Chapter 6 Environmental Measurements and Monitoring Programs

Chapter 6 presents the details of the environmental monitoring programs that are instituted for the periods prior to application submission (pre-application), during construction, prior to operation (pre-operational), and during operation of Fermi 3. These monitoring programs establish a baseline of information that allows for the evaluation of future information and provide a method of quantifying the environmental effects of Fermi 3 operations.

The environmental measurements and monitoring programs are described in the following sections:

- Thermal Monitoring (Section 6.1)
- Radiological Monitoring (Section 6.2)
- Hydrological Monitoring (Section 6.3)
- Meteorological Monitoring (Section 6.4)
- Ecological Monitoring (Section 6.5)
- Chemical Monitoring (Section 6.6)
- Summary of Monitoring Programs (Section 6.7)

Monitoring details (e.g., sampling equipment, constituents, parameters, frequency, and locations) for each specific phase of the overall program are described in these sections. The following provides brief details related to the applicable monitoring periods:

- Pre-Application Monitoring: These field monitoring and data collection activities are used to support the baseline discipline-specific descriptions presented below.
- Construction Monitoring: These monitoring activities evaluate the impacts from site preparation and construction. These activities also detect any environmental impacts and allow comparison to preconstruction baseline data for assessing the subsequent impacts of site preparation and construction.
- Pre-Operational Monitoring: These monitoring activities establish a baseline for identifying and assessing environmental impacts resulting from Fermi 3 operation.
- Operational Monitoring: These monitoring activities establish the impacts of Fermi 3 operations and detect any environmental impacts.

6.1 Thermal Monitoring

This section describes the thermal monitoring program for the Fermi 3 plant cooling system. The program is divided into three phases: pre-application monitoring [combined construction and operating license (COL) application], pre-operational monitoring (including construction monitoring), and operational monitoring.

Features of the plant and site, including the boundaries and bathymetry of all water bodies adjacent to the site both before and after construction activities, is discussed in Subsection 2.3.1.1,

Subsection 4.2.2, and Subsection 5.2.2. The location of all thermal, hydrological, or aquatic biological monitoring stations is discussed in Subsection 2.3.3. The predicted extent of the thermal plume is discussed in Subsection 5.3.2.1.1.6, and Subsection 6.1.1.

6.1.1 Pre-Application Monitoring

This program includes evaluations made for the licensing and permitting of Fermi 2 and additional information presented in this section.

Current Lake Monitoring

This program utilized the data collected or generated by the National Oceanic and Atmospheric Association (NOAA). Water level values at the Fermi plant (Buoy ID 9063090) have been collected at hourly intervals and are available from January 1, 1996 to March 1, 2008 (Reference 6.1-1). Both ambient lake temperature and current data were generated by the Lake Erie Observational Forecast System (LEOFS) (Reference 6.1-2), a component the NOAA's Great Lakes Coastal Forecasting System (GLCFS), for a location approximately 2-km east of the plant location. LEOFS uses near real-time atmospheric observations and numerical weather prediction forecast guidance to produce three-dimensional forecasts of water temperature and currents. Data values were generated every three hours from January 1, 2006 to March 1, 2008. The monitoring data collected as described above adequately established baseline data in Lake Erie to support the potential environmental impacts discussed in this report and the thermal discharge descriptions and evaluations provided in Section 5.3.

Past Thermal Impact Evaluations

Previous thermal studies of the Fermi site have concluded that hot water discharge plumes from cooling water discharges to western Lake Erie have negligible impact due to the large size (approximately 811,000 acres) and assimilation capacity of western Lake Erie. Past studies have indicated that plumes do not restrict fish passage or significantly raise lake temperature (Reference 6.1-3).

New Thermal Modeling of Fermi 3

The cooling system for Fermi 3 is described in Section 3.4. Additional review of cooling system impacts was conducted in 2008 using the CORMIX (Cornell Mixing Zone Expert System) mixing zone model (which is supported by the U.S. Environmental Protection Agency (EPA)).

The modeling shows that the combined cooling water blowdown discharge plume from Fermi 3 will have minimal impact on western Lake Erie (see Subsection 5.3.2.1). The model used design values that reflected inter-annual temperature variations from operation of Fermi 3 including maximum monthly effluent temperatures. Lake temperature data was based upon forecasted temperature ranges as discussed in Subsection 5.3.2.1.

The maximum mixing zone size (plan view area) determined by the CORMIX model for a temperature rise up to 3°F above ambient lake temperature per Michigan water quality regulations (Reference 6.1-4) is about 130 feet long and 226 feet wide. The total area of the plume is 29,486

ft^2. This plume is located approximately 1317 feet from the western shoreline of Lake Erie. The longest plume predicted by CORMIX is narrower and covers a smaller plan view area. It is about 179 feet long and 42 feet wide at the same outfall location. For both cases, the plume would be very small within the lake before dissipation.

Additional discussion of this topic is provided in Subsection 5.3.2.1.

Neighboring Facility Thermal Plumes

Any other facilities that discharge heated water into the Western Basin are beyond the area influenced by the Fermi 3 thermal plume. Based on the thermal discharge analysis (See Subsection 5.3.2.1), no interference or interaction with plumes generated by nearby facilities is expected.

Summary of Evaluations

The modeling results as described above adequately established baseline data in the western basin of Lake Erie to support the potential environmental impacts discussed in this report and the thermal discharge descriptions and evaluations provided in Section 5.3. As indicated in the CORMIX modeling described above and in Subsection 5.3.2.1, thermal impacts to Lake Erie are shown to be minimal. Construction and operation of Fermi 3 will not cause hydrological alterations of Lake Erie flow or water supplies (as discussed in Section 4.2 and Section 5.2) that will impact thermal monitoring programs.

6.1.2 Pre-Operational Monitoring

The pre-operational monitoring program would be a continuation of the existing monitoring program, as required by the Michigan Department of Environmental Quality (MDEQ) for Fermi 2. Detroit Edison will continue to monitor and continuously record the Fermi 2 cooling water blowdown discharge temperature as required by the MDEQ in the National Pollutant Discharge Elimination System (NPDES) permitting process.

6.1.3 Operational Monitoring

The operational monitoring program is anticipated to be a continuation of the pre-operational monitoring program, and would conform to applicable NPDES permit requirements at the time of operation.

For current operations of Fermi 2, the MDEQ requires continuous monitoring/recording of discharge water temperature from Outfall 001, which includes the cooling water blowdown discharge. Detroit Edison expects similar monitoring requirements for operation of Fermi 3.

A description of the estimated thermal discharge and the predicted rapid dissipation of the thermal plume are presented in Subsection 5.3.2. Due to the extremely small size of the predicted thermal plume as well as the well-accepted basis for the estimation of the extent of the plume, direct monitoring of the plume dimension is not planned. In fact, given the wind-induced turbulence present in Lake Erie and the relatively small areas affected, resolution of the plume by boat-based

measurement would be challenging. The plume is very likely to be small and the changes in temperature from ambient would be modest. The plume is also likely to migrate from side to side due to wind-driven current direction variability.

The temperature of the effluent from Fermi 3 will be monitored on a continuous basis prior to discharge as required by a Fermi 3 NPDES permit (see Reference 6.1-5 for the Fermi 2 NPDES permit). Because the monitoring activities of the MDEQ (via current and future permits) are extensive and complete, additional monitoring of thermal effluents is not warranted for Fermi 3.

6.1.4 References

6.1-1 National Oceanic and Atmospheric Association, Center for Operational Oceanographic Products and Services, "Great Lakes Water Level 9063090 Fermi Power Plant, Michigan," 23 November 2005, http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=9063090+Fermi+Power+Plant,+MI&type=Historic%20Great%20Lakes%20Water%20Level%20Data, accessed 30 March 2008.

6.1-2 National Oceanic and Atmospheric Association, "Lake Erie Operational Forecast System, Field Forecast," 24 March 2008, http://tidesandcurrents.noaa.gov/ofs/leofs/leofs.html, accessed 30 March 2008.

6.1-3 Detroit Edison, "Enrico Fermi Atomic Power Plant Unit 2 Environmental Report Operating License," Volume 3, Supplement 5, January 1979.

6.1-4 Michigan Department of Environmental Quality, Water Bureau Water Resources Protection, "Water Quality Standards," January 13, 2006.

6.1-5 Michigan Department of Environmental Quality, "NPDES Permit No. MI0037028, Detroit Edison Company, Fermi 2 Power Plant," 2005.

6.2 Radiological Monitoring

The Fermi 2 Radiological Environmental Monitoring Program (REMP) will be utilized to support the pre-operational and operational monitoring needs of Fermi 3, and provide adequate baseline information prior to Fermi 3 operation.

6.2.1 Introduction

This subsection provides a description of the annual Radioactive Effluent Release and Radiological Environmental Operating Report required by Subsection 5.6.2 and Subsection 5.6.3 of the Fermi 2 Technical Specifications. The Fermi 2 REMP adequately characterizes the radiological environment of the biosphere in the vicinity of a new facility on the Fermi site. It provides data on measurable levels of radiation and radioactive materials on the site environs, and provides baseline data on surveillance of principal pathways of exposure to the public. This subsection extensively utilizes the 2006 Radioactive Effluent Release and Radiological Environmental Operating Report for Fermi 2 to adequately describe the REMP (Reference 6.2-1).

Radioactive effluents are discussed in Section 3.5.

The following description of the Fermi 2 REMP includes: (1) number and location of sample collection points and measuring devices and the pathway sampled or measured; (2) sample size, sample collection frequency, and sampling duration; (3) type and frequency of analysis; (4) general types of sample collection and measuring equipment; (5) lower limit of detection for each analysis; (6) the approximate date on which the program was effective; and (7) the quality-assurance programs for environmental monitoring programs.

A similar type of program would be utilized to support the pre-operational and operational monitoring needs of Fermi 3. Any unique characteristics required of the program for Fermi 3 (e.g., those brought on by a new reactor design) would be incorporated into the program sufficiently in advance of operation of Fermi 3 in order to provide adequate baseline information prior to operation.

6.2.2 Fermi 2 Radiological Environmental Monitoring Program

The Fermi 2 REMP was established to provide a supplementary check on the effluent controls, to assess the radiological impact of the plant's operation on the surrounding area, and to determine compliance with applicable radiation protection guides and standards. The REMP was established in 1978, seven years prior to the plant becoming operational. This pre-operational surveillance program was established to describe and quantify the radioactivity, and its variability, in the area prior to the operation of Fermi 2. After Fermi 2 became operational in 1985, the operational surveillance program continued to measure radiation and radioactivity in the surrounding areas.

The Fermi 2 REMP is conducted in accordance with 10 CFR 50; Nuclear Regulatory Commission (NRC) Regulatory Guides 4.1 and 4.8; the Fermi 2 Offsite Dose Calculation Manual (ODCM) (Reference 6.2-2); and plant operating procedures. Samples are collected either weekly, monthly, quarterly, semiannually, or annually, depending upon the sample type and nature of the radionuclides of interest.

