Report to the Director on the Fermilab Environment CY 1997

1.0 Introduction

Monitoring and surveillance are critical elements of an effective environmental protection program. Fermilab has established and implemented comprehensive environmental monitoring and surveillance programs to ensure compliance with legal and regulatory requirements imposed by Federal, State, and local agencies and to provide for the measurement and interpretation of the impact of Fermilab operations on the public and the environment. The surveillance and monitoring activities are selected to be responsive to both routine and unplanned releases of penetrating radiation and liquid or airborne effluents. The location and frequency of samples are based on established routines, operational considerations and historic levels of pollutants found in each location. Sampling locations are selected based on relative 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 CY1997.

2.0 1997 Laboratory Highlights

In 1997 Fermilab concluded an extensive 800 GeV fixed target run, reaching record-setting intensities in the accelerator before shutting down the historic Main Ring in mid-September 1997. Experiments ran in the Neutrino, Meson and Proton Beamlines and beam also continued to be targeted in the Antiproton Area. Dismantlement of the Main Ring has begun. It will be replaced by the Fermilab Main Injector. The Fermilab Main Injector construction progressed rapidly towards its goal to be operational in 1999.

2.1 Significant Environmental Accomplishments

Fermilab received two environmental awards in CY1997 for demonstrated leadership and excellence in environmental development and awareness: The Renew America Award was given to the Fermilab Natural Areas Restoration Project for natural resource conservation and environmental sustainability in the category of Biological Diversity/Wilderness. The Fermilab Natural Areas Restoration Project was also awarded the Conservation Foundation Award in recognition of land conservation, river and watershed protection, education and community outreach.

The performance of the Fermilab Activation Analysis Laboratory is regularly evaluated through ongoing participation in the intercomparison program of quality assurance conducted by DOEís Environmental Measurements Laboratory (EML). Fermilab was one of only four labs to receive a 100% acceptable rating out of the 116 laboratories that participated world-wide.

A long-range land management plan was developed in 1997 and has been approved by the Fermilab Director. About thirty acres of new prairie were planted in three tracts this year, adding to the more than 1000 acres of prairie onsite in various stages of reconstruction.

Three new environmental research projects were approved. The three new projects include studying native grassland and non-native grassland bird breeding, quantifying fuels/biomass in a tallgrass prairie, and identifying mycorrhizal fungi associated with several rare and difficult to establish prairie plant species. Four other projects were active in 1997: *Evolution of Plant Defenses to Insect Herbivory, Soil and Mycorrhizal Fungi Response to Prairie Restoration, Population Dynamics in Small Mammal Populations underVarying Degrees of Predation Pressure,* and *Successional Dynamics in a Prairie Reconstruction.*

In 1997, after nearly six years of study, Fermilab concluded that a program for deer population control was necessary in order to reduce the size of the herd that was causing extensive damage to the ecosystem and an increase in car accidents onsite. Under an Interagency Agreement reached in early 1997, the Wildlife Services of the U.S. Department of Agriculture (USDA) analyzed the deer herd at Fermilab and prepared an Environmental Assessment (EA) of deer management alternatives. Approval for USDA to prepare an EA was obtained from DOE in August of 1997 and a public meeting was held in October 1997. Based on the proposal which considered numerous alternatives, the USDA initiated a program of management that included lethal removal, and succeeded in removing approximately 15% of the estimated population. The program was accomplished with very few problems. We expect to continue the program in the fall of 1998.

An EA was approved and a Finding of No Significant Impact (FONSI) was issued in early 1998 for the proposed NuMI beamline.

2.2 Other Environmental Issues

Fermilab's Low-level Radioactive Waste (LLW) is transported to the Hanford facility in Richland, Washington for disposal. The acceptance requirements for LLW at Hanford are extremely stringent, and are accompanied by highly technical survey techniques used to examine incoming wastes. A sample (5%) of containers are regularly subjected to X-ray scanning to ascertain whether any unauthorized objects or substances are inside the containers. Fermilab has an outstanding reputation with Hanford for accuracy and completeness in characterizing our waste shipments to them. Nevertheless, a small 9-volt battery was discovered through a radiographic scan of a drum of LLW shipped to Hanford this year. The unopened drum was returned to Fermilab for investigation. After locating and removing the battery, we returned the drum to Hanford on March 6, 1998. As a consequence of this incident, Hanford operators were to perform surveillance on 10% of the containers in our next shipment to verify their content. No further problems were found.

