FERMILAB
Report to the Director on the Fermilab Environment CY2001

1.0 Introduction

Environmental stewardship continued to be a guiding principle at Fermilab in 2001. That principle was translated into a working reality through the effective deployment of the environmental protection program. The environmental protection program (EPP) establishes policies and procedures to ensure compliance with regulatory requirements imposed by Federal, State and local agencies and with DOE orders. In addition, the EPP provides for the measurement and interpretation of the impact of Fermilab operations on the public and the environment via its comprehensive environmental monitoring and surveillance program.[1]

Surveillance and monitoring tasks are conducted to confirm compliance with standards and permit limits as well as ensure early detection of an unplanned pollutant release. The location and frequency of sampling are based on established routines, operational considerations and historic levels of pollutants found in each location. Sampling points are selected based on the potential for adverse impacts.

To evaluate the effects of Fermilab operations on the environment, 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. The status of environmental protection activities and the progress on environmental restoration, waste management and corrective action activities are discussed in this report. There were no abnormal occurrences that had an impact on the public, the environment, the facility or its operation in CY2001.[2]

2.0 Laboratory Highlights

After a decade of preparation, Collider Run II at the Tevatron, recently upgraded with a more powerful new Main Injector and improved Detectors, began on schedule in March of 2001. Run II, which is a 10 percent energy increase over Run I, has the potential of revealing much more new physics (for example: discovering hidden dimensions, confirming the existence of the proposed Higgs boson, and providing a better understanding of the top quark, discovered at Fermilab in 1995 during Collider Run I).

The Neutrinos at the Main Injector (NuMI) project construction continued throughout 2001. The priority this year was completion of the 350-foot deep Main Injector Neutrino Oscillation Search (MINOS) shaft and excavation of the 3000-foot decay tunnel via utilization of a Tunnel Boring Machine. A full-time safety expert and full-time employee to supervise compliance with ES&H requirements joined the project staff after a safety accident resulted in a temporary work stoppage in July. In addition, the Laboratory ordered a safety stand down; the stand down provided safety training in job-specific hazard analysis as a way of integrating safety into all aspects of the work. The project was rejuvenated in September after a DOE committee recommended adoption of a new project budget and a schedule for completion in 2005.

In August of 2001, Fermilab was awarded $1.28 million dollars by means of DOE's Scientific Discovery through Advanced Computing Program; this money will be received over the next three years and enable the Lab to participate in three significant nationwide collaborations.

As a result of the terrorist attacks of September 11, 2001, Fermilab, along with other Federal facilities, instituted heightened security measures that restricted public access to the Lab.

A project to upgrade the compressor and cooling tower, critical elements of Fermilab's unique-liquid helium cooling system, was finished in September of 2001. This upgrade to the Central Helium Liquefier (CHL) plant will reduce energy consumption by a megawatt, cutting the Laboratory's annual electric bill by hundreds of thousands of

dollars. This project was initiated under the Utility Incentive Program and was granted the Energy Saver Showcase Award by the DOE.

Construction of the MiniBooNE project continued with the building of its uniquely designed detector. The detector consists of a 40-foot spherical tank with more than a thousand photomultiplier tubes covering the inside of the sphere and pointing to the center of the tank. Upon completion, the tank was filled with 250,000 gallons of mineral oil; the detector will record flashes of light that occur as neutrinos collide with oil molecules. The detector became fully operational in December of 2001.

In December 2001 at a signing ceremony attended by the Speaker of the House Dennis Hastert, the DOE extended for five years its contract with Universities Research Association, Inc. (URA), to manage and operate the Fermi National Accelerator Laboratory. The new agreement is estimated to have a value of about $1.5 billion over the term of the agreement.

2.1 Significant Environmental Accomplishments

The improved groundwater-monitoring program continued to show no adverse chemical or radiochemical impact from Fermilab operations on the Class I resource groundwater below the site. A reduction in the number and frequency of chemical parameters was negotiated with the IEPA for monitoring wells at both Solid Waste Management Unit 12 (Central Utility Building Tile Field) and SWMU 13 (Meson Hill). In addition, an investigation was begun into the detected concentrations of sulfates found in glacial till monitoring wells at Meson Hill (see Section 4.12.1 for more details). Initial indications point to natural conditions and sources for the detected sulfate concentrations. Water levels have been documented over a period lengthy enough to establish the flow direction in the Class I groundwater below the D-Zero Assembly Building, Main Injector Service Building (MI30), and Proton East Enclosure 3. Dedicated pumping systems will be placed into current piezometers at each location in the down gradient direction. The investigation of impacts on groundwater from the NuMI construction has shown no adverse effects on the potentiometric surface of groundwater in the Class I resource beyond the localized area of the construction.

An EPA-approved plan to remediate PCB-contaminated soil at twenty-four transformer sites located at service buildings around the Main Ring was essentially completed in CY2001 (see Section 4.16 for further details). The contamination had occurred primarily because of past (pre-TSCA) practices in which transformer oil containing 2-5% PCBs was drained onto the ground as a prelude to sampling to assess the status of the oil's dielectric properties.