Environmental samples collected by Fermi 2 personnel are divided into four general types:

- Direct radiation – measured by thermoluminescent dosimeters (TLD)
- Atmospheric – including samples of airborne particulates and airborne radioiodine
- Terrestrial – including samples of milk, groundwater, and broad leaf vegetation
- Aquatic – including samples of drinking water, surface water, fish, and Lake Erie shoreline and bottom sediments

REMP samples are collected onsite and offsite up to 20 miles away from the site. Sampling locations are divided into two general categories: indicator and control. Indicator locations are those which would be most likely to display the effects caused by the operation of Fermi 2. Generally, they are located within ten miles of the site. Control locations are those which should be unaffected by plant operations. Typically, these are more than ten miles away from the site. Data obtained from the indicator locations are compared with data from the control locations. This comparison allows REMP personnel to take into account naturally occurring background radiation or fallout from weapons testing in evaluating any radiological impact Fermi 2 has on the surrounding environment. Data from indicator and control locations are also compared with pre-operational data to determine whether significant variations or trends exist.

Part of the Fermi 3 construction will include a new protected area fence (PAF) that will enclose both Fermi 2 and 3. It is expected that some current near-field TLD locations will be impacted (e.g., TLDs T47 and T48) and new near-field TLD locations will be established at the common PAF, as necessary, to provide adequate monitoring for both Fermi 2 and Fermi 3. The locations of the existing terrestrial, atmospheric, and aquatic sample collection sites are expected to remain adequate for use in monitoring the exposure pathways to the surrounding environment.

6.2.2.1 **Sample Analysis**

When environmental samples are analyzed, several types of measurements may be performed to provide information about the radionuclides present. The major analyses that are performed on environmental samples collected for the Fermi 2 REMP include:

- Gross beta analysis
- Gamma spectral analysis
- Tritium analysis
- Strontium analysis
- Gamma doses

Often samples will contain little radioactivity, and may be below the lower limit of detection (LLD) for the particular type of analysis used. The LLD is the smallest amount of sample activity which can be detected with a reasonable degree of confidence, at a predetermined level. When a measurement of radioactivity is reported as less than LLD (<LLD), it means that the radioactivity is so low that it cannot be accurately measured with any degree of confidence by that particular

method for an individual analysis. Table 6.2-2 contains the various sample types, numbers of analyses, and LLDs utilized in the Fermi 2 REMP.

6.2.2.2 Pathways Monitored

A description of the Fermi 2 REMP locations utilized to monitor the exposure pathways is described in Table 6.2-1 and shown on Figure 6.2-1, Figure 6.2-2, and Figure 6.2-3. The exposure pathways monitored include airborne, direct radiation, waterborne, and ingestion. The radioactive effluent release points are discussed in Section 3.5. The significant pathways of radiological impact to man and biota are discussed in Subsection 5.4.1.

6.2.2.3 Land Use Census

The Land Use Census is conducted in accordance with the Fermi 2 ODCM, control 3.12.2 (Reference 6.2-2), and satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR 50. This census identifies changes in the use of unrestricted areas to permit modifications to monitoring programs for evaluating doses to individuals from principal pathways of exposure. The pathways of concern are listed below:

- Inhalation Pathway – Internal exposure as a result of breathing radionuclides carried in the air
- Ground Exposure Pathway – External exposure from radionuclides deposited on the ground
- Plume Exposure Pathway – External exposure directly from a plume or cloud of radioactive material
- Vegetation Pathway – Internal exposure as a result of eating vegetables which have absorbed deposited radioactive material or which have absorbed radionuclides through the soil
- Milk Pathway – Internal exposure as a result of drinking milk which may contain radioactive material as a result of dairy animals grazing on a pasture contaminated by radionuclides

The Land Use Census is conducted during the growing season and is used to identify, within a radius of five miles, the location of the nearest residences, milk animals, meat animals, and gardens (greater than 50 m^2 and containing broad leaf vegetation) in each of 16 meteorological sectors surrounding Fermi 2. Gardens greater than 50 m^2 are the minimum size required to produce the quantity (26 kg/year) of leafy vegetables assumed in NRC Regulatory Guide 1.109 for consumption by a child.

6.2.2.4 Quality Assurance Program for REMP

An important part of the environmental monitoring program at Fermi 2 is the Quality Assurance (QA) program. It is conducted in accordance with the guidelines specified in NRC Regulatory Guide 4.15. The QA program is designed to identify possible deficiencies in the REMP so that corrective actions can be initiated promptly. Fermi 2's QA program also provides confidence in the results of the REMP through:

- Performing regular audits of the REMP, including a careful examination of sample collection techniques and record keeping
- Performing audits of the vendor laboratory which analyzes the environmental samples
- Requiring the analytical vendor laboratory to participate in an approved Cross-Check Program
- Splitting samples prior to analysis by an independent laboratory and then comparing the results for agreement
- Requiring the analytical laboratory to perform in-house spiked sample analyses

6.2.3 Conclusion

The sample sites, types of analyses, sampling frequencies, and lower limits of detection currently being utilized in the Fermi 2 REMP adequately support the pre-operational and operational monitoring needs of Fermi 3, except that some current near-field TLD locations will be impacted and new near-field TLD locations will be established, as necessary, to provide adequate monitoring.

6.2.4 References

6.2-1 Detroit Edison, “Fermi 2 – 2006 Radioactive Effluent Release and Radiological Environmental Operating Report,” January 1, 2006 through December 31, 2006.

6.2-2 Detroit Edison, “Fermi 2 Offsite Dose Calculation Manual,” Revision 14, 1999.

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 1 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Airborne	Radioiodine and Particulates 3 samples from close to 3 site boundary locations in different sectors	API-2 (0.6 mi NNW)–Site boundary and Toll Road, on site fence by T-4 API-3 (0.6 mi NW)–Site boundary and Toll Road, on site fence by T-5 API-5 (1.2 mi S)–Pole, N corner of Pointe Aux Peaux and Dewey Rd.	A mechanical air sampler is used to draw a continuous volume of air through two filters designed to collect particulates and radionuclides. Air samples are collected weekly.	Radioiodine–I-131 analysis weekly. Air Particulate–Gross beta radioactivity analysis following filter change. Air Particulate–Particulate filters for each sampling location are combined quarterly to form a "composite sample" and are analyzed for gamma radiation.
	Radioiodine and Particulates 1 sample from the vicinity of a community having the highest X/Q	API-1 (1.4 mi NE)–Estral Beach pole on Lakeshore, 18 poles S of Lakeview		
	Radioiodine and Particulates 1 sample from a control location, for example 15-30 km distance and in the least prevalent wind direction	API-4 (14.0 mi W)–Pole, at Michigan Gas substation on N. Custer Rd., 0.66 miles west of Doty Rd.		
Direct Radiation	TLDs Stations located at incremental distances of roughly 1 through 5 miles, and at 10 miles from the reactor. Stations are located on land and spread throughout the meteorological sectors (there are no stations on Lake Erie). Those stations located at the site boundary are designated as such.	T4 (0.6 mi NNW)–Site boundary and Toll Rd. on Site fence by API-2. T5 (0.6 mi NW)–Site boundary and Toll Rd. on Site fence by API-3. T6 (0.6 mi WNW)–On Site fence at south end of N. Bullet Rd. T8 (1.9 mi NW)–Pole on Post Rd. near NE corner of Dixie Hwy. and Post Rd. T9 (1.5 mi NNW)–Pole, NW corner of Trombley and Swan View Rd. T10 (2.1 mi N)–Pole, S side of Massarant- 2 poles W of Chinavare. T11 (6.2 mi NNE)–Pole, NE corner of Milliman and Jefferson. T12 (6.3 mi NNE)–Pointe Mouille Game Area Field Office, Pole near tree, N area of parking lot.	Quarterly	mR exposure quarterly

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 2 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	TLDs Stations located at incremental distances of roughly 1 through 5 miles, and at 10 miles from the reactor. Stations are located on land and spread throughout the meteorological sectors (there are no stations on Lake Erie). Those stations located at the site boundary are designated as such.	T13 (4.1 mi N)–Labo and Dixie Hwy. Pole on SW corner with light. T14 (4.4 mi NNW)–Labo and Brandon Pole on SE corner near RR. T15 (3.9 mi NW)–Pole, behind building at the corner of Swan Creek and Mill St. T16 (4.9 mi WNW)–Pole, SE corner of War and Post Rd. T17 (4.9 mi W)–Pole, NE corner of Nadeau and Laprad near mobile home park. T18 (4.8 mi WSW)–Pole, NE corner of Mentel and Hurd Rd. T19 (5.2 mi SW)–Fermi siren pole on Waterworks Rd. NE corner of intersection - Sterling State Park Rd. Entrance Drive/Waterworks. T22 (1.2 mi S)–Pole, N side of Pointe Aux Peaux, 2 poles W of Long - Site boundary. T23 (1.1 mi SSW)–Pole, S side of Pointe Aux Peaux, 1 pole W of Huron next to Vent Pipe - Site boundary. T24 (1.2 mi SW)–Fermi Gate along Pointe Aux Peaux Rd. on fence wire W of gate Site boundary. T25 (1.4 mi WSW)–Pole, Toll Rd. - 12 poles S of Fermi Drive. T26 (1.1 mi WSW)–Pole, Toll Rd. - 6 poles S of Fermi Drive.	Quarterly	mR exposure quarterly

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 3 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	TLDs Stations located at incremental distances of roughly 1 through 5 miles, and at 10 miles from the reactor. Stations are located on land and spread throughout the meteorological sectors (there are no stations on Lake Erie). Those stations located at the site boundary are designated as such.	T32 (10.3 mi WNW)–Pole, corner of Stony Creek and Finzel Rd. T33 (9.2 mi NW)–Pole, W side of Grafton Rd. 1 pole N of Ash and Grafton intersection. T34 (9.8 mi NNW)–Pole, SW corner of Port Creek and Will-Carleton Rd. T36 (9.1 mi N)–Pole, NE corner of Gibraltar and Cahill Rd. T37 (9.8 mi NNE)–Pole, S corner of Adams and Gibraltar across from Humbug Marina. T38 (1.7 mi WNW)–Residence – 6594 N. Dixie Hwy. T49 (1.1 mi WSW)–Corner of Site boundary fence north of NOC along Critical Path Rd. T50 (0.9 mi W)–Site boundary fence near main gate by the south Bullet Street sign. T51 (0.4 mi N)–Site boundary fence north of north Cooling Tower. T52 (0.4 mi NNE)–Site boundary fence at the corner of Arson and Tower. T55 (3.3 mi WSW)–Pole, north side of Nadeau Rd. across from Sodt Elementary School Marquee. T56 (2.9 mi WSW)–Pole, entrance to Jefferson Middle School on Stony Creek Rd.	Quarterly	mR exposure quarterly