3.0 Environmental Monitoring and Surveillance

The goal of the Fermilab Environmental Monitoring Program is to assist Laboratory management in decision-making by providing data relevant to impacts that Fermilab operations have on the surrounding environment. The Environmental Monitoring Program consists of effluent monitoring to confirm compliance with permits, generally at a particular point, and environmental surveillance conducted at various locations to intercept the pathway of potential pollutants to receptors such as plants, animals or members of the public. We collect 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. Samples are collected and radiation is measured from areas both 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 radiation is measured to determine the effectiveness of effluent controls and to ascertain whether there is any build-up of radioactive materials as a result of 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 Strategy, which is maintained by the ES&H Section, provides more details.

3.1 Air

The potential for public exposure to air pollution from Fermilab is very low. We have an air pollution permit issued by the Illinois Environmental Protection Agency (IEPA) under the Clean Air Act, including a ìNational Emissions Standards for Hazardous Air Pollutantsî or NESHAPs element, which covers airborne radionuclides.

Airborne radionuclides are normally released to the atmosphere from target stations operating in the Fixed Target and in the Antiproton Source areas. Monitoring is conducted at targeting areas where air emissions are considered to be 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 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 offsite by the public are calculated from data gathered through environmental surveillance of the onsite sources. 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 can 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 management and fire extinguisher training, operation of various boilers and total organic emissions from vapor degreasing operations. Pollutant levels are estimated based on the knowledge of the processes that generate them and the characteristics of individual pollutants.

3.1.1 Radioactive Air Emissions

During Calendar Year 1997 protons were focused onto numerous targets in the Fixed Target Area as well as the Antiproton Source Area. Airborne radionuclides 11C, 13N, and 41Ar were identified in emissions from AP0 and monitored beamline stacks. The Debonding Oven, a potential source of tritium only while radioactive components are being burned, was not used in CY1997. The releases from the AP0 stack in the Anti-Proton Area and from the stacks in the Fixed Target Area (M05, NM2, NW8, ME6, TSB spur, PW8, and PB4) resulted in an estimated total released activity of approximately 29.48 Curies in 1997. This is an increase over the 21 Curies released in 1996 when the Fixed Target Area only ran for 7 months out of the year. Emission measurements were taken at the sources and levels are well within 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.

The CAP-88PC computer modeling results for CY1997 emissions showed that the maximum dose equivalent potentially delivered to a member of the public at the site boundary has remained considerably less than 0.1 mrem. The maximum potential dose for 1997 was 0.015 mrem, a slight increase over last year's 0.01 mrem. This increase was due to the operation of the Fixed Target Beamlines in addition to continued operation of the Anti-Proton Area this year. Emissions for CY1997 continue 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 EPAís continuous monitoring threshold of 0.1 mrem/year.

This year, the estimated collective dose equivalent delivered to the public within a 50 mile radius through radioactive air emissions from Fermilab was 0.031 person-rem, comparable to that reported for CY1996. Fermilabís CY1997 Radionuclide Air Emissions Annual Report was submitted to DOE in May 1998.

3.1.2 Non-Radioactive Air Emissions

The IEPA decided in late 1996 that the level of emissions at the Laboratory do not warrant the issuance of a Federally Enforceable State Operating Permit (FESOP). 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 less than last year. The degreasers, small sources of non-volatile organic material (non-VOM) emissions, were not used in 1997. There were no instances of non-compliant emissions in CY1997. The 1997 Annual Air Emission Report on criteria pollutants was submitted to the Illinois Environmental Protection Agency (IEPA) in April 1998.

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 muons range out under the ground surface. However, some emerge above the surface and present a small potential for radiation dose. Storage of radioactive materials onsite results in another potential exposure to ionizing radiation. These sources of penetrating radiation are monitored throughout the site at locations based on criteria outlined in the Fermilab Monitoring Strategy. Dose estimates incorporate the extremely

conservative assumption that a single individual could be exposed for an entire year at the site boundary. Effective dose equivalents obtained due to natural causes (i.e., cosmic rays, terrestrial sources and indoor radon, etc.) average approximately 300 mrem/year.