Fermilab's Pollution Prevention Initiative consists of a Restoration and Reuse (R&R) Program and a Waste Minimization (reduction before and after generation) Program. Under the Restoration and Reuse program, the Particle Physics Division cleaned out the experimental hall Proton West (PW8) at Fixed Target in 2001. This project resulted in the removal of over 5 million pounds of material (primarily steel); 83% of this material was recycled or reused on site. The newly available space will be used for storage of items previously stockpiled offsite in a rented warehouse. The recycled and reused material from this R&R project counted toward Fermilab's 2001 waste minimization goal, thus illustrating the beneficial synergy of these two programs. Also in 2001, the Environmental Protection Subcommittee of the Laboratory Safety Committee and the ES&H Section continued to conduct peer reviews for the merit-based distribution of funds earmarked for proposed pollution prevention/waste minimization efforts.

Greening the Government Through Leadership in Environmental Management (Executive Order 13148) contains requirements for implementing and assessing Environmental Management Systems (EMSs) at Federal facilities. In February 2001, DOE issued Notice 450.4, "Assignment of Responsibilities for EO 13148." Fermilab responded to a questionnaire in September 2001 as part of DOE's assessment of the evolution of EMSs at its facilities. The information contributed to both a DOE EMS self-assessment summary report and an annual report to the USEPA on DOE's progress in meeting the goals of EO 13148. Fermilab has until December 31, 2005 to implement an EMS through incorporation with the Integrated Safety Management System.

U.S. Department of Agriculture Wildlife Service-contracted deer removal operations were effectively administered during the 2001-2002 season; however, no aerial survey of the Fermilab deer population was conducted in 2001. A

vegetation study conducted by a consultant in May 2001 showed substantial recovery in the forest and fewer signs of deer browse damage, a significant rebounding after 2 years of the deer reduction program. The consultant report recommended that efforts to manage the deer population should continue in order to ensure the protection of plant communities, especially wooded areas.

The ES&H Section reduced its involvement in environmental oversight for the larger onsite construction projects (Neutrinos at the Main Injector [NuMI] and Mini-Booster Neutrinos Experiment [BooNE]) in 2001. The Facilities Engineering Services Section took ownership for this by designating the responsibility to their personnel. Plans to control soil erosion during the construction of NuMI and MiniBooNE continued to be implemented this year; these plans were updated as necessary. In addition, the ES&H Section provided task manager and contractor training on all aspects of environmental compliance including erosion control.

2.2 Other Environmental Issues

Seven National Environmental Research Park (NERP) research projects (Differences in Reproductive Success of Prairie Plant Species between Restored and Remnant Prairies; Carbon Sequestration in Terrestrial Ecosystems; Assessment of the Impact of Biological Controls on Garlic Mustard and on Non-target Species in Forest Communities; Bird Surveys at Fermilab; Status and Management of Giant Canada Geese in Northeastern Illinois; Effects of Tree Removal on Recovery of Ground Cover in Big Woods at Fermilab; Mycorrhizal Community Dynamics and their Impact on Plant Communities at Fermilab) remained underway, while two additional projects (Bird Species Composition at Fermilab; The Role of Insect Flower Herbivory in Native and Restored Prairies) were proposed but work had not yet begun in the field.[3]

The Laboratory's long-range Land Management Plan was updated in 2001. Existing prairie tracts were enriched with forbs and burned or mowed to discourage intrusion of brush, trees and exotic plants.

The moratorium, issued by the Secretary of Energy in July 2000, on recycling of scrap metals from posted radiological or radioactive materials areas, remained in effect throughout 2001. Measures continued to be taken throughout 2001 at Fermilab to separate materials subject to this moratorium. Due to this, materials were amassed that were considered non-radioactive according to Fermilab's DOE-approved release criteria and which had been recycled prior to the moratorium.

3.0 Environmental Monitoring and Surveillance

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

The pathways available for movement of radioactive materials and chemicals from Fermilab operations to the public are the atmosphere, surface water and groundwater. Environmental surveillance consists of collecting and analyzing samples of various media and measuring penetrating radiation within and outside 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 monitored for radionuclide concentrations. Surface waters are also monitored for potential chemical constituents. While levels of penetrating radiation are measurable

near operational areas on the site, the levels decrease rapidly with distance from the sources. External penetrating radiation and airborne emissions are normally below instrument detection levels at the site boundary and must be estimated to provide information about the maximum potential radiation doses to offsite populations. The results of the environmental surveillance program are interpreted and compared with environmental standards where applicable. The Fermilab Environmental Monitoring Plan, which is maintained by the ES&H Section, provides more details.

3.1 Air Quality

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

Airborne radionuclides are normally released to the atmosphere from operating target stations. Monitoring is conducted at targeting areas where air emissions are considered a significant contributor to the overall transport of radioactive materials offsite. The Magnet Debonding Oven at the Industrial Complex also contributes a small quantity of airborne radionuclides when operating. Our permit application states that total releases will average no greater than 100 Ci/year with a maximum of 900 Ci/year.

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 CAP-88PC. This model was created by USEPA to predict the movement of airborne radionuclides and its use is required by regulations governing hazardous air pollutants at 40CFR61. Maximum calculated concentrations offsite are predicted to be below the level that could be detected by monitoring.