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 4 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	TLDs Stations located at incremental distances of roughly 1 through 5 miles, and at 10 miles from the reactor. Stations are located on land and spread throughout the meteorological sectors (there are no stations on Lake Erie). Those stations located at the site boundary are designated as such.	T57 (2.7 mi W)–Pole, north side of Williams Rd. across from Jefferson High School entrance. T58 (4.9 mi WSW)–Pole west of Hurd Elementary School Marquee. T59 (2.6 mi NW)–Pole north of St. Charles Church entrance on Dixie Hwy. T60 (2.5 mi NNW)–1st pole north of North Elementary School entrance on Dixie Hwy. T61 (10.1 mi W)–Pole, SW corner of Stewart and Raisinville Rd. T62 (9.7 mi SW)–Pole, NE corner of Albain and Hull Rd. T63 (9.6 mi WSW)–Pole, NE corner of Dunbar and Telegraph Rd.	Quarterly	mR exposure quarterly
	TLDs Stations in “Special Areas” and “Control” locations	T1 (1.3 mi NE)–Estral Beach, Pole on Lakeshore 23 Poles S of Lakeview. (Special Area). T2 (1.2 mi NNE)–Pole at termination of Brancheau St. (Special Area) T3 (1.1 mi N)–Pole, NW corner of Swan Boat Club fence. (Special Area) T7 (14.0 mi W)–Pole, at Michigan Gas substation on N. Custer Rd., 0.66 miles west of Doty Rd. (Control) T20 (2.7 mi WSW)–Pole, S side of Williams Rd., 9 poles W of Dixie Hwy. (Special Area)		

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 5 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	TLDs Stations in “Special Areas” and “Control” locations	T21 (2.7 mi WSW)–Pole, N side of Pearl at Parkview Woodland Beach. (Special Area) T27 (6.8 mi SW)–Pole, NE corner of McMillan and East Front St. (Special Area) T28 (10.7 mi SW)–Pole, SE corner of Mortar Creek and LaPlaisance. (Control) T29 (10.3 mi WSW)–Pole, NE corner of S Dixie and Albain. (Control) T30 (7.8 mi WSW)–E side S end of foot bridge, St. Mary's Park corner of Elm and Monroe St. (Special Area) T31 (9.6 mi WSW)–1st pole W of entrance drive Milton "Pat" Munson Recreational Reserve on North Custer Rd. (Control) T35 (6.9 mi N)–Pole, S Side of S. Huron River Dr. across from Race St. (Special Area)	Quarterly	mR exposure quarterly
	TLDs Near-field stations located onsite, all within 1 mile of the reactor	T39 (0.3 mi S)–SE corner of PAF. T40 (0.3 mi S)–Midway along OBA - PAF. T41 (0.2 mi SSE)–Midway between OBA and Shield Wall on PAF. T42 (0.2 mi SSE)–Midway along Shield Wall on PAF. T43 (0.1 mi SE)–Midway between Shield Wall and Aux Boilers on PAF.		

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 6 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Direct Radiation	TLDs Near-field stations located onsite, all within 1 mile of the reactor	T44 (0.1 mi ESE)–Opposite OSSF door on PAF. T45 (0.1 mi E)–NE Corner of PAF. T46 (0.2 mi ENE)–NE side of barge slip on fence. T47 (0.1 mi S)–South of Turbine Bldg. rollup door on PAF. T48 (0.2 mi SW)–30 ft. from corner of AAP on PAF. T53 (0.2 mi NE)–Site boundary fence east of South Cooling Tower. T54 (0.3 mi S)–Pole next to Fermi 2 Visitors Center. T64 (0.2 mi WNW)–West of switchgear yard on PAF. T65 (0.1 mi NW)–PAF switchgear yard area NW of RHR complex. T66 (0.1 mi NE)–Behind Bldg. 42 on PAF. T67 (0.2 mi NNW)–Site boundary fence West of South Cooling Tower.	Quarterly	mR exposure quarterly
Waterborne	Surface Water 1 sample onsite and 1 control sample	SW-2 (11.7 mi NNE)—Detroit Edison's Trenton Channel Power Plant Intake Structure (Screenhouse #1). (Control) SW-3 (0.2 mi SSE)–Fermi 2 General Service Water Intake Structure.	Surface water samples are collected at time intervals that are very short (hourly) relative to the sample collection period (monthly) in order to assure obtaining a representative sample.	Gamma isotopic and Sr-89/90 analysis monthly. The monthly samples for each location are combined on a quarterly basis to form a quarterly composite sample and are analyzed for tritium.

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 7 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Waterborne	Groundwater Samples from 3 locations down-gradient from the reactor, and one control location	GW-1 (0.4 mi S)–Approx. 100 ft W of Lake Erie, Fermi 1 parking lot near combustion turbine generator (CTG). GW-2 (1.0 mi SSW)–4 ft S of Pointe Aux Peaux Rd. Fence 427 ft W of where Pointe Aux Peaux crosses over Stony Point's Western Dike. GW-3 (1.0 mi SW)–143 ft W of Pointe Aux Peaux Rd. Gate, 62 ft N of Pointe Aux Peaux Rd. Fence. GW-4 (0.6 mi WNW)–42 ft S of Langton Rd, 8 ft E of Toll Rd. Fence. (Control)	Quarterly	Gamma isotopic and tritium analysis quarterly
	Sediment 4 sample location in various directions from the reactor, and one control location	S-1 (0.9 mi SSE)–Pointe Aux Peaux, Shoreline to 500 ft offshore sighting directly to Land Base Water Tower. S-2 (0.2 mi E)–Fermi 2 Discharge, approx. 200 ft offshore. S-3 (1.1 mi NE)–Estral Beach, approx. 200 ft offshore, off North shoreline where Swan Creek and Lake Erie meet. S-4 (3.0 mi WSW)–Indian Trails Community Beach. S-5 (11.7 mi NNE)–Detroit Edison's Trenton Channel Power Plant intake area. (Control)	Semiannually	Gamma isotopic and Sr-89/90 analysis semiannually

Table 6.2-1 Fermi 2 Radiological Environmental Monitoring Program Locations (Sheet 8 of 8)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency of Analyses
Ingestion	Milk One sample from milking animals at an indicator location, and one sample at a control location 5 miles apart	M-2 (5.4 mi NW)–Reaume Farm – 2705 E. Labo. M-8 (9.9 mi WNW)–Calder Dairy – 9334 Finzel Rd. (Control)	Semimonthly when animals are on pasture; Monthly when animals are on stored feed. When milk samples are not available, grass samples are collected.	Gamma isotopic, Sr-89/90, and I-131 analysis semimonthly
	Fish One sample at an indicator location and samples are taken at two control locations	F-1 (9.5 mi NNE)–Near Celeron Island. (Control) F-2 (0.4 mi E)–Fermi 2 Discharge (approx. 1200 ft offshore). F-3 (3.5 mi SW)–Brest Bay. (Control)	Semiannually	Gamma isotopic and Sr-89/90 analysis on edible portions semiannually
	Garden One sample of broadleaf vegetation at an indicator location, and one control sample at a distance and direction which is considered to be unaffected by plant operations	FP-1 (3.8 mi NNE)–9501 Turnpike Highway. FP-9 (10.9 mi W)–4074 North Custer Road. (Control)	Monthly during the growing season	Gamma isotopic and I-131 analysis monthly
	Drinking Water One sample is taken at an indicator location and one sample is taken at a control location	DW-1 (1.1 mi S)–9501 Monroe Water Station N Side of Pointe Aux Peaux ½ Block W of Long Rd. DW-2 (18.5 mi N)–Detroit Water Station 14700 Moran Rd, Allen Park. (Control)	The automatic samplers collect samples, known as aliquots, at time intervals that are very short (hourly) relative to the sample collection period (monthly) in order to assure that a representative sample is obtained.	Gross beta, Sr-89/90, and gamma isotopic analysis monthly. Monthly samples are combined on a quarterly basis and analyzed for tritium activity.

Source: Reference 6.2-1

Table 6.2-2 Radiological Environmental Monitoring Program Summary (Sheet 1 of 3)

Sample Type (Units)	Type & Number of Analyses[1]		LLD[2]
Air Particulates (pCi/m^3)	Gross Beta	255	0.01
	Gamma Spec.	20	
	Cs-134		0.05
	Cs-137		0.06
Airborne Iodine (pCi/m^3)	I-131	257	0.07
Direct Radiation (mR/std qtr)	Gamma (TLD)	191	1.0
Vegetation (pCi/kg wet)	I-131	14	60
	Gamma Spec.	14	
	Cs-134		60
	Cs-137		80
Surface Water (pCi/l)	H-3	8	2000
	Sr-89/90	24	N/A
	Gamma Spec.	24	
	Mn-54		15
	Co-58		15
	Fe-59		30
	Co-60		15
	Zn-65		30
	Zr-95		15
	Cs-134		15
	Cs-137		18
	Ba-140		15
	La-140		15

Table 6.2-2 Radiological Environmental Monitoring Program Summary (Sheet 2 of 3)

Sample Type (Units)	Type & Number of Analyses[1]		LLD[2]
Groundwater (pCi/l)	H-3	16	2000
	Gamma Spec.	16	
	Mn-54		15
	Co-58		15
	Fe-59		30
	Co-60		15
	Zn-65		30
	Zr-95		15
	Cs-134		15
	Cs-137		18
	Ba-140		15
	La-140		15
Sediment (pCi/kg dry)	Sr-89/90	10	N/A
	Cs-134		150
	Cs-137		180
Fish (pCi/kg wet)	Gamma Spec.	19	
	Sr-89/90	19	N/A
	Mn-54		130
	Fe-59		260
	Co-58		130
	Co-60		130
	Zn-65		260
	Cs-134		130
	Cs-137		150

Table 6.2-2 Radiological Environmental Monitoring Program Summary (Sheet 3 of 3)