During the CY1997 accelerator run, the potential muon sources were the Fixed Target MC, NC, NT, KTeV, PB, PC, PW and ME beamlines, the C0 Beam Absorber and the AP0 target. The effective dose equivalent due to each beamlineís operation at their respective nearest site boundary locations was estimated to be: 0.016 mrem/year from the C0 Beam Absorber, 0.107 mrem/year from the MC beamline, 0.110 mrem/year from the NC beamline, 3.44 mrem/year from the NT beamline, and 0.314 mrem/year from the PB beamline. These estimates were calculated using records of the number of protons delivered to these locations and mrem/proton measurements made at the site boundary. No significant muon fluences were detected onsite or offsite from the AP0, MT, ME, PC, PW, NW and KTeV beamlines in CY1997. Radioactive material stored at the Railhead accounted for no measurable dose equivalent rate at the site boundary in CY1997. This is due to the continued reduction of radioactive material storage and improved shielding of remaining radioactive items. Consequently, the maximum radiation dose to an individual at the nearest offsite house was not measurable in CY1997.

3.3 Surface Waters

Fermilab discharges liquid effluent to surface water bodies and to publicly owned treatment works in Batavia and Warrenville. We hold a National Pollutant Discharge Elimination System (NPDES) permit to discharge commingled non-process, non-contact 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 permit also regulates stormwater discharges from designated solid waste management units (SWMUs). A Stormwater Pollution Prevention Plan is frequently modified to reflect changes that occur as part of the RCRA Facility Investigation (RFI) of the SWMU sites. The Lab also continues to maintain a Stormwater Pollution Prevention Plan in conjunction with our NPDES permit to construct the Fermilab Main Injector.

An NPDES pre-treatment permit allows us to release a treated effluent from the Central Utility Building regeneration process to the City of Batavia sanitary sewer system. In addition to the monitoring required by our NPDES permits, samples of surface water are taken annually from selected bodies of water onsite and analyzed for radionuclides. We sample surface waters on the basis of their potential for contamination. Chemical and physical parameters are not normally monitored in surface waters because Laboratory policies are designed to direct effluents into the sanitary sewers. Maximizing allowable discharges to the sanitary systems directs contaminants to the publicly owned treatment works (POTW) and minimizes environmental contamination.

3.3.1 Radioactive Releases to Surface Water

Numerous sumps located throughout the site collect and drain water from building footings and from under beamline tunnels in the Tevatron enclosure 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 from beamline cooling water systems. Surface water monitoring conducted during CY1997 showed tritium concentrations to be less than the Department of Energy Derived Concentration Guides for allowable radionuclide releases to surface waters (2000 pCi/ml). Only six of

seventy-eight samples taken from onsite ditches, ponds and creeks showed a detectable level of tritium, the highest of which was 110 pCi/ml.

The effluent from the Central Utility Building regeneration process was sampled prior to each discharge and analyzed for accelerator-produced radionuclides. Approximately 4.47 mCi of beryllium-7, 0.07 mCi of sodium-22 and 2.95 mCi of tritium were released to the sanitary sewer during 1997. This anticipated increase over last year is due to the regeneration of activated deionization bottles from the Fixed Target Area.

3.3.2 Non-Radioactive Releases to Surface Water

Monitoring for non-radiological chemical constituents in surface water was limited to NPDES permit parameters this year.

In October 1997 there was a small release of oil-contaminated water to a ditch when water was pumped from a manhole at the Master Substation prior to maintenance and without first identifying possible oil contaminants in the pit. Booms were installed to prevent the spread of the oil sheen until cleanup could be accomplished. The oil contamination is thought to have originated from the T82A transformer failure of many years ago. This incident demonstrated the importance of effluent surveillance during manhole pumping operations.

