Deposit Monitoring Wells			2Q17	4Q17
	Class II GW Quality Standard		Well CUBD1 MWD1	Well CUBD1 MWD1
PARAMETER				
INORGANIC (mg/L)				
Chloride, Total	200		880	980
Lead, Total	0.1		U	0.004 J

Grey Shading = Above the Class II GW Quality Standard

U = Undetected

J = Estimated

Bedrock Monitoring Wells		2Q17	4Q17	4Q17
	Class I GW Quality Standard	Well CUBBd4 MW6B	Well CUBBd4 MW6B	Well CUBBd3 MW7B
PARAMETER				
INORGANIC (mg/L)				
Chloride, Total	200	17	24	4 J
Lead, Total	0.0075	0.008	0.017	0.208

Grey Shading = Above the Class I GW Quality Standard

U = Undetected

J - Estimated

Bedrock wells MW6B produced 2nd quarter total lead results of 0.008 mg/L. Bedrock wells MW6B and MW7B produced 4th quarter total lead results of 0.017 and 0.208 mg/L, respectively. The Class I groundwater quality standard is 0.0075 mg/L.

7.15 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.

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

Under SARA Title III Section 313 regulations Fermilab is required to provide U.S. EPA and the State of Illinois with an annual account of toxic chemicals over certain reporting thresholds that were manufactured, processed or used in a given year. Reporting is accomplished through the Toxic Release Inventory (TRI) reporting system. Fermilab had no chemicals that exceeded the reporting threshold in calendar year 2017.

Additionally, under Tier II reporting requirements, Fermilab provides annually to state and local officials a description of hazardous, toxic, and extremely hazardous chemicals used or stored onsite in quantities greater than their respective reporting thresholds.

7.17 Oil Spill Prevention

Fermilab's Spill Prevention Control and Countermeasures (SPCC) Plan complies with 40 CFR 112 – Oil Pollution Prevention. This US EPA-enforced regulation requires 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 all oil sources with a capacity of 55 gallons or more. In 2017 Fermilab updated its SPCC Plan to ensure regulatory compliance. The plan was approved by a professional engineer familiar with the regulation and Fermilab operations. A FESHM chapter and SPCC training for oil handling employees describe the Fermilab SPCC Plan. Training is provided annually to affected employees in accordance with the regulation.

Fermilab has more than 700,000 gallons of oil on site including more than 350 oil-filled transformers. In 2015 Fermilab developed a new SPCC database to improve overall management of the inventory. The database has helped to ensure the oil sources owned by each division/section remain in compliance with 40 CFR 112 by cataloging all monthly inspections and the locations of oil sources.

In 2017 Fermilab removed the NOVA Surface Detector containing 14,800 gallons of scintillator oil. 2,800 gallons of oil was disposed, and the remaining 12,000 gallons of oil was placed into a new tank farm at the Meson Detector Building east parking lot.

7.18 Toxic Substance Control Act (TSCA)

There are no changes to the status of the Groundwater at Main Ring service buildings B1 and B4 since it was determined in 2002 to be PCB-contaminated as a result of seepage of groundwater into the excavations after the completion of the phased cleanup in 2002. These locations could not be declared "clean" so Fermilab requested approval from EPA to classify the residual PCB contamination as "disposed in place." USEPA approved the request with some conditions that included Fermilab placing a notice to the deed that identified the location of the contaminated groundwater and indicate that its use is restricted. This was accomplished in June of 2010. The laboratory was also required to notify the Agency in writing, at least 10 days prior to conducting any excavation activities that involve the removal of soil or other material in the area where the contaminated groundwater exists. If groundwater is encountered, it must be sampled, and all results must be reported to EPA. Several internal mechanisms were created to ensure that these requirements were

met, including placing signs at the affected locations, adding the locations to the Geographic Information System (GIS), and modifying ESH&Q review procedures.

8.0 Pollution Prevention and Waste Minimization

Fermilab continues to make progress minimizing waste and reducing pollution. In FY2017, Fermilab generated 572 metric tons of municipal type waste. Fermilab recycled 354 tons (62%) of material through a combination of office/ residential type recycling, and the recycling of scrap metals, wood, tires and other materials. Only 218 tons (38%) were sent to a landfill. This amount does not include electronics.

Fermilab recycles or donates for reuse 100% of eligible used computer equipment. This includes computing and electronic equipment including servers, printers, laptops, monitors, cellphones, PDAs, TVs etc. Donations for reuse go through DOE's Computers for Learning program.

Permanent dumpsters dedicated to recycling construction and demolition debris were staged on site. Fermilab has these dumpsters to encourage 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. In 2017, these dumpsters and construction dumpsters from large scale fixed price projects collected 370 tons of construction waste; 316 tons (86% of the total) was recycled.

Other notable pollution prevention measures include:

- In May 2014, the cafeteria food service provider started composting their kitchen scraps, coffee grounds and paper towels. In 2017, 2.7 metric tons of food and compostable waste was diverted from the landfill and hauled to a compost facility.
- The kitchen's grease traps are cleaned out every two months and the "sludge" is taken to an anaerobic digester at either Fair Oaks Dairy Farm in Indiana or the Downers Grove sanitation district. It is mixed with other organic waste as fuel to create electricity. In 2017, 6.8 metric tons of sludge was converted to energy.
- Several surrounding municipalities dispose of their residential fall leaf refuse on Fermilab's agricultural fields. In 2017, 17,500 cubic yards (roughly 793 tons) were incorporated into 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.
- In 2017, 100% of eligible PCs, laptops, and monitors had power management enabled and are centrally managed. A comprehensive managed print services is in place throughout the site. Printers are defaulted to double-sided printing and black/white ink.

Grid Computing Center received the U.S. EPA Energy Star Award for the seventh consecutive year in 2017 and is in compliance with 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 Illinois Accelerator Research Center OTE building at Fermilab was certified as a LEED-NC Gold building in March 2015. The existing Roads and Grounds building at Site 37 also became compliant with the Guiding Principles. Mu2e, SBN-Near, SBN-Far and MC1 buildings completed their High Performance Sustainable Building Guiding Principles checklist and were added to Fermilab's inventory of buildings that meet the Guiding Principles. The design of ICB-a was finished in 2017 and it is currently at 70% compliance using the latest 2016 version checklist. The remaining 30% are construction-related items and expected to be 100% complaint when construction finishes next year. PIP2 and IERC started the checklist at the conceptual level.

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 2017 Fermilab continued to operate a metals recycling program that has a rigorous material screening process and has incorporated numerous ongoing improvements that have been made since 2000. An enhanced Material Move Request form (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 being disposed from posted Radioactive Material Areas. Recycling packages will include a precise description of the metals to be released, with photo documentation, and area surveys of the building where the metals were removed. Additionally, a summary of the timeline tracks the location of the materials for the duration that they were on site. In 2017, 293 metric tons of various metals met Fermilab's release requirements and were recycled.

10.0 Conclusion

Fermilab operations during 2017 had no significant adverse impact on the environment or on public safety. An emphasis on compliance with regulations and requirements, and environmental stewardship remains a high priority for the laboratory.