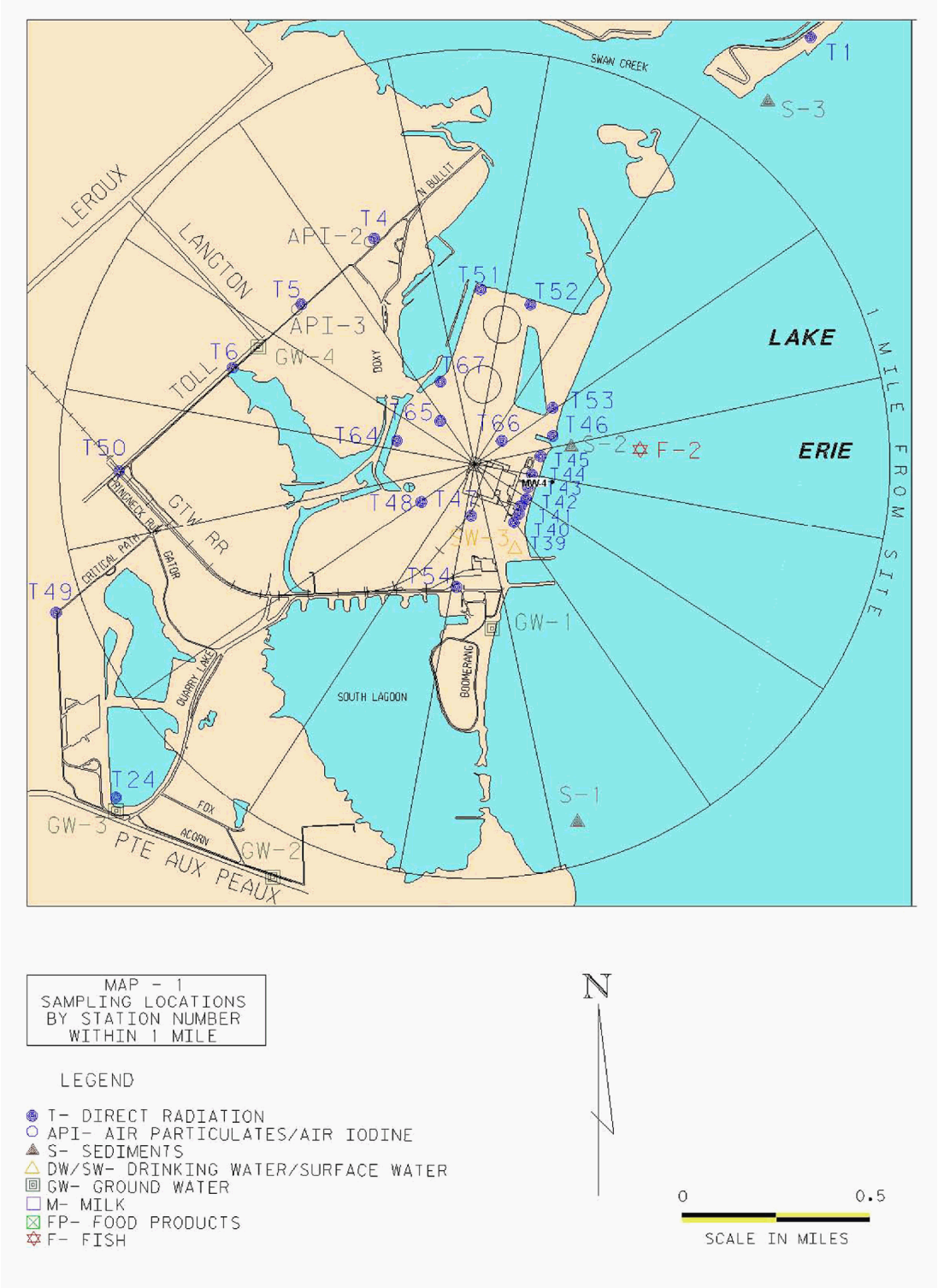
Sample Type (Units)	Type & Number of Analyses[1]		LLD[2]
Milk (pCi/l)	I-131	36	1
	Gamma Spec.	36	
	Sr-89/90	36	N/A
	Cs-134		15
	Cs-137		18
	Ba-140		15
	La-140		15
Drinking Water (pCi/l)	Gross Beta	25	4
	Gamma Spec.	25	
	H-3	8	2000
	Sr-89/90	25	N/A
	Mn-54		15
	Co-58		15
	Fe-59		30
	Co-60		15
	Zn-65		30
	Zr-95		15
	Cs-134		15
	Cs-137		18
	Ba-140		15
	La-140		15

Notes:

1. H-3 = Tritium
2. LLD = Fermi 2 ODCM LLD: nominal lower limit of detection based on 4.66 sigma error for background sample.

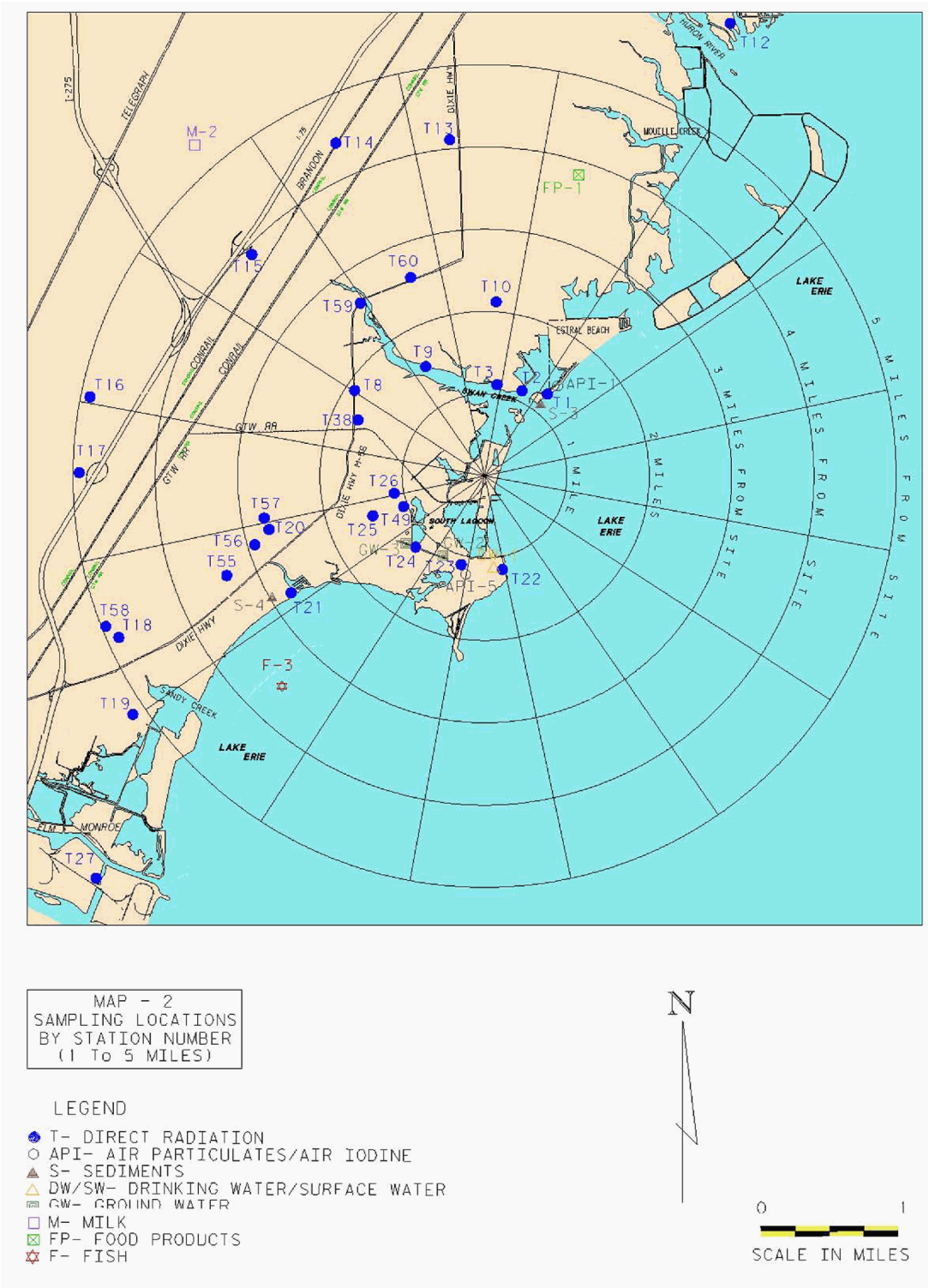
Source: Reference 6.2-1

Figure 6.2-1 Sample Collection Sites – Within 1 Mile



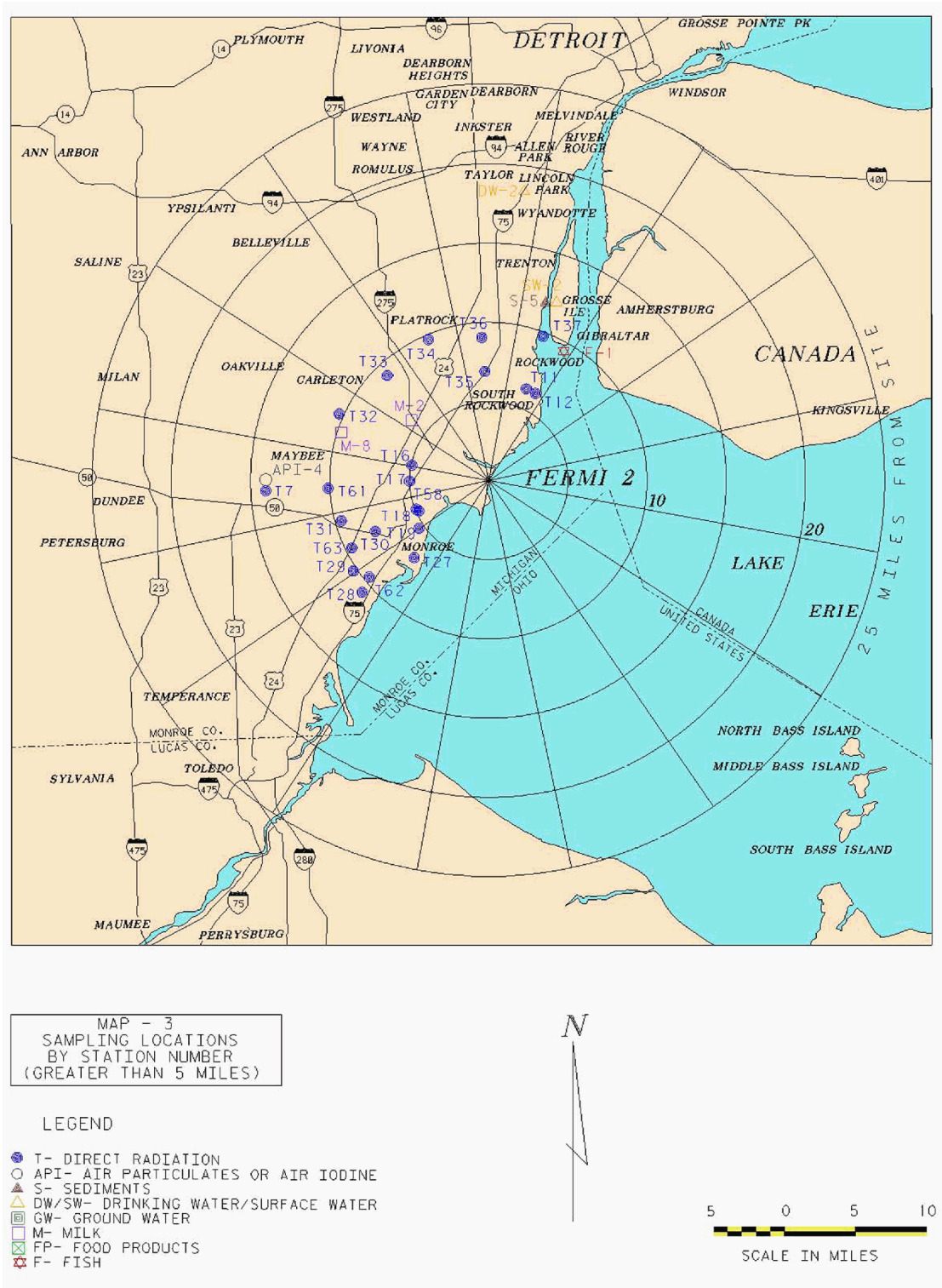
Source: Reference 6.2-1

Figure 6.2-2 Sample Collection Sites – 1 to 5 Miles



Source: Reference 6.2-1

Figure 6.2-3 Sample Collection Sites – Greater than 5 Miles



Source: Reference 6.2-1

6.3 Hydrological Monitoring

This section discusses the following hydrological monitoring programs:

- Pre-application monitoring to verify existing hydrologic conditions, substantiate design assumptions related to site hydrology, and support the baseline hydrologic descriptions in Subsection 2.3.1.
- Site preparation and construction monitoring to control anticipated impacts from site preparation and construction activities and detect unexpected impacts arising from these activities.
- Pre-operational monitoring to establish a baseline for identifying and assessing environmental impacts resulting from Fermi 3 operation.
- Operational monitoring programs to establish the impacts of Fermi 3 operation.