3.3.2.1 Cooling Water System

Our NPDES permit for the cooling water system requires that water temperature and pH be monitored at all three outfalls and reported to the IEPA on a monthly basis. Chlorine concentration is recorded for the Kress and Indian Creek outfalls. Due to problems with chlorine exceedances last year, we submitted a proposed NPDES permit modification to the IEPA for the installation and operation of a dechlorinator and to notify them of a change in treatment chemicals to be used in the Industrial Cooling Water system. The IEPA determined that a permit modification was not necessary. The dechlorination equipment has been installed and is operational. During 1997, the permit limit for total chlorine (0.05 mg/l) was never exceeded.

In late November 1997, the discovery of a large number of water leaks at welded joints in the newly installed Fermilab Main Injector (FMI) Low Conductivity Water (LCW) system prompted an extensive investigative effort to determine the cause and extent of the damage. Inappropriate weld specifications and inspection, coupled with standing water in the LCW system, apparently provided an environment conducive to bacterial action which aggressively degraded most of the joints. The initial response was to use biocide to kill the existing bacteria. Next, a complete survey of damage was undertaken utilizing x-ray radiography and video cameras. It was determined that approximately 75% of the piping in the tunnel contained severely compromised welds. Welds were repaired and cleaned. It is anticipated that a long term maintenance program will include the installation of ultraviolet sterilization devices and the initiation of a program to monitor for bacterial growth.

Routine maintenance projects for the LCW systems were also reviewed to ensure NPDES compliance. These projects require the intermittent discharge of cooling waters from the beamline enclosures to surface waters. Effluents from these areas discharge to surface waters onsite and ultimately leave the site via Ferry and Indian Creek outfalls. The annual cumulative volume to be routinely discharged from these systems is expected to be a few thousand gallons. Less than once per year a major maintenance project such as the work currently going on at the FMI could require a

discharge of up to 50,000 gallons. In March 1998, the IEPA determined that a NPDES permit modification is not required for these discharges.

3.3.2.2 Releases to Sanitary Sewers

The pretreatment permit for the Central Utility Building regeneration effluent requires the collection and analysis of composite process effluent samples for specified metals. Samples are analyzed for radionuclides as well in order to confirm that insignificant amounts of activity are released. In order to provide information on the process, these samples are taken at the process release point rather than at the site boundary where Fermilab actually discharges to the Batavia municipal sewers. Concentrations in the process effluent would actually be greatly diluted by other wastewaters prior to reaching the site boundary where the Batavia city ordinance on sewer discharges is applicable. Heavy metal analytical results are submitted to the IEPA. Analyzed samples from the process effluent have never been in exceedance of the Batavia Sanitary Sewage Ordinance or the Department of Energy Derived Concentration Guide which specify discharge limits.

Sampling stations at site boundary locations monitor sewer discharges to each municipality. Analytical results are compared to municipal discharge limits to track compliance. The Batavia sewer sampler showed several exceedances of the iron discharge limit (5.0 mg/l). Three samples yielded iron concentrations from 7.3 mg/l to 9.3 mg/l and another had iron at levels greater than 50 mg/ml. These high concentrations are thought to be related to the routine flushing of the water system conducted during those months and also due to the flushing of the line between Well W-3 and the main line when Well W-3 was used after a period of inactivity. Although these excursions do not present a health concern, the site operations group was notified.

Approximately 40,000 gallons of sanitary sewer water was discharged to the Village Oxidation Pond during the Labor Day weekend in order to repair a leak that had developed in the dry well at the pump station where sanitary sewage is pumped from Fermilab to the city of Warrenville. No water left the pond. Samples taken after the event indicated no metal contaminants were released into surface waters. Following this event a number of upgrades were made to the system and the option to discharge to the pond was eliminated.

3.4 Groundwater

Forty-four of sixty-five onsite wells were sampled during the year for various radionuclides or chemical parameters. The applicable regulatory limits for groundwater are water quality standards published by the State. 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 generally considered to be Class I groundwater. Water in the overlying till is usually considered to be Class II water and has less stringent standards.