Fermilab is not a significant source of chemical air pollution. Our permits cover emissions caused by open burning conducted for prairie/land management and fire extinguisher and firefighter training, a magnet debonding oven, a fuel dispensing facility, a vapor degreaser and the operation of several natural gas-fired boilers. Pollutant levels are estimated based on the knowledge of the processes that generate them and the characteristics of individual pollutants. The results are submitted to the Illinois Environmental Protection Agency in an annual air emissions report.

3.1.1 Radioactive Air Emissions

Debonding Oven operation is a potential source of tritium while radioactive components are being burned. However, it was not operated in CY2001. The Anti-Proton stack is estimated to have released a total of 15.47 Curies in CY2001. These radioactive air emissions were less than 16% of the limits of our current air pollution permit application on file with the Illinois Environmental Protection Agency (IEPA). No detectable levels of radionuclides reached the site boundaries. Doses to the public from emissions in CY2001 continued to be well below the Environmental Protection Agency (EPA) standard of 10 mrem/year to a member of the public and also much less than the EPA's continuous monitoring threshold of 0.1mrem/year. Using the CAP-88 PC v2 gaussian dispersion code, the highest dose equivalent to any member of the public was estimated to be 0.00607 mrem.

Fermilab's CY2001 Radionuclide Air Emissions Annual Report was submitted to DOE in June 2001.

3.1.2 Non-Radioactive Air Emissions

The IEPA decided in late 1996 that the level of air emissions at the Laboratory did not warrant the issuance of a Federally Enforceable State Operating Permit (FESOP). In CY2000, the Agency issued Fermilab a revised Lifetime

Operating Permit adding a vapor degreaser to the previously permitted air pollution sources. The new permit covers the Magnet Debonding Oven, three boilers at CUB, a 12,000-gallon tank of gasohol, accelerator tunnel ventilation stacks and a vapor degreaser at Industrial Building 3. Permit conditions require the monthly logging of fuel consumption for covered fuel combustion sources and solvent usage at the degreaser. Source operations were reviewed by Fermilab personnel again this year to ensure that permitted equipment continued to operate and be maintained in accordance with permit conditions. The estimated concentrations of pollutants emitted were slightly increased as compared to last year due to the operation of the vapor degreaser. All source emissions were compliant in CY2001. The Annual Air Emission Report for CY2001, an estimate of criteria pollutant emissions, was submitted to the Illinois Environmental Protection Agency (IEPA) by May 1, 2002.

3.2 Penetrating Radiation

Operation of the Fermilab accelerator and associated beamlines produces ionizing radiation such as muons. Beamlines and experiments are designed so that most of the radiation has ranged out before reaching the ground surface. However, some emerge above the surface and present a small potential for radiation dose. Small muon fields have been measured in conjunction with the operation of the Tevatron (TeV) Abort and the Meson Test (MT), Meson Center (MC), and Kaons at the Tevatron (KTeV) beamlines in the past. However, these beamlines were not operated in CY2001 and therefore contributed no effective dose equivalent to any member of the public.

Storage of radioactive materials at a centralized onsite location, known as the Railhead, results in another potential exposure to ionizing radiation. These sources of penetrating radiation were monitored periodically in CY2001 through onsite surveys. In past years the dose equivalent rate arising from this storage has not been measurably different from ambient background levels in the Railhead area. However, during the period from October 18 –December 31, 2001 a large amount of radioactive steel from the PW8 building was moved to an unshielded area of the Railhead. This unshielded steel caused an indirectly measurable dose equivalent rate to arise at the site boundary. Dose estimates were calculated under the extremely conservative assumption that a single individual was exposed for the 74-day period (October 18-December 31, 2001) at the site boundary. Based on measurements made in CY2001, it is believed that radioactive materials stored at the Railhead contributed a dose equivalent at the site boundary in 2001 of approximately 7.6 mrem. The maximum radiation dose equivalent to an individual at the nearest offsite house was similarly estimated to be approximately 1.3 mrem in CY2001.

In 2002, Fermilab took action to help prevent a reoccurrence of such a dose equivalent at the site boundary. First, the radioactive steel from PW8 was moved to a location east of Lundy Barn directly behind the ES&H Section Super Shed. In this position, the Super Shed served to shield the site boundary from radiation emitted by the PW8 steel. Second, continuous monitoring of the dose rates in the Railhead area was reestablished by placing a large volume ionization chamber (referred to as a ‘Hippo’) there.

3.3 Water Quality

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

A Notice of Intent (NOI) to discharge storm water associated with the MiniBooNE Target Hall/ 8GeV Beamline construction site activities was submitted in July 1999. The IEPA determined that the stormwater discharges associated with these sites were covered by a General NPDES permit. A project-specific Storm Water Pollution Prevention Plan (SWPPP) continues to be maintained to ensure compliance with this permit.