Monitoring requires compliance with specific agencies and permitting to be accomplished before activities are initiated, during construction, and during operation. Effluents discharged to navigable streams are governed by the Federal Clean Water Act (CWA), 40 CFR, and State of Michigan water quality standards. These require Detroit Edison to obtain a stormwater permit under the NPDES, Section 3112, for the reactor to operate in compliance with the CWA; it is not a prerequisite to obtaining an NRC license (Reference 6.3-1). Adequate monitoring (baseline and operational) is a prerequisite for obtaining or amending an NPDES permit. A Section 401 Water Quality certification is required prior to application for a new, or amendment of an existing, NPDES permit. The Section 401 certification is also required prior to issuance of the COL. The monitoring associated with the NPDES permit is the only monitoring required for effluent discharges to navigable streams. Figure 2.3-5 depicts water bodies, rivers, creeks, and streams feeding into Lake Erie. Figure 2.1-2 shows the water bodies within a 7.5-mile radius of the Fermi site. Figure 2.3-8 shows the bathymetry of Lake Erie and Lake Saint Clair.

As part of the detailed design for Fermi 3, the present Fermi 2 groundwater monitoring programs will be evaluated with respect to the addition of Fermi 3 to determine if any modification of the existing programs is required to adequately monitor plant effects on groundwater. Wells exist onsite from previous projects and current investigations. Monitoring plans may include components for both the overburden groundwater and the Bass Island Group aquifer.

6.3.1 Pre-Application Monitoring

This subsection primarily addresses monitoring that is performed for Fermi 2. Monitoring results and data for Fermi 2 are presented in Reference 6.3-4. In 1967, the surface water quality of Michigan streams was investigated by the State of Michigan in a comprehensive project. The project was conducted in cooperation with the Michigan Department of Natural Resources (MDNR) under agreement with the State Water Resources Commission for water resources investigations. Samples were collected at approximately 200 gaging stations in late March and early April when stream flow was high and also in late August and early September under low streamflow conditions.

The goals of the sampling program were as follows:

a. Compare water quality in the Fermi 2 area with the entire State of Michigan under conditions that produce extremes in natural water quality

b. Evaluate regional variation in water so that reasonable water quality estimates may be made

c. Establish values to which future measurements may be compared for evaluating changes in water quality

d. Develop a framework on which future detailed water quality studies can be conducted

During the 1967 surface water quality investigation, personnel of the Michigan District of the U.S. Geological Survey (USGS) collected samples of water from each stream during their regular visits to the gaging stations. The samples were collected in disposable plastic bottles and returned to the district office for chemical analysis. Multiple samples were collected at several time intervals to verify the parameters' stability. Field analysis consisted of using mercuric nitrate for chloride determination, the turbidimetric method for sulfate, the colorimetric EDTA method for hardness, and colorimetric and potentiometric titration for specific conductance.

In August 1971, the first base flow and chemical quality monitoring program was initiated for minor streams tributary to Lake Erie. This included representative streams within the Swan Creek Watershed. The study was conducted by the USGS Office in Okemos, Michigan.

In conjunction with the 1971 USGS study, the MDNR performed routine water quality measurements on various waters from selected locations including: coliforms, dissolved oxygen, oxygen demand, solids, and nutrients. Sampling locations near the Fermi 2 site were Swan Creek at Sigler Road bridge, the temporary sewage disposal facility to Lake Erie, the sewage plant to Swan Creek, the Fermi 1 discharge to Swan Creek, the mouth of Swan Creek, the Fermi 1 intake canal, the Fermi 1 discharge at head wall, raw water from the City of Monroe water treatment facility, the Dixie Highway Bridge over Swan Creek, and Lake Erie at Sterling State Park Beach.

Since some of the MDNR's sampling locations were on discharge lines from the Fermi site, there was a direct and independent verification of the quality of the plant effluents. The EPA maintained water quality surveillance stations near the site through the Region V office in Chicago, Illinois.

During a 1991 through 1992 fish entrainment and impingement study, hydraulic monitoring to obtain average velocities through the Fermi 2 intake screens was performed by Detroit Edison three times. Monitoring was scheduled to correspond to anticipated normal low (winter), high (summer), and intermediate (spring) intake flow conditions. (Reference 6.3-5)

A limited groundwater level monitoring program at Fermi 2 is currently performed on a quarterly basis as part of the REMP. Fermi 2 has four groundwater wells included in its REMP, which are monitored monthly for water levels and sampled quarterly for the radionuclides and sensitivities specified in the ODCM (Reference 6.3-2).

In addition, sixteen groundwater monitoring wells have been installed around Fermi 1 in support of decommissioning activities. These are also sampled on a quarterly basis with samples assayed for tritium and gamma emitters for the sensitivities specified in the Fermi 2 ODCM.

Chemical testing of groundwater was performed to establish baseline conditions at the site. The groundwater samples for chemical testing were collected from all shallow and deep monitoring wells installed as part of the Fermi 3 investigation. Figure 2.3-57 shows groundwater and surface water sampling locations. Each monitoring well was sampled once for the parameters listed in Table 6.3-1. At a similar frequency, surface water samples were collected from Lake Erie in the area of the plant gaging station, and from other specific locations. The surface water samples were also tested for the parameters listed on Table 6.3-1. Discussion on chemical monitoring data regarding water quality is included in Section 6.6.

To monitor groundwater fluctuations, groundwater levels in piezometers and monitoring wells were measured monthly for a period of approximately one year from June 29, 2007 to May 29, 2008. Groundwater elevations in piezometers and monitoring wells, and surface water elevations at the gaging stations, were generally measured on the same working day.

Cooling system and nonradiological waste retention impacts are discussed in Section 5.2. Surface water flow rates and sediment transport are discussed in Subsection 2.3.1 and Section 5.2. Groundwater flow velocities are discussed in Subsection 2.3.1.

6.3.2 Construction Monitoring

No adverse hydrological impacts are predicted from the construction of Fermi 3. Coverage under the NPDES Stormwater Construction Permit may require an additional construction monitoring program to be instituted for the construction activities associated with Fermi 3 to assess hydrologic changes resulting from construction. Before the Fermi 3 construction activities are authorized under the NPDES Stormwater Construction Permit, a Soil Erosion and Sedimentation Control (SESC) Plan and Pollution Incident Prevention Plan (PIPP) must be developed (Reference 6.3-3). The elements included in the SESC Plan and PIPP are described in Subsection 4.2.1. Construction impacts are reduced through development and implementation of the site-specific SESC Plan and PIPP. Inspections will be periodically performed to ensure that the control measures in these plans are installed and maintained.

During construction dewatering, piezometers are monitored as needed to evaluate the drawdown of shallow and bedrock groundwater levels. Fermi 3 wells or piezometers are used for monitoring, as appropriate. Monitoring is performed at frequent intervals when construction dewatering begins in order to document water level declines. Monitoring frequency is reduced after dewatering levels have stabilized. The drawdown effects of construction dewatering on existing wells near the Fermi site are shown on Figure 4.2-2 and Figure 4.2-3 for the proposed excavation barrier methods.

Following dewatering, groundwater level monitoring using shallow and bedrock piezometers and monitoring wells is performed monthly to establish groundwater flow patterns with Fermi 3 in-place. Fermi 3 wells and piezometers are used as appropriate.

Safeguards will be implemented to minimize the possibility of adverse impacts to groundwater due to construction and operation of Fermi 3. Such safeguards would include typical best management practices (BMPs) for the storage, handling, and conveyance of hazardous materials, such as appropriate containment areas around storage tanks, emergency cleanup procedures in the event of surface contaminant spills, secure hazardous materials storage areas, etc.

6.3.3 Pre-Operational Monitoring

Pre-operational hydrological monitoring is conducted to establish a baseline for identifying and assessing environmental impacts resulting from Fermi 3 operations. The monitoring is used to verify existing hydrologic conditions and substantiate design assumptions related to site hydrology. This includes continual lake water level readings performed by NOAA. As adverse hydrological impacts due to construction are not anticipated, Detroit Edison anticipates a pre-operational monitoring program that is similar to the operational monitoring program described in Subsection 6.3.4. Additional pre-operational baseline hydrologic monitoring may be required as part of the NPDES permitting process.

6.3.4 Operational Monitoring

Since the permitted site is a nuclear power station, it is anticipated that the monitoring requirements of the new/amended permit would be similar to the Fermi 2 NPDES permit. Monitoring of Lake Erie water levels will continue during Fermi 3 operation. Also, operational monitoring will be used to evaluate the following:

- Alteration of surface water flow
- Alteration of groundwater flow
- Impact of sanitary and chemical waste retention methods on water quality.
- Alteration of sediment transport
- Alteration of wetlands

Monitoring of the Spoils Disposal Pond is anticipated. Sediment removal of dredged sediments will be performed, and the sediment will be relocated appropriately. This will prevent increases in sediment or turbidity discharged into Lake Erie. Monitoring is performed using industry standard equipment and analytical procedures. The program may be modified as improved equipment and analysis methods are developed, or as needed to meet updated regulatory program requirements. Monitoring is to occur during discharge events or monthly, which includes water level monitoring events and sampling events for water quality.

Groundwater monitoring will be performed by measuring groundwater levels quarterly, using new up-gradient and down-gradient monitoring locations, dewatering piezometers, and Fermi 3 hydrogeology monitoring locations, as appropriate.

Groundwater sample monitoring and operational accident monitoring are addressed in Section 6.2.

6.3.5 References

6.3-1 Michigan Department of Environmental Quality, Water Bureau, “Industrial Storm Water Operator Training Manual,” http://www.michigan.gov/documents/deq/wb-storm-Industrial-SW-Manual_198899_7.pdf, accessed 7 May 2008.

6.3-2 Detroit Edison, “Fermi 2 Offsite Dose Calculation Manual,” Revision 14, 1999.

6.3-3 Michigan Department of Environmental Quality, Water Bureau, “Construction Site Program,” http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-23997--,00.html, accessed 28 August 2008.

6.3-4 Detroit Edison, “Enrico Fermi Atomic Power Plant Unit 2, Environmental Report Operating License Stage,” Volume 3, Supplement 5, January 1979.