This year four new background monitoring wells were installed in locations upgradient to Fermilab operations. These wells are capable of obtaining representative samples of the upper Class I groundwaters for either chemical or radiochemical analysis. They have been added to the sampling plan for 1998. Four new wells were also installed this year at the Central Utility Building (CUB) Tile Field to support an ongoing RCRA Facility Investigation (RFI) at that site. Seventeen piezometers were constructed near the New Muon Building to gather information on the direction of groundwater flow that will be used in modeling the transport of potential contaminants. Six piezometers were installed as part of the NuMI (Neutrinos at Main Injector) site characterization to plan for groundwater protection. Fermilab continues to analyze groundwater issues associated with this

proposed construction project that involves construction within the dolomite aquifer. Three monitoring wells at the Master Substation were properly abandoned in November 1997.

3.4.1 Radionuclides

The Department of Energy groundwater concentration guide and the Illinois Class I groundwater standard for tritium are 20 pCi/ml. Tritium was detected in one of four Central Utility Building Tile Field monitoring wells in CY1997. After the installation of new dedicated pumps in these wells, resampling showed tritium levels in all four wells to be less than the detection limit of 0.19 pCi/ml.

During 1997, Fermilab embarked on a comprehensive program to identify areas where contamination of the soil and groundwater by accelerator operations might be possible. The Fermilab Director appointed a number of multi-disciplinary review committees chartered to analyze radiological and hydrogeological conditions. Various work groups were commissioned to look at AP0, C0, Neutrino, PE, Switchyard, Booster, MI-40, M-Center, KTeV, and P-West areas. The Head of the Beams Division extended this study by appointing several committees to review the design of additional target stations that are planned for physics research in the near future. The committees utilized theoretical evaluations, collection and analysis of radiological and hydrogeological data, and reviews of historical data and design details to characterize each area and to recommend further empirical studies or monitoring actions. Analysis results from concrete corings obtained near AP0 will be compared to the predictions from the CASIM model. The information collected by the various review committees is still being assimilated. Once finished, any recommendations for improvements to the design of the accelerator shielding to prevent environmental contamination by activation and for upgrades to our monitoring program to assess potential environmental impacts will be implemented. Several of the recommendations of these committees are already in the implementation stage. An *ad hoc* group has already been established to further evaluate the present groundwater concentration model.

A need to upgrade shielding beneath the Booster West Tower resulted in a project to characterize the geology and hydrogeology in that area in order to investigate the environmental impacts of the project. With Beams Division cooperation, samples of glacial sediments were taken below and adjacent to the Booster tunnel and analyzed for radiochemical content. Interpretation of results is pending.

In 1996, samples from all five 45^{o} angled monitoring wells drilled into the Neutrino berm (four grouped closely in the vicinity of the Neutrino Target Area and one farther upstream) contained tritium in measurable concentrations, though most remained less than the Illinois Class I groundwater standard of 20 pCi/ml for tritium. These wells are finished in the till, at elevations varying from approximately 30 to 50 feet above the level of the Class I groundwater.

Tritium levels in groundwater samples from one of the monitoring wells (S-1087) that was screened below the bathtub area of the Neutrino Fixed Target Beamline increased from <5 pCi/ml to as high as 69 pCi/ml. This well monitors groundwater located midway between the bottom of the bathtub and the Class I groundwater located approximately 70 feet below ground surface. Concentrations of tritium have fluctuated at this well since an abrupt increase was first noted in April 1995. Well recharge studies are consistent with the hypothesis that well construction causes the transport of contamination to lower elevations and results in the observed increase and fluctuation.

Last year saw the completion of a study to characterize the hydrogeology at two areas along the Neutrino Fixed Target Beamline in order to determine the source of the increased tritium levels in the

samples from S-1087. The purpose of this project was to gain a better understanding of the underlying glacial deposits and the upper bedrock. It also extended our monitoring network beyond its current capabilities from within the glacial deposits to the Class I groundwater in the vicinity of this area of soil activation. Piezometers were installed at NS1 and NS2 Service Buildings to determine the vertical and horizontal groundwater flow gradients. Once the horizontal gradient was established, three monitoring wells were installed in the upper dolomite down-gradient of NS1 and NS2. A new technology in drilling was utilized in this project to provide undisturbed core material for better characterization and analysis of the geological environment beneath these locations. Sampling of the newly developed wells along the Neutrino beam lines was begun in December 1996. Water samples from all three wells were analyzed, and the levels of tritium in all were below 1 pCi/ml, the detection limit of our onsite Activation Analysis Lab. This new information will be provided to the IEPA as part of an ongoing RCRA Facility Investigation of the activated soil in areas along the Neutrino beamline.