In 1999, the NuMI construction project was issued a General NPDES permit by the IEPA covering construction related to mining activities. This permit is primarily focused upon ensuring the safe discharge of effluents from the mining of dolomite during digging of the associated tunnel and providing erosion controls for construction areas and associated stockpiles. In concert with this project, several new outfalls to onsite waterways have been identified for monitoring. Monitoring for Total Suspended Solids (TSS), pH, and flow rate is performed at these NuMI-specific outfalls. In addition, the Corps of Engineers authorized NuMI activities for coverage under the Clean Water Act Section 404 permit program in August of 1999. This authorization was renewed in 2001.

3.3.1 Radioactive Releases to Surface Water

Numerous sumps collect and drain water from building footings and from under beamline tunnels in the Tevatron, Main Injector and the Experimental Areas. Water collected by these sumps often contains detectable concentrations of radionuclides (primarily tritium, H^3) that have been leached by rainwater from radioactive soil near beam targets and absorbers or released accidentally to sumps from beamline cooling water systems. These sumps discharge to ditches and ponds onsite. Surface water monitoring conducted during CY2001 showed tritium concentrations to be well within the Department of Energy Derived Concentration Guides for allowable radionuclide releases to surface waters (2000 pCi/ml). Six of the seventy-two samples taken from onsite ditches, ponds and creeks in CY2001 showed a detectable level of tritium[4], the highest of which was 81.0 pCi/ml. No radionuclides were detected in samples taken at the site boundary.

3.3.2 Non-Radioactive Releases to Surface Water

Monitoring for non-radiological chemical constituents in surface water was limited to NPDES permit parameters (temperature, flow, TSS, pH and chlorine) this year. Discharge Monitoring Reports for six different outfalls were submitted monthly to the IEPA. Throughout 2001, the NuMI project reported numerous occurrences of exceeding the permitted discharge limits. The NuMI construction project experienced difficulty achieving the discharge limits for both total suspended solids and pH. During the course of the year, IEPA approved adjustments were made to water treatment systems in order to improve the quality of water discharging from both of the Numi construction sites (Target and MINOS). A total of 13 permit limit exceedances were reported to the IEPA in 2001. Also reported to IEPA was a situation in which oil contaminated material, generated from the NuMI construction site, was accidentally deposited at an on-site rock stockpile. The oil-contaminated material was subsequently removed from the stockpile and hauled to a permitted landfill.

MiniBooNE construction continued within the conditions of the NPDES General permit and the project-specific Clean Water Act Section 404 wetlands permit authorization. A Corps of Engineers contractor, to ensure compliance with both permits, conducted monthly inspections throughout 2001. Additionally, the permanent alignment of Indian Creek was re-established following its temporary re-routing to enable the construction of the 8 GeV line for MiniBooNE; this work was conducted in accordance with the Section 404 permit authorization. Erosion control structures and practices were routinely scrutinized to ensure conformance with the SWPPP.

3.3.2.1 Cooling Water System

An NPDES permit authorizes the discharge of commingled cooling water and stormwater runoff to surface waters through outfalls to Kress, Indian and Ferry Creeks. Due to the presence of the RCRA-permitted (Resource Conservation and Recovery Act) Hazardous Waste Storage Facility onsite, the NPDES permit also regulates stormwater discharges from designated solid waste management units (SWMUs). The Stormwater Pollution Prevention Plan required by this NPDES permit is periodically modified to reflect changes that occur as part of the RCRA Facility Investigation (RFI) of the SWMU sites. Our site-wide NPDES permit dictates that water temperature, pH, and flow be monitored at all three outfalls. The results are reported to the IEPA on a monthly basis. Chlorine concentration[5] is also reported for the Kress and Indian Creek outfalls.

3.3.2.2 Releases to Sanitary Sewers

Another NPDES permit allows us to pretreat and release effluent from the Central Utility Building (CUB) regeneration process to the City of Batavia sanitary sewer system. The pretreatment permit for the effluent generated by this process requires the collection and analysis of composite process effluent samples for specified metals on a quarterly basis. Samples were also collected and analyzed before each discharge for accelerator-produced radionuclides in order to confirm that amounts of radioactivity released meet DOE Guidelines. In CY 2001, samples from the process effluent were in compliance with the specified levels in the Batavia Sanitary Sewage Ordinance and the Department of Energy Derived Concentration Guide. Approximately 0.47 mCi of tritium was released to the sanitary sewer from the CUB during CY 2001.

Monitoring stations, located at the site boundary, sample sewer discharges to each municipality. The discharge at these locations is a mixture of all effluents contributing to that sanitary sewer system. Analytical results are compared to municipal discharge limits to track compliance. This year, the Batavia sewer sampler revealed exceedances of the iron discharge limit of 5.0 mg/l during the months of September through December. Samples yielded iron concentrations ranging from 8 to 41 mg/l. These excursions were thought to be due to the aging of the pipes and ongoing work to upgrade that infrastructure.

3.4 Groundwater Quality

Groundwater quality standards are published by the State[6]. Class I groundwater is considered to be a non-degradable resource and is highly protected. The water that is located in or near the dolomite aquifer 50 to 70 feet below ground surface of Fermilab is Class I groundwater according to criteria published by the State[7]. Water in the overlying till has been demonstrated to be Class II water and therefore has less stringent standards.