6.3-5 Lawler, Matusky, & Skelly Engineers, Fish Entrainment and Impingement Study (October 1991-September 1992), February 1993, Fermi Power Plant. www.yahoo.com

Table 6.3-1 Groundwater and Surface Water Testing Parameters

Hardness	Alkalinity
Sulfate	Fecal Streptococci
Silica, Dissolved	Chromium (VI)
Turbidity	Total Suspended Solids
Phosphorous, Total	Chloride
Sodium	Silica, Total
Iron	Copper
Phosphorous, Orthophosphate	Lead
Potassium	Nickel
Color	Silver
Ammonia	Biological Oxygen Demand
Calcium	Mercury
Bicarbonate	Selenium
Odor	Zinc
Nitrate	Total Dissolved Solids
Magnesium	pH
Arsenic (III)	Conductivity
Nitrite	Temperature
Total Coliforms	Phytoplankton (surface water only)
Cadmium	Carbon dioxide (groundwater only)
Organic Nitrogen	Dissolved oxygen
Fecal Coliforms	Chemical Oxygen Demand
Chromium, Total	
ORP/Eh	

6.4 Meteorological Monitoring

The current Fermi onsite meteorological monitoring program has been in place since it was implemented for Fermi 2 pre-operational meteorological assessment beginning in June 1975. The existing Fermi onsite meteorological tower complies with Regulatory Guide 1.23, Revision 0, February 1972. Except as described in Subsection 6.4.1.1 regarding the proximity of trees to the meteorological tower, the onsite meteorological monitoring program complies with the proposed Revision 1 to Regulatory Guide 1.23 (September 1980). Since June 1975, some of the meteorological monitoring program components have been upgraded (Reference 6.4-1). Subsection 6.4.1 describes the current state of the onsite meteorological measurement program. The Fermi 2 meteorological monitoring program provides the basis for the Fermi 3 preapplication meteorological monitoring program. In addition, data from the onsite meteorological tower is used as the sole input for models that describe the short- and long-term atmospheric transport and diffusion characteristics of the site, as provided for in NRC Regulatory Guides 1.145 and 1.111, respectively. A description of the model used to analyze the short- and long-term atmospheric transport and diffusion conditions of the site is described in Subsection 2.7.6.1 and Subsection 2.7.6.2.

The NDCT for Fermi 3 will be built in the approximate location of the current onsite meteorological tower. Thus, a new meteorological tower will be erected in the southeast corner of the Fermi site as displayed in Figure 2.1-4. Subsection 6.4.2 will describe the construction, pre-operational, and operational meteorological monitoring program for Fermi 3.

The purpose of this section is to identify that the onsite meteorological measurements program and other data-collection programs used by Fermi 3 are adequate to: (1) describe local and regional atmospheric transport and diffusion characteristics within 50 mi (80 km) of the plant, (2) ensure environmental protection, and (3) provide an adequate meteorological database for evaluation of the effects of plant operation. This discussion includes an analysis of the following meteorological monitoring system elements:

- The location of the meteorological tower and instrument siting
- Meteorological parameters measured
- Meteorological sensors
- Instrument surveillance
- System accuracy
- Data recording and transmission
- Data acquisition and reduction
- Data validation and screening
- Data display and archiving
- Data recovery rate and annual and joint frequency distribution of data

6.4.1 Fermi 3 Preapplication Meteorological Monitoring Program

6.4.1.1 Tower and Instrument Siting

Figures showing the location of the onsite meteorological tower in respect to offsite meteorological stations and surrounding topography are provided in Figure 2.7-1 and Figure 2.7-56 through Figure 2.7-59, respectively. Figure 2.1-4 provides the location of the Fermi site structures in relation to the current onsite meteorological tower. The existing onsite meteorological open-latticed tower is located approximately 1113 feet west-southwest of the Fermi 3 reactor containment building and has a height of 197 feet above plant grade. This location is within a distance that is less than 10 times the height of the Fermi 3 reactor building, and therefore does not fully meet the siting criteria of NRC Regulatory Guide 1.23. Accordingly, a new meteorological tower will be built prior to construction of Fermi 3. Subsection 6.4.1.1 describes the location of the new meteorological tower. The meteorological parameters specified in NRC Regulatory Guide 1.23 are measured by instrumentation mounted at two levels (10-m (33-ft) and 60-m (197-ft)) on the tower. The 10-m and 60-m elevations were selected to approximate the heights of release of activity emanating from ground level and the plant's heat dissipation system, respectively. The meteorological sensors are mounted on booms to minimize any impact to downwind measurements. The meteorological sensor types, heights, and location in reference to structures are in conformance with NRC Regulatory Guide 1.23, Revision 0, February 1972. The length of the boom complies with Revision 0 of Regulatory Guide 1.23; however, it does not comply with Regulatory Guide 1.23, Revision 1, March 2007, in that the length is less than twice the longest horizontal dimension. As described in Subsection 2.7.6 up to twelve years of meteorological data were used in the calculation of atmospheric dispersion estimates. This extensive data set provides assurance that the meteorological data used in the calculations accurately characterize the site, and that the calculated atmospheric dispersion estimates are appropriately conservative.

The influence of terrain near the base of the tower on temperature measurements is minimal. The tower is situated in a relatively flat area. A small climate-controlled instrument shelter is located at the base of the tower. The tower is situated in an area east of a grove of trees that is located less than ten times the obstruction height recommended in Regulatory Guide 1.23. Potential impact of the trees on the analysis is described in Subsection 6.4.1.6. The tower is located sufficiently close to the shoreline of Lake Erie such that it can measure the dynamic onshore flow conditions that could affect gaseous effluent releases. This effect on the dispersion conditions is representative of the site because the facility itself is located along the western shoreline of Lake Erie.

6.4.1.2 Instrumentation and Their Accuracies and Thresholds

Meteorological Sensors

The instrumentation on the meteorological tower consists of the following: wind speed and wind direction sensors at the 10-m and 60-m levels, a 10-m air temperature sensor, a 10-m to 60-m vertical air temperature difference system (ΔT), and a 10-m dewpoint temperature sensor. In addition, a heated tipping bucket rain gauge monitors precipitation at ground level at the base of the meteorological tower. Table 6.4-1 provides a listing of the meteorological parameters monitored on

the tower, the sampling height(s), as well as the sensing technique for the primary and secondary systems.

To minimize data loss due to ice storms, external heaters are installed on the primary wind sensors. The heaters are thermostatically controlled and are of the slip-on/slip-off design for easy attachment. The wind sensor specifications are not affected by these heaters. A windscreen is mounted around the precipitation gage to minimize the amount of windblown snow and debris deposited in the gage.

The accuracies and thresholds for the meteorological sensors located on the meteorological tower are presented in Table 6.4-2. The accuracies and thresholds for each sensor are within the limitations specified in the proposed Revision 1 to Regulatory Guide 1.23 (September 1980). The accuracy of the differential temperature channel does not comply with Regulatory Guide 1.23, Revision 1, March 2007. Revision 1 of Regulatory Guide 1.23 was issued during the final year of data collection to support the Fermi 3 COL application. The majority of the meteorological data, obtained from several years prior to 2007, were consistent with the regulatory guidance in effect at the time. As discussed in Subsection 2.7.6, up to twelve years of meteorological data were used in the calculation of atmospheric dispersion estimates. The tower is an open lattice construction. The open areas in between the support frames of the tower minimizes the area of impact to the sensors. The extensive data set and the open lattice design provides assurance that the meteorological data use din the calculations accurately characterize the site, and that the calculated atmospheric dispersion estimates are appropriately conservative.

Data Recording Equipment

After the data are collected by the sensors, the output is routed through signal conditioning equipment and then directed to digital data recorders. The digital recorders sample the data at least once very five seconds. The signal conditioning equipment and digital recorders are located at the base of the tower in the instrument shelter. An analog backup recorder also records the output from the sensors in the event that the primary digital recorder fails.

The accuracies for the primary and secondary recording devices are presented in Table 6.4-2.

Electrical power is supplied to the primary and secondary systems by independent power supplies. One source of power is Fermi 2; the other is an offsite source. If one supply fails, the other automatically supplies the necessary power for both systems. Two precautions are taken to minimize lightning damage to the system, two of the three legs of the tower are grounded and the signal cables are routed through a lightning protection panel. Each signal line is protected by transient protection diodes specifically designed to stay below the individual line voltage breakdown point.

6.4.1.3 **Instrument Calibration**

The sensors, electronics, and recording equipment are calibrated on a six month basis. More frequent onsite calibrations are performed if the past operating history of the sensor indicates it is necessary. Any necessary adjustments are made onsite and the equipment that malfunctioned is

either corrected onsite or replaced with similar spare equipment. After any adjustments or repairs, the calibration is repeated. Electronics calibrations are performed by simulating the output of each of the sensors with precision test equipment and monitoring the recorded values for each parameter. The resistance response to specified temperatures for the temperature thermistors is performed in the laboratory using calibrated measurement equipment. The calibrated temperature thermistor is then used to replace the existing sensor installed on the meteorological tower. The response of the calibrated temperature thermistor is then compared to an ambient temperature measurement taken at the sensor with a calibrated thermometer.

The dew point sensor is calibrated by comparing the result reported by the dew point sensor against the dew point measured by a calibrated, portable dew point hygrometer at the aspirator inlet.

The precipitation sensor is calibrated by comparing the result reported by the precipitation sensor to a known volume of liquid.

The calibration of the wind speed sensors is performed in a wind tunnel by an outside vendor using calibrated measurement equipment and a NIST Traceable Wind Tunnel Anemometer. In the wind tunnel the wind velocity is calibrated at specific points and the starting threshold is determined. The calibrated wind speed sensor is then used to replace the existing sensor installed on the meteorological tower.

The calibration of the wind direction sensor is performed by an outside vendor using calibrated measurement equipment. The calibration does not include a specific test of the starting threshold for wind direction. The starting threshold of the calibrated wind direction sensor is assessed at the time of installation by rotating the wind direction sensor body with the shaft in the horizontal plane and observing that the vane remains stationary. A new bearing is installed in the wind direction sensor if required. After installation of the new wind direction sensor, the directional alignment of the wind direction sensor is checked by sighting a known alignment point and comparing the result reported by the wind direction sensor to a known response. Examination of the 2003-2007 meteorological data indicates that there is variability in the wind direction measurements during periods when wind speed is less than 1 mph, providing reasonable assurance that the starting threshold for the wind direction sensors is equal to or less than 1 mph.

The records documenting results of calibrations, drift from calibrations, and corrective action taken for the digital instrumentation are kept and filed onsite.

6.4.1.4 **Instrument Service and Maintenance**

Visits are made periodically to the tower to make a visual inspection of the sensors, as well as the data output and recording equipment in the instrument shelter, to see if they are damaged and need maintenance. In the event the sensors or monitoring equipment is found damaged or malfunctioning, the equipment is replaced or corrected in a timely fashion. A stock of spare parts and equipment is maintained to minimize and shorten the periods of outages. Using the same precision test equipment used for calibration, the instrumentation is checked to ensure reliable operation. Records documenting results of major causes of instrument sensor outages and other

malfunctions of the meteorological monitoring system are kept and filed onsite. A similar inspection and maintenance program is in place for the computers and equipment located in the control room.