Continued monitoring of groundwater flow parameters (gradient and direction) indicates that they are very stable. As a result of this project, the remaining 45^{o} angled wells have been removed from the routine sampling schedule. The four angled wells in the vicinity of the Neutrino Target Area will be replaced by a state-of-the-art monitoring well, and then subsequently removed and closed according to State guidelines. Closing these wells will remove a potential pathway for tritium soil contamination in the activated areas adjacent to beamlines. The new monitoring wells will be designed and installed to eliminate construction concerns. The new monitoring system will be capable of sampling groundwater in the glacial deposits at the same elevation as the old wells.

Analytical results from all other wells onsite showed no measurable concentrations of tritium or other accelerator-produced radionuclides in CY1997.

3.4.2 Chemicals

Two rounds of groundwater samples were collected during CY1997 from the four monitoring wells installed in the fractured dolomite at the CUB Tile Field. Water samples from the wells used to monitor an old perforated pipe field within the Main Ring continued to yield measurable levels of chloride, chromium and other metals. Metal concentrations were generally less than the IEPA Class II groundwater standards. One sample exceeded the limit for manganese and another slightly exceeded the nickel limit. Chloride concentrations in the vicinity of the Central Utility Building Tile Field continued to exceed the chloride standard for Class II groundwater. Samples for these analyses were collected from seven monitoring wells finished in the glacial till (from 15 to 40 feet below ground level and 20 to 45 feet above the aquifer). A Phase II Workplan for this area is part of the RFI (RCRA Facility Investigation) and will further address any remediation needed at this location.

4.0 A Summary of Compliance With Specific Environmental Regulations

Clean Air Act

Open burn permits to allow prairie management burning and fire extinguisher training were renewed in 1997. Annual air emissions reports for CY1996 were submitted to the IEPA and EPA on schedule in 1997.

Underground Storage Tanks

An internal audit was conducted of the Fuel Service Center Leak Detection System during the second quarter of 1997. A tabletop spill drill was held for the Fuel Service Center in the 3rd quarter of 1997. No compliance issues were identified.

Department of Transportation

An internal audit of Fermilab implementation of DOT regulations was conducted in the 4th quarter of 1997. No compliance issues were identified.

The Endangered Species Act of 1973

No compliance issues were identified in CY1997.

Executive Order 11988, ìFloodplain Managementî

No compliance issues were identified in CY1997.

Executive Order 11990, ìProtection of Wetlandsî

Evaluation of Fermilab activities in wetlands is accomplished through the NEPA review process. No new compliance issues were identified in CY1997.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

In CY1997, the use of pesticides and herbicides at Fermilab was handled in accordance with FIFRA.

The Migratory Bird Treaty Act

There were no compliance issues identified in CY1997.

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 Environmental Safety and Health Manual Chapter 8060. This year an Environmental Assessment (EA) was completed for a proposal to construct a new particle beamline (NuMI) that would direct muon neutrinos from the Fermilab Main Injector to detectors at Fermilab and in northern Minnesota. An EA was also completed for the deer management program proposed by the USDA. Findings Of No Significant Impact (FONSIs) on the environment were issued for both NuMI and

the deer management program in January 1998. Other NEPA reviews completed in 1997 included the A-0 Photoinjector and the Giese Road Containment projects.

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 CY1997 to assess any potential impacts on historic resources. No compliance issues were identified in CY1997.

Resource Conservation and Recovery Act of 1976 (RCRA)

As a condition of our 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 IEPA be notified of any changes to a previously identified SWMU.