Four background monitoring wells in locations upgradient to Fermilab operations continued to be utilized to obtain representative samples of the upper Class I groundwaters for either chemical and/or radiochemical analysis. Ten wells at the Central Utility Building (CUB) Tile Field and seven at Meson Hill were sampled as part of ongoing RCRA Facility Investigation (RFI) Corrective Actions at these sites. Over forty piezometers were used to gather information on the direction of groundwater flow sitewide. The information collected will be used in modeling the transport of potential contaminants. Piezometers that had been installed as part of the NuMI site characterization were monitored to assist the Lab in planning for groundwater protection at that facility. Fermilab continues to analyze groundwater issues associated with this project that involves construction within the dolomite aquifer. To date, the investigation of impacts on groundwater from the NuMI construction has shown no adverse effects on the potentiometric surface of groundwater in the Class I resource beyond the localized area of the construction.

Thirty-three of one hundred-four-onsite groundwater monitoring locations were sampled during the year for radionuclide or chemical parameters. The remainder were available for water level monitoring.

Water levels have been documented over a period lengthy enough to establish the flow direction in the Class I groundwater below the D-Zero Assembly Building, Main Injector Service Building 30, and Proton East Enclosure 3. Dedicated pumping systems will be placed into current piezometers at each location in the down gradient direction.

3.4.1 Groundwater Characterizations

No new characterizations were conducted during 2001.

3.4.2 Monitoring Well Modification and Abandonment Activities

No new monitoring wells were installed or modifications or abandonments performed on existing monitoring wells during 2001.

3.4.3 Radionuclides

The Department of Energy groundwater concentration guide and the Illinois Class I groundwater standard for tritium is 20 pCi/ml. Monitoring of all Central Utility Building Tile Field monitoring wells in the first half of CY2001 showed tritium levels in those wells to be less than the detection limit of 1.0 pCi/ml. The permit requirement for monitoring these wells for radionuclides was eliminated during this year. (See Section 4.12.1 RFI Activities.)

3.4.4 Chemicals

Three rounds of groundwater samples were collected in 2001 at several Solid Waste Management Units (SWMUs) under our RCRA RFI. (See Section 4.12.1 RFI Activities.)

4.0 Compliance with Specific Environmental Regulations

Below is a summary of Fermilab compliance with key environmental regulations.

4.1 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 2001. Annual air emissions reports for CY2001 were submitted to the IEPA in April 2002 and will be submitted to the USEPA by the end of June 2002.

An estimated 15.5 Curies were released in conjunction with the operation of the Fermilab Anti-Proton Areas stack in CY2001; no Fixed Target experiments were conducted during the year. The Magnet Debonding Oven, a potential source of tritium was not operated during CY2001. The CAP-88PC v2 dispersion model calculated the maximum dose equivalent delivered to a member of the public (at the boundary of the lab) to be 0.00607 mrem/year due to CY2001 Fermilab operations. This was a slight increase from the CY2000 calculated maximum dose equivalent of 0.00459 mrem/year; the increase was a result of Run II, which ran throughout 2001 with the exception of a 6-week shutdown. The collective effective dose equivalent for CY2001 was estimated to be 13.5 person-mrem.

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.

4.2 Underground Storage Tanks

Fermilab met the December 22, 1998 deadline for compliance with the EPA underground storage tank (UST) regulations 40 CFR 280.80. All pre-existing USTs installed prior to 1988 have been properly closed. The only two remaining underground storage tanks (USTs) were installed in 1994 and are currently in use at the Fermilab Fuel Dispensing Facility. They comply with the current UST standards. Two enforcement individuals from the USEPA RCRA Office of USTs/LUSTs visited Fermilab on January 22, 1999 to confirm that the two remaining USTs on site met the required codes. No concerns have been identified since that time.

In April 2001 the Lab responded to a notice from the Office of the Illinois State Fire Marshal regarding a potential compliance issue involving installation and corrosion protection of existing UST flex connectors at our Fuel Service Center located at Site 38. Business Services Section personnel as well as an independent subcontractor inspected the connectors and determined that the equipment was in compliance.

4.3 The Endangered Species Act of 1973

No compliance issues were identified in CY2001.

4.4 Executive Order 11988, "Floodplain Management"

No compliance issues were identified in CY2001.

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

Pre-evaluation of Fermilab activities in wetlands continues to be accomplished through the NEPA review process and construction design reviews. In addition, task manager training was updated to include all aspects of environmental compliance management and to instruct participants how to ensure that potential work areas are screened for the presence of wetlands.

The permanent alignment of Indian Creek was re-established following its temporary re-routing to enable the construction of the 8 GeV beamline for MiniBooNE. The Corps of Engineers (COE) Section 404 permit authorization to realign the creek and to fill wetlands was strictly followed. In addition, the Corps of Engineers renewed a site preparation Section 404 permit authorization associated with the NuMI project that would have otherwise expired in 2001.

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

In CY2001, the use of pesticides and herbicides at Fermilab was handled in accordance with FIFRA.

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

Fermilab personnel inspected the permitted Fermilab Main Injector Class III Dam (the FMI berm) in April 2001 to ascertain that the dam was being maintained in accordance with the maintenance plan associated with the permit. The Main Injector berm is permitted by the Illinois Department of Natural Resources as a small Class III dam. The need for some minor remedial actions and routine maintenance was discovered and actions were taken. There were no compliance issues identified. The annual report was submitted to the State on time.