6.4.1.5 Data Reduction and Transmission

The pre-application meteorological monitoring program is composed of two independent meteorological trains of instrumentation – a primary train and a secondary train – mounted on the tower. Both trains feed the data acquisition equipment of the Integrated Plant Computer System (IPCS) located in the Fermi 2 Control Room. The IPCS has the capability to share the meteorological data with other plant computers, display the data on IPCS terminals at various plant locations, and perform plume dispersion analysis in support of Emergency Plan activities. Users can simultaneously access the meteorological data through two available dial-up lines located at the instrument shelter. The NRC can also receive selected meteorological data through the Emergency Response Data System (ERDS) interface on IPCS. The operational meteorological monitoring system is described in further detail in the following subsections and is illustrated in Figure 6.4-1.

Signal Conditioning and Data Reduction

Inside the instrument shelter, sensor signals are conditioned. Each sensor signal requires a single printed-circuit board to perform the necessary conversion, amplification, and scaling to provide a pair of analog outputs for each parameter. Zero and full-scale test switches are front-panel mounted on each printed-circuit board to facilitate parameter testing.

After conditioning through their respective printed-circuit boards, the 10-m horizontal wind direction and vertical wind speed signals pass into the Climatronics Standard Deviation Computer boards to compute the 15-minute average sigma theta and sigma phi.

The primary and secondary signal conditioner and standard deviation computer boards are independent of each other.

Data Transmission

The outputs of the instrument signal conditioning equipment are transmitted to the Control Room via two independent transmission lines. One line incorporates a phone line between the instrument shelter and the Nuclear Operations Center, where information is microwaved to the Office Service Building. From the Office Service Building, the signals are transmitted to the Control Room. The second line uses a separate phone line from the instrument shelter to the Nuclear Operations Center, where the data are transmitted to the Office Service Building via a phone line. From the Office Service Building, the signals are transmitted to the Fermi 2 Control Room. The two signals are electrically separated from one another from the tower to the control room. The instrumentation at the tower is electrically isolated from the equipment in the computer room of the Control Room.

6.4.1.6 Data Acquisition and Processing

The dual IPCS data acquisition multiplexers accept two trains of data from the meteorological system primary and secondary data acquisition equipment. These data are provided to the IPCS

computers to screen data for data validity and quality, perform meteorological calculations, update the data archive, display the information on the man-machine interface, and output the data to communication devices. The IPCS provides redundant computers that provide a main (Master) and backup (Slave) capability. The redundant computers in conjunction with the two trains of data acquisition provide two independent paths of data. The IPCS system monitors available error signals to determine equipment status. If an instrument input malfunctions, if data are suspect, or if an instrument input is manually removed from service, the IPCS will substitute the reading from the next level of redundancy as listed in Table 6.4-3 and indicate the substitution on the IPCS computers. In the event that a data path to IPCS is unavailable, a digital recorder is available on each train of instrumentation at the instrument shelter to archive the raw data. Meteorological data are generally reviewed each day to identify possible data problems. The meteorological data are also validated to ensure that the amount of data retained in the master record meets the regulatory requirements for minimum recovery rates as outlined in NRC Regulatory Guide 1.23. During the validation process the following steps are followed:

- Utilize software to review raw data
- Identify and edit questionable or invalid data
- Recover data from backup sources
- Adjust data to reflect calibration sources

After the validation process is completed, the processed data are archived and permanently stored electronically.

The objective for the meteorological monitoring program is to maintain data recovery rates of at least 90 percent on an annual basis for all meteorological parameters in order to assess the relative concentrations and doses resulting from accidental or routine releases. Table 6.4-4 provides recovery rates for the meteorological parameters monitored on the onsite meteorological tower. The recovery rates for each parameter, including the joint data recovery of wind speed, wind direction, and ΔT, exceed the 90 percent guidance criteria in NRC Regulatory Guide 1.23. The meteorological tower is located east of a grove of trees that is located less than ten times the obstruction height recommended in Regulatory Guide 1.23. The impact of the trees, for upwind sectors, is to reduce the indicated wind speed at the 10 meter elevation. Very little impact to the wind speed has been observed at the 60 meter elevation. The SACTI analysis (Section 5.3) uses the data from the 60 meter elevation and, thus, is not impacted by the presence of the trees. For determination of the atmospheric dispersion factors used in the analysis of off-site design basis accident (PAVAN) and Severe Accidents (MACCS2), using the lower indicated wind speed provides conservative results. For determination of atmospheric dispersion factors used in analysis of routine releases (XOQDOQ) the analyses were run using both the current data and the data from 1985-1989. Results based on both sets of data are reported in Subsection 2.7.6.2. Therefore, the onsite meteorological data are considered adequate to represent onsite meteorological conditions as required by 10 CFR 100.10 and 10 CFR 100.20, as well as to make estimates of atmospheric dispersion for design basis accident and routine releases from the reactor.

Meteorological data are available in five different formats: instantaneous values, 1-minute blocked averages, 15-minute rolling averages, 15-minute blocked averages, and 1-hour blocked averages. Routine data summaries are generated for each day, calendar month, and calendar year and then archived on the IPCS computers. In addition, joint frequency distributions of wind speed and wind direction for each Pasquill stability category are created from the 1-hour blocked averages. The format of the annual onsite meteorological data summaries and joint frequency distribution tables conforms to the recommended format found in NRC Regulatory Guide 1.23.

6.4.2 Fermi 3 Construction, Pre-Operational, and Operational Onsite Meteorological Monitoring Program

As described in Section 6.4 of NUREG-1555, the current meteorological program establishes a baseline for identifying and assessing the environmental impacts during preapplication meteorological monitoring. The NDCT for Fermi 3 will be built in the approximate location of the current onsite meteorological tower. Thus, a new meteorological tower will be erected in the southeast corner of the Fermi site prior to construction of Fermi 3. The new meteorological tower will be operational for at least one year and possibly two years prior to the decommissioning of the existing onsite meteorological tower. The meteorological data recorded concurrently from the current and new onsite meteorological towers will undergo a detailed analysis to ensure the meteorological parameters measured at the new meteorological tower are representative of the atmospheric conditions at the Fermi site. Actual and perceived data biases between the current and new meteorological towers will be documented and evaluated. The construction, pre-operational, and operational onsite meteorological monitoring program is described in greater detail in the following subsections.

6.4.2.1 Tower and Instrument Siting

The new meteorological tower will be a guyed open-latticed tower built to ANSI/TIA/EIA- 222-G standards and will have a height of 60 m (197 ft). The location of the new onsite meteorological tower in respect to the current onsite meteorological tower and Fermi 3 site layout is provided in Figure 2.1-4. Regulatory Guide 1.23 estimates that a meteorological tower located at least a distance of 10-building-heights horizontal distance downwind from a nearby structure will not have adverse wake effects exerted by the structure. The reactor building is located approximately 1450 m (4747 ft) north-northwest of the new onsite meteorological tower. The height of the reactor building is approximately 48.2 m (158 ft) above plant grade. Using the method suggested by Regulatory Guide 1.23 the zone of turbulent flow created by the reactor building will be limited to approximately 481.6 m (1580 ft). The 4-cell MDCT will be located approximately 1356 m (4449 ft) north-northwest of the new onsite meteorological tower. The height of the MDCT will be considerably lower than the reactor building, and will exert a smaller zone of turbulent flow. Therefore, the reactor building and MDCT are located at distances that will not produce adverse wake effects on the wind direction and speed measurements at the new meteorological tower.

Other structures near the location of the new meteorological tower include a NDCT and water tower. The NDCT is hyperbolically shaped and has a maximum width at the base of the tower, which has an outer diameter of 140.2 m (460 ft). The downwind wake zone for hyperbolically shaped and sloping structures is expected to be smaller than for structures that are square or

rectangular and have sharp edges. 40 CFR 51.100(ii)(3) defines good engineering practices (GEP) stack height as that which ensures that emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, or eddy effects created by the source itself, nearby structures, or nearby terrain features. "Nearby structures" is defined in 40 CFR 51.100(jj)(1) as that distance up to five times the lesser of the height or width dimension of a structure. Furthermore, the wake zone area becomes increasingly smaller as the height to width ratio of a structure increases (Reference 6.4-2). For the NDCT the lesser dimension is the width, which is the base width. Therefore, a conservative method to calculate the outermost boundary of influence exerted by the NDCT is to multiply the maximum width by five.

Using this method, with a maximum width of 140.2 m (460 ft) at the base of the tower, the downwind wake effect is estimated to extend 701.1 m (2300 ft) from the base of the NDCT. The NDCT is located approximately 1422 m (4665 ft) northwest of the new meteorological tower. Thus, the new meteorological tower is at a distance that will not be affected by the wake zone of the NDCT.

The water tower near the location of the new meteorological tower has a height of 44.2 m (144.9 ft) and a maximum width of approximately 16.2 m (53.3 ft) at the equator of the tank head. The tank head of the water tower structure is spherical and has a sloping surface and like the NDCT exerts a downwind wake zone that is conservatively estimated as five times the maximum width of the water tank head. Thus, for the water tower with a maximum width of 16.2 m (53.3 ft), the outermost boundary of influence exerted by the water tower is conservatively estimated to be 81 m (265.8 ft). The water tower is located approximately 153 m (502 ft) southwest of the new meteorological tower. Thus, the new meteorological tower is at a distance that will not be affected by the wake zone of the water tower.

Natural obstructions that can influence wind measurements near the new meteorological tower include trees that are taller than 5 m (16 ft). The area surrounding the location of the new meteorological tower contains trees that would influence wind measurements if left at their current height. However, prior to installing the new meteorological tower the trees will be trimmed to a height less than 5 m (16 ft) outwards to a distance that satisfies the 10-building-height distance of separation stated in Regulatory Guide 1.23.

NRC Regulatory Guide 1.23 indicates that ΔT should be measured at 10 m and 60 m, and if necessary at 10 m and a higher level that is representative of diffusion conditions from release points higher than 85 m (278.9 ft). The atmospheric release heights above plant grade for Fermi 3 are 52.6 m (172.6 ft) for the reactor building/fuel building stack, 71.3 m (233.9 ft) for the turbine building stack, and 18 m (59.1 ft) for the radwaste building stack. All release heights for Fermi 3 are below 85 m (278.9 ft); therefore, the new meteorological tower will have meteorological sensors located at 10 m and 60 m elevations to estimate dispersion conditions for ground-level and the plant's heat dissipation system. Wind sensors on the side of the tower will be mounted at a distance equal to at least twice the longest horizontal dimension of the tower (e.g., the side of a triangular tower). Temperature sensors will be oriented such that the aspirated temperature shields are either pointed downward or laterally towards the north and the shield inlet is at least 1-1/2 times the tower horizontal width away from the nearest point on the tower.