In early 1995, the IEPA was notified that the Railhead Storage Yard might contain lead contamination not originally identified and that Fermilab planned to investigate this concern. In 1996, Fermilab conducted an evaluation of the environmental impact resulting from the storage of lead (e.g., bricks) and lead-containing materials (e.g., Nevis shielding blocks) at the Railhead. At the IEPAís request we prepared and implemented a sampling plan to determine the rate and extent of lead contamination. A report on this Phase II sampling conducted during the first quarter of 1997 indicated that four areas within the Railhead Area had contamination in excess of the remediation standard. The Nevis shielding blocks had been stored in three of these areas. Results of this Phase II sampling were submitted to the Agency during the second quarter of 1997. The three identified areas were excavated down to clay and the lead-contaminated soil was disposed of as hazardous waste. The soil at the bottom of the excavations was sampled, analyzed and found to be non-hazardous. The Phase II investigation for this SWMU is considered to be nearly complete. Almost two-thirds of the shield blocks were reused in the KTeV shielding. Because the remaining blocks are now under roof, they do not present an ongoing environmental hazard and no further action is planned at this time.

The State asked for similar ìrate and extentî studies for the CUB tile field and the Village Machine Shop. Phase II reports have been submitted for these sites and the projects are nearing completion. The Agency also determined in 1997 that four new potential solid waste management units that we identified and characterized in 1996 would require no further investigation.

The State also provided guidance on permanent closure of the Meson Hill ìlandfillî. A closure plan was prepared and submitted to the IEPA in the second quarter of 1997. This plan was approved and during the third quarter, closure activities including moving concrete, grading, installing a clay cap and placing topsoil on the clay cap were accomplished. Hydroseeding of the top of the hill and a site inspection were completed by the end of the year. Six piezometers that had been placed around the perimeter of the hill have been properly sealed. This closure is considered to be nearly complete. The IEPA has sent us final security and monitoring requirements for the landfill and monitoring has commenced.

The USEPA conducted an inspection of the Fermilab RCRA facilities on September 29 and 30, 1997. It included a review of waste manifests, annual reports, training records, the contingency plan, the closure plans, the Part B permit and operating records. Satellite waste accumulation areas and the Hazardous Waste Storage Facility were also visited. No deficiencies were cited.

The volume of regulated chemical waste collected in CY1997, 54.2 cubic meters, was up from last year's total. The increase was due to waste generated in the maintenance of beamline areas that had been inaccessible for a while. The volume of low-level radioactive waste collected this year decreased to 28.3 cubic meters.

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 that determined that our program was compliant with their regulations.

During CY1997 the action level for lead (Pb) in drinking water was exceeded in samples from the distribution system for both the Main Site and D-Zero public water supplies. While not a compliance issue, this required additional sampling, distribution of educational materials describing the hazards of lead in drinking water and the development of corrosion control plans. The Lab completed a corrosion control plan to address high lead levels in the Main Site drinking water and it was submitted to the IDPH in January 1997. Notification was submitted to the IDPH in December 1997 that public education had been distributed for both the Main Site and D-Zero supplies for lead action level exceedances that occurred in samples taken from the Main Site water distribution system in February and July 1997 and for D-Zero in June 1997. The D0 supply exceeded the Pb action level again in January 1998 and efforts are underway to remove any remaining potential sources of lead contamination in the system. A revised Main Site supply corrosion control plan that includes the installation of an orthophosphate treatment system at Well W-1 is being prepared for IDPH review and approval.

At the suggestion of the IDPH, we completed the paperwork in September 1997 to defer sampling of unregulated organic chemicals until negotiations between the State and the EPA are complete over the list of parameters applicable to Illinois water supplies. In addition to routine bacteriological analysis, Fermilab completed the required testing for pesticides/herbicides and nitrates for both water supplies this year. Onsite semi-private wells (except Well 68 which is slated for decommissioning) were also sampled for nitrates as well as coliform and found to be acceptable.

In 1996, benzene levels that were slightly elevated over the drinking water standard were found in the water from a semi-private well at the Hazardous Waste Storage Facility (HWSF). The benzene was thought to have originated from a nearby remediated leaking underground storage tank site even though the tank had been removed and the site cleaned to appropriate standards. Activated charcoal and micron filters were installed to remove traces of benzene and particulate matter from the water supply for the emergency shower and eye wash station. Subsequent analyses indicated that the filters were operating properly. The source of the contamination appeared to be along the line from the well, a length of approximately 50 yards. Neither the well water nor the water to the house also located at Site 55 were contaminated. The water line to the HWSF was rerouted and replaced in mid-CY1997. Subsequent sampling showed no benzene in the water.