4.8 The Migratory Bird Treaty Act

There were no compliance issues identified in CY2001.

4.9 National Environmental Policy Act (NEPA)

Fermilab met these requirements by continuing to implement a program of reviewing all of its activities for compliance as set forth in the Fermilab Environment, Safety and Health Manual Chapter 8060. In 2001, a work group was formed to review and make necessary revisions to that chapter. The new chapter will be issued in 2002. DOE approved fifteen projects for Fermilab as being categorically excluded (CXs) from further review in CY2001.

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

Compliance with these Acts was accomplished through the NEPA review process that included an evaluation of all proposed land-disturbing projects in CY2001 to assess any potential impacts on historic resources. No compliance issues were identified in CY2001.

Additionally, the DOE has requested that a Cultural Resources Management Plan (CRMP), following guidelines outlined in DOE Publication DOE/EH-0501, be prepared for Fermilab. The CRMP will assure continued compliance with the previously stated 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. The completed CRMP is expected by the end of July 2002.

4.11 National Pollutant Discharge Elimination System (NPDES)

Our NPDES permit to pretreat demineralizer regenerant waste at the CUB was reissued in August 2000. MiniBooNE construction activities continued to be covered under a NPDES General Permit. In addition, a NPDES General Permit for Non-Coal Mines regulates discharges from the NuMI construction project. See Section 3.3.2.2 for further discussion.

In December 2001, a modification request related to the site-wide NPDES permit was submitted to the IEPA. The request addressed anticipated operational changes at the CUB related to upgrades to the cooling towers. The new cooling system at the CUB will ultimately change the characteristics of the resultant effluent from this process. The improved system is expected to come online in May 2002.

4.12 Resource Conservation and Recovery Act of 1976 (RCRA)

On 7/31/2001, the USEPA conducted its annual RCRA inspection of Fermilab's Hazardous Waste program. This included a review of waste manifests, annual reports, training records, the contingency plan, the closure plans, and the Part B permit and operating records. Satellite waste accumulation areas and the Hazardous Waste Storage Facility were visited. No deficiencies were cited.

The Resource Conservation and Recovery Act (RCRA) Part B permit renewal application was submitted to the Illinois Environmental Protection Agency on April 24, 2001.

The Annual Hazardous Waste and Illinois Generator Non-Hazardous Special Waste Reports for CY2001 were submitted to the DOE Fermi Area Office in January and February 2002 respectively. DOE subsequently submitted these reports to IEPA.

The following volumes of non-radioactive waste were generated by Fermilab and managed for disposal by the Hazard Control Technology (HCT) Team of the Environmental Protection Group in the 2001 Fiscal Year.

374.6 m^3	Non-Routine Hazardous Waste (RCRA + TSCA)
2.0 m^3	Routine Hazardous Waste (RCRA + TSCA)
85.4 m^3	Non-Routine Non-Hazardous (Special) Waste
35.2 m^3	Routine Non-Hazardous (Special) Waste
10,666.6 m^3	Dumpster/Landfill Waste

4.12.1 RFI Activities

As a condition of the Lab's RCRA Part B permit, the IEPA has required Fermilab to undertake a RCRA Facility Investigation (RFI). The purpose of the RFI is to investigate whether hazardous constituents have been released to the environment from identified solid waste management units (SWMUs) located onsite. In addition to requiring the reporting of newly identified SWMUs, RCRA also requires that IEPA be notified of any changes to a previously identified SWMU. A total of three SWMUs are still being addressed in accordance with the corrective action requirements of Fermilab's RCRA permit: the CUB Pipe and Clay Tile Field, the Meson and Neutrino Experimental Areas, and the Meson Hill Landfill. Further investigation is not required at the Village Machine Shop and the Railhead Storage Yard, so long as institutional controls remain in place.

Village Machine Shop (SWMU# 5)

The Supplemental Phase II RFI report for the Village Machine Shop was approved by the IEPA. Supplemental information was requested by the agency on the engineered barrier. This information was forwarded to the IEPA during CY2001.

CUB Tile Field (SWMU# 12)

The CUB Tile Field has been removed along with all chromate-contaminated soil and gravel. The soil was properly disposed and the surrounding soil sampled and analyzed. Fermilab continues monitoring of all the CUB Tile Field wells. Monitoring wells at SWMU 12 were sampled during the 1st, 2nd, and 4th quarters. A new sampling schedule was negotiated with the IEPA midyear. The new schedule requires sampling during the 2nd and 4th quarters only. Wells MWS1, MWS2, MWS3 and MWD1 indicated chloride levels above the Class II standard in CY2001. MWBD3 showed levels of lead slightly above the Class I standard during the second quarter in CY2001.