The influence of terrain near the base of the new meteorological tower on temperature measurements is expected to be minimal. The area surrounding the new meteorological tower will not be paved or contain temporary land disturbances, such as plowed fields or rock piles. In addition, the tower will be situated in a relatively flat area that will be at a similar elevation as the plant structures. A climate-controlled instrument shelter will be installed on a concrete slab at the base of the tower; however, materials that minimize influence on the measurements will be used to construct the shelter. The new meteorological tower will be built close to the shoreline of Lake Erie such that it can measure the dynamic onshore and offshore flow conditions within the thermal internal boundary layer. Fermi 2 and Fermi 3 are located at similar distances to the western shoreline of Lake Erie, such that measurements made at the new meteorological tower will be representative of atmospheric dispersion conditions that could affect gaseous effluent releases.

6.4.2.2 **Instrumentation**

Meteorological Sensors

The instrumentation on the new meteorological tower will consist of the following: wind speed and wind direction sensors at the 10 m and 60 m levels, a 10 m air temperature sensor, a 10 m to 60 m ΔT, and a 10 m dewpoint temperature sensor. To minimize data loss due to ice storms, external heaters will be installed on the primary wind sensors. The heaters will be thermostatically controlled and of the slip-on/slip-off design for easy attachment. The wind sensor specifications are not affected by these heaters. In addition, a heated tipping bucket rain gauge will be mounted at ground level on a concrete slab at the base of the meteorological tower away from any potential obstructions. A windscreen will be mounted around the precipitation gage to minimize the amount of windblown snow and debris deposited in the gage.

Redundant, secondary sensors at the 10 m and 60 m levels will also be installed on the new meteorological tower for air temperature, vertical wind speed, horizontal wind speed, and wind direction measurements. Table 6.4-1 provides a listing of the meteorological parameters that will be monitored on the new meteorological tower, the sampling height(s), as well as the sensing technique for the primary and secondary systems.

For the new meteorological tower the applicant intends to use meteorological instrumentation that matches the manufacturer and model numbers in use on the current meteorological tower. The accuracies and thresholds for each sensor on the new meteorological tower will be within the values specified in NRC Regulatory Guide 1.23, Revision 1, March 2007.

Data Recording Equipment

The data recording process planned for the new meteorological monitoring program will mirror the data recording process for the preapplication monitoring program as described in Subsection 6.4.1.2. For the new meteorological tower the applicant intends to use meteorological instrumentation that matches the manufacturer and model numbers in use on the current meteorological tower. One exception is that the signal conditioning equipment used for the current meteorological monitoring program is no longer available from the manufacturer. Therefore, the signal conditioning equipment for the new meteorological monitoring program will be replaced with

signal conditioning equipment that has accuracies that are equal or better than the accuracies listed for the current signal conditioning equipment.

Electrical power for the new meteorological monitoring program will continue to be supplied to the primary and secondary systems by independent power supplies. One source of power will be Fermi 2; the other will be an offsite source. If one supply fails, the other automatically supplies the necessary power for both systems. The new meteorological tower will be built with two precautions to minimize lightning damage to the system. Two of the three legs of the tower will be grounded and the signal cables will be routed through a lightning protection panel. Each signal line will be protected by transient protection diodes specifically designed to stay below the individual line voltage breakdown point.

6.4.2.3 Instrument Calibration, Service, and Maintenance

The instrument calibration, service, and maintenance procedures in place for the current meteorological monitoring program will continue for the new meteorological monitoring program. Subsection 6.4.1.3 provides a description of the instrument calibrations program, while Subsection 6.4.1.4 provides a description of the instrument service and maintenance program. System components that collect, transmit, process, record, and display the meteorological data will be inspected, calibrated, serviced, and maintained such that at least 90% data recovery is achieved for the new meteorological monitoring system.

6.4.2.4 Data Reduction, Transmission, Acquisition, and Processing

The method of data reduction, transmission, acquisition, and processing that is described in Subsections 6.4.1.5 and 6.4.1.6 for the preapplication monitoring program will be used for the construction, pre-operational, and operational monitoring programs.

6.4.3 References

6.4-1 Detroit Edison, “Fermi 2 Updated Final Safety Analysis Report,” Revision 14, November 2006

6.4-2 U.S. Environmental Protection Agency, “Guideline for Determination of Good Engineering Practice Stack Height, Technical Support Document for the Stack Height Regulations,” EPA-450/4-80-023, Revision, June 1985

Table 6.4-1 Meteorological Parameters Monitored at the Fermi Site

Parameter	Sampling Height (meters)	Sensing Technique
Primary Monitoring System		
Wind Speed	10 and 60	Cups/light chopper
Wind Direction	10 and 60	Vane/potentiometer
Vertical Wind Speed	10	Propeller
Differential Temperature	10 to 60	Matched thermistors
Ambient Temperature	10	Thermistor
Dewpoint	10	Lithium Chloride Type
Precipitation	1.5	Tipping bucket
Secondary Monitoring System		
Wind Speed	10 and 60	Cups/light chopper
Wind Direction	10 and 60	Vane/potentiometer
Vertical Wind Speed	10	Propeller/light chopper
Differential Temperature	10 to 60	Matched thermistors
Ambient Temperature	10	Thermistor

Source: Reference 6.4-1

Table 6.4-2 Accuracies and Thresholds for the Fermi Onsite Meteorological Monitoring Program Instruments

Equipment	Manufacturer and Model	Range	System Accuracy	Starting Threshold	Measurement Resolution
Wind Speed	Climatronics Model F460-100075	0 to 125 mph	0.15 mph	1.0 mph	0.1 mph
Wind Direction	Climatronics Model F460-100076	0° to 540°	±3.2 degree	1.0 mph	1.0 degree
Temperature	Omega OL-703 Linear Thermistor Probe	-22°F to 212°F	0.4°F	N/A	0.1°C
Dewpoint Temperature	Climatronics Model 101197	-22°F to 122°F	±2.7°F	N/A	0.1°C
Differential Temperature	N/A	N/A	0.15°C	N/A	0.01°C
Precipitation	Fisher & Porter Company Model 35-1559 EA10	0 to 19.5 inches	±0.1 in	N/A	0.01 in
Recorder	Thermo Westronics Model SV180	N/A	±0.05% of programmed range	N/A	0.006% of full scale

Table 6.4-3 Method for Substituting Redundant Parameters of the Critical Meteorological Measurements

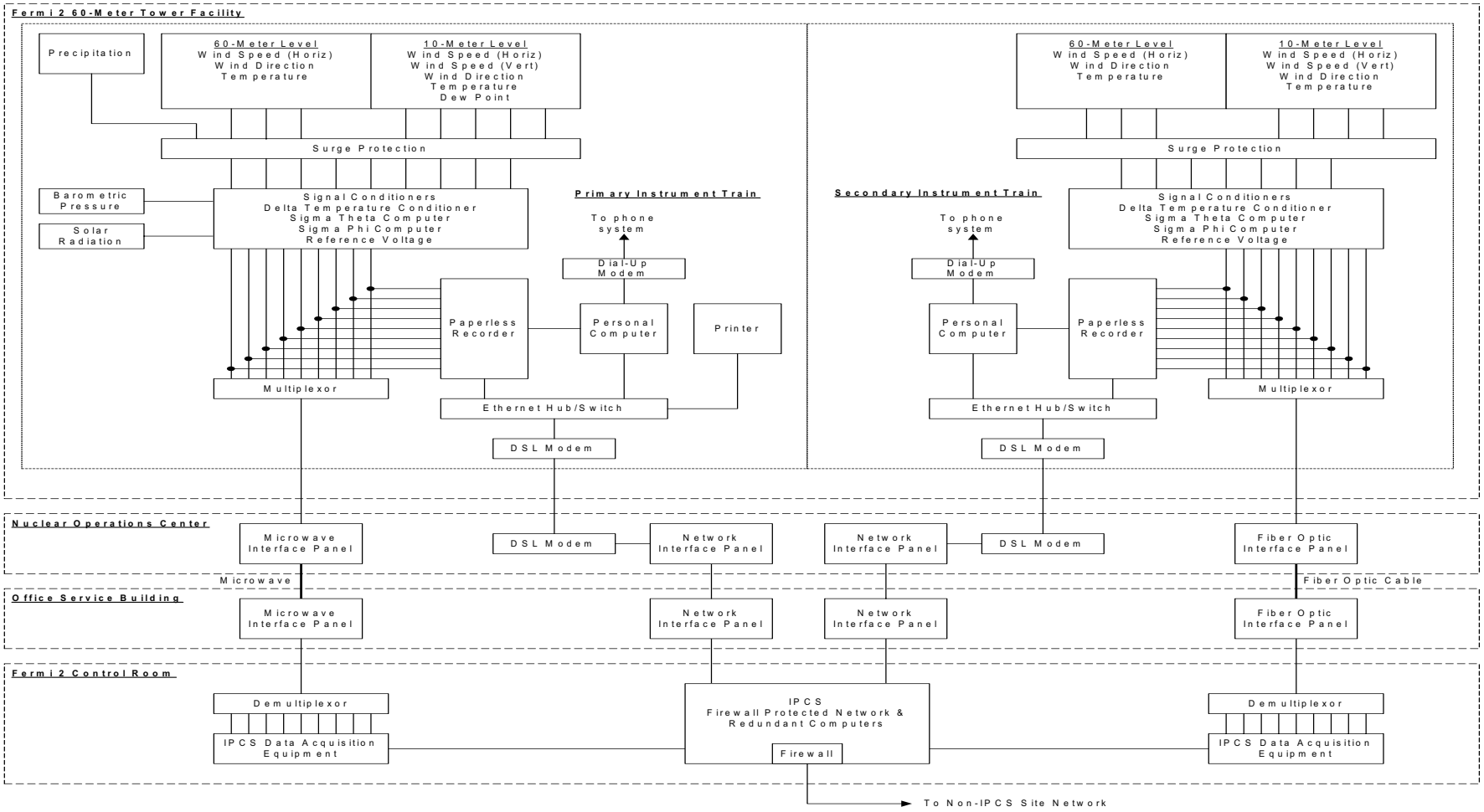
Level of Redundancy	10-meter Level Wind Speed	10-meter Level Wind Direction	Stability Indicator
0	Primary WS10	Primary WD10	Primary Delta
1	Secondary WS10	Secondary WD10	Secondary Delta
2			Primary Sigma theta
3			Secondary Sigma theta

Source: Reference 6.4-1

Table 6.4-4 Data Recovery Percentages for the Fermi Onsite Meteorological Monitoring Instruments During the 2003-2007 Time Period

Recorded Parameter	Recovery Percentages
Wind Speed	
10-m	97.93%
60-m	97.93%
Wind Direction	
10-m	98.14%
60-m	98.21%
Temperature	
10-m	98.54%
10-m to 60-m Difference (ΔT)	97.66%
Dewpoint	
10-m	96.29%
Precipitation	
Ground Level	94.57%

Figure 6.4-1 Process Flow Diagram of the Fermi Onsite Meteorological Monitoring Program



Source: Reference 6.4-1

6.5 Ecological Monitoring

The following subsections present information regarding ecological monitoring for terrestrial ecology and land use (Subsection 6.5.1), and aquatic ecology (Subsection 6.5.2) of the Fermi site. The discussion centers on areas likely to be affected by site