Other significant activities in the area of drinking water included the development of a memorandum of agreement between the Facility Engineering Services Section and the ES&H Section over the ìFermilab Domestic Water Program Responsibilitiesî and a subsequent tripartite assessment of the drinking water program which found the program to have improved greatly over the past year.

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. Reportable materials present at Fermilab in 1996 were Freon

R-11, Trimethylbenzene, Halon and ethylene glycol. The SARA Title III Report for CY1996 was submitted to the EPA in mid-1997. Our inventory of these materials was also submitted to state and local emergency services and disaster agencies in early CY1998. Kane County has requested more detailed information (Tier II). The extra information will also be provided to DuPage County. The inventory prepared for the CY1997 report was not available at time of this report but it is not expected to be significantly different from last year.

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 above-ground oil storage tanks at Fermilab. The total volume of oil in transformers onsite is estimated to be 251,681 gallons. Potential onsite oil spill sources are located (with one exception) such that 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 is located downstream of the Indian Creek spillway and therefore has the potential for spilling directly into State Waters. A project to upgrade the secondary containment for this transformer was completed this year. Many onsite transformers already employ secondary containment as an added precaution.

Toxic Substance Control Act (TSCA)

The application of TSCA requirements to Fermilab involves the regulation of polychlorinated biphenyls (PCBs) and asbestos. Significant strides in PCB management were made at Fermilab in CY1997.

An EPA-approved plan is underway to remediate PCB-contaminated soil at twenty-four transformer sites located at service buildings around the Main Ring. The contamination occurred as a consequence of past (pre-TSCA) sampling procedures in which transformer oil containing 2-5% PCBs was drained onto the ground as part of a sampling procedure to verify that dielectric properties had not deteriorated. Cleanup efforts at these transformer yards continued in 1997. We have now completed the cleanup of 8 sites out of the total of 24 needing attention. Removal of PCB-contaminated soil and concrete at the four F-sector Main Ring service buildings was initiated in November 1997. The removal of contaminated concrete pads at A3 and the cleanup of a small spill on the truck lane asphalt at B4 were also added to the job. All of these areas were declared clean by early January 1998. Further transformer yard cleanups are planned for the fall of 1998.

In January 1995, in preparation for shipping large, high-voltage Linac capacitors to the warehouse for storage as spares, the manufacturer was contacted to verify the nature of the dielectric oil. Contrary to an earlier report, the manufacturer stated that the units probably contained PCBs. Sampling confirmed that the oil was 100% PCB. Work to remove the capacitors and to decontaminate the cabinets which held them continued in 1997 according to a plan devised in May 1995. The first phase of this work began in October 1997. The second phase was completed during the holiday shutdown. The final report from the contractor has not yet been received, but a preliminary review of sampling data indicates that cleanup of the cabinets was successful in meeting standards for unrestricted use except for one cable which was clean enough to allow encapsulation with epoxy paint. The EPA has verbally approved this approach. One hundred and ten PCB Linac capacitors from this project were shipped for disposal in the fourth quarter of 1997.

A milestone was also reached this year when the last 6 Main Ring pulsed-power transformers containing regulated concentrations of PCBs were shipped offsite for disposal in early October 1997.

The Giese Road transformer was retrofilled with mineral oil in September 1997, reducing its PCB concentration to less than 50 ppm.

The inventory of TSCA-regulated PCB equipment

is now zero.

Waste Minimization and Pollution Prevention

In 1997 Fermilab recycled nearly 100 metric tons of solid waste. Reductions were made in volumes of waste disposed in dumpsters. The installation of a press has allowed four-fold volume reduction of activated metal and has resulted in decreased disposal costs. A baler was obtained to aid in the recycling effort but unfortunately the cardboard recycling services had to be drastically cutback this year due to various factors including the decline in the price of cardboard.

5.0 Conclusion

The operations at Fermilab during CY1997 had no significant adverse impact on the environment or on public safety.