Meson Hill (SWMU# 13)

Closure activities for Meson Hill were completed in 1998. This included moving concrete, grading, installing a clay cap and placing topsoil on the clay cap and hydroseeding of the top of the hill and a site inspection. Fermilab continues sampling of all monitoring wells at this unit. Monitoring wells at SWMU 13 were sampled during the 1st, 2nd, and 4th quarters. A new sampling schedule was negotiated with the IEPA midyear. The new schedule requires sampling during the 2nd and 4th quarters only. Statistical analyses confirmed that the concentrations of total dissolved sulfates in samples from monitoring wells G101, G102, G103, G104, G105 and G106 have exceeded the 99% confidence level. Concentrations of total dissolved sulfate in monitoring wells G101 and G205 have also exceeded the Class II groundwater standard.

Due to the elevated concentrations of sulfates recorded in monitoring wells at SWMU 13, an updated notification of a "significant change in groundwater quality" was sent to the IEPA. A Monitoring Assessment Plan was also developed and forwarded to the IEPA for review. The plan was developed to determine the source of the increase, the concentrations and extent of the sulfates, and assess any potential threat to human health and the environment. Initial indications point to natural conditions and sources for the detected concentrations.

During December 2001, a small portion of the northern slope at SWMU 13 failed causing a limited amount of material to slide to the base of the slope. The area was covered with geotextile until remedial measures can be taken during CY2002.

Railhead Storage Yard (SWMU #14)

No information was requested or generated at this unit during CY2001.

Meson Neutrino (SWMU #15)

Fermilab continues to sample seven monitoring wells at this unit on a quarterly schedule for accelerator-produced radionuclides. The results of samples from the Class I groundwater along with flow directions in the upper dolomite are reported annually to IEPA.

4.13 Safe Drinking Water Act

Fermilab provides drinking water to its employees through two Fermilab-operated public water supplies and a satellite supply connected to the City of Warrenville public water supply. Full jurisdiction for Fermilab's public water supplies was transferred from the Illinois Environmental Protection Agency (IEPA) to the Illinois Department of Public Health (IDPH) in 1996. Initially, this involved an IDPH review of our existing monitoring program, which determined that our program was compliant with their regulations.

During CY 2001, water samples were collected and analyzed for required parameters and at the prescribed frequencies in compliance with United States Environmental Protection Agency (USEPA) Regulations and the Drinking Water Systems Code adopted by the Illinois Department of Public Health. All results were acceptable and met requirements.

Also during CY 2001, the majority of the Main and Branch lines of the Domestic Water System in the Village were upgraded. These infrastructure improvements have significantly enhanced the aesthetic quality of the water.

4.14 SARA TITLE III or Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA)

Under these regulations Fermilab is required to provide the EPA, State, and local officials with an annual accounting of hazardous chemicals and extremely hazardous chemicals used or stored onsite in quantities greater than a given threshold. Fermilab filed a Toxic Chemical Release Inventory Report (TRI) for CY2000 with the USEPA and IEPA in June 2001. The toxic chemicals processed or used at Fermilab at threshold activity levels under SARA Title III Section 313 were 1,2,4-trimethylbenzene, friable asbestos, and ethylene glycol, trichlorofluoromethane, bromotrifluoromethane, and 2,2 dichloro-1,1,1 trifluoroethane. As required by Section 312 of SARA Title III, Fermilab also submitted a Tier II Emergency and Hazardous Chemical Inventory (CY2000) to State and local emergency services and disaster agencies in February 2001.

4.15 Oil Spill Prevention

Oil inventory at Fermilab consists of numerous oil-filled electrical transformers ranging in volume from 4 gallons to 17,300 gallons. There are no aboveground oil storage tanks at Fermilab. The total volume of oil in transformers onsite is estimated to be about 250,000 gallons. Potential onsite oil spill sources are located such that surface water discharge spillways can be effectively used to prevent any oil spills from leaving site and entering State Waters. The only exception is the transformer at Giese Road (1695 gallons) near Indian Creek. This transformer was previously located downstream of the Indian Creek outfall to State Waters. Even though the outfall has been moved to a location further downstream in Indian Creek, this transformer still has the potential to spill into regulated waters because there is no in-stream mechanism to prevent a discharge from making it to Waters of the State. As an added precaution, the Giese Road transformer and others onsite utilize secondary containment. In accordance with 40 CFR 110-112, Fermilab maintains a Spill Prevention Control and Countermeasures plan (SPCC) for the Giese Road transformer; this plan is periodically reviewed and revised as necessary.

4.16 Toxic Substance Control Act (TSCA)

The application of TSCA requirements to Fermilab involves the regulation of asbestos and polychlorinated biphenyls (PCBs). Only ancillary asbestos removal activity occurred during 2001. Illinois Department of Public Health licensed asbestos workers removed three cubic yards of asbestos containing pipe wrap insulation from Booster Gallery West. Conversely, significant progress in PCB management was made at Fermilab during 2001.

An EPA-approved plan to remediate PCB-contaminated soil at twenty-four transformer sites located at service buildings around the Main Ring was essentially completed in CY2001. The contamination had occurred primarily

because of past (pre-TSCA) practices in which transformer oil containing 2-5% PCBs was drained onto the ground as a prelude to sampling to assess the status of the oil's dielectric properties.

In October-November, all PCB-contaminated concrete, soil, and gravel were removed from the transformer yards at the A4, B1, B4 and E1 service buildings. The four clean excavations were backfilled to match the surrounding hardstand. During the excavation work at B1 and B4, groundwater was encountered that contained PCBs at concentrations that were quite low, but nonetheless above the 0.5 ppb EPA standard for unrestricted use. At B4, it was necessary to remove and dispose of this water in order to complete soil cleanup. This appeared to be a limited, localized pocket of perched water, and, judging from the very small amount of inflow still occurring when the excavation was completed, very little of it remains. At B1, the soil was more porous, and dewatering was not needed because the water that entered through the walls of the excavation eventually percolated out through the bottom. Fermilab plans to conduct some groundwater sampling at these two areas to verify the depth, lateral extent, and concentration of this contamination in order to make a risk-based determination on the need for further remedial action.

Sampling of old Main Ring pulsed power transformers still used to power certain beamline elements revealed that two of them had experienced significant leach-back of PCBs from their windings since they were retrofilled and/or chemically detoxified in the late 1980s-early 1990s. Fermilab plans to have both transformers retrofilled again during the August 2002 shutdown.

4.17 Pollution Prevention and Waste Minimization

There were numerous activities conducted throughout the Lab in 2001 to prevent pollution and minimize waste. Each of these activities is summarized below.

By removing only the activated portions, the amount of low-level radioactive steel deemed as waste was significantly reduced. Using a torch cutter, 509 cubic feet of steel (weighing 159,400 pounds) was reduced to 218 cubic feet (53,000 pounds). The balance of 106,400 pounds of steel was recycled. Significant volume reduction was also achieved using a hydraulic press to compress void space in low-level waste metals - 52 cubic feet were reduced to 14.5 cubic feet of waste. Savings include $6,154 of disposal costs and $11,700 in transportation charges.

Fermilab Fire Technicians transferred 106 large, older style high voltage smoke detectors containing radioactive sources to the Westinghouse Savannah River Site. The detectors were salvaged during upgrades to the Booster Ring. The Savannah River Site intended to reuse the detectors at that facility.

Under the Restoration and Reuse program, the Particle Physics Division cleaned out the experimental hall Proton West (PW) 8 at Fixed Target. This project resulted in the removal of an estimated 14,600 cubic feet of materials, weighing almost 5 million pounds. Approximately 8,000 cubic feet of steel (4 million pounds), 2,600 cubic feet of concrete (400,000 pounds), 530 cubic feet of lead (374,000 pounds) and 1000 cubic feet of miscellaneous materials were salvaged for reuse. This meant that 83% (by volume) of the removed materials were recycled or stored for future reuse on site while only 17% of the materials had to be sent to the landfill.

A new environmentally friendly road de-icing agent was used in conjunction with traditional rock salt applications. The winter average salt use is 700 tons/year. The new mixture was more effective, had better staying power on applied surfaces and reduced salt usage by up to 30%. It also provided savings indirectly on labor and fuel costs by reducing the number of needed applications, and was less corrosive to the equipment.

Materials that would otherwise have been discarded or scrapped were used to help construct two new visitor information kiosks at the site entrances. The kiosks were constructed with reused steel, framing materials and leftover paint. Wood chips generated from on site tree and brush maintenance were used for landscaping.

Roads and Grounds (FESS) purchased eight new picnic tables constructed of recycled aluminum to replace worn out treated tables. Pressure treated lumber picnic tables contain potentially harmful chemicals and are difficult to move due to size and weight. Recycled plastic replacement lumber was also used to repair broken tables.

The Main Ring Kicker Building (Beams Division) houses 1,800 gallons of mineral oil used for experimental equipment. The oil is non-hazardous but has the potential to leak via sumps to surface water. A containment dike was built to contain the oil in the event of a leak or catastrophic spill.

180 pallets made from recycled plastic were purchased by Business Services Section to replace deteriorating wood pallets. Wood pallets were routinely replaced on average every 5-7 years. These new recycled plastic pallets came with a 50-year guarantee. The estimated replacement savings over a seven-year life cycle was $2,400.

A web-based interdivisional excess chemical exchange database was developed to reduce chemical waste and disposal costs. The database was made available to all Fermilab employees and was featured in a Lab wide ESH newsletter.

The Laboratory continued to expand paper and cardboard recycling at additional facilities around the site. Expansion and improvements included adding Feynman Computing Center, Collider Detector Facility, D-Zero Assembly Building, and Technical Division into a formal recycling collection program that uses our custodial services. A 20-yard compactor truck was used to collect cardboard throughout the site. The collected material was taken to a local recycling center. The Laboratory recycles approximately 200,000 pounds of waste paper products (including cardboard) annually.

5.0 Conclusion

The operations at Fermilab during CY2001 had no significant adverse impact on the environment or on public safety.

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[1] Details of the Fermilab Environmental Monitoring Program (FEMP) can be found on the ES&H home page.

[2] Supporting data are available upon request from the Fermilab ES&H Section.

[3] Fermilab Annual Ecological Land Management Plan for calendar year 2001.

[4] Lower limit of detection for tritium in surface water is 1.0 pCi/ml.

[5] Total halogen is measured as chlorine

[6] 35 IAC 620

[7] 35 IAC 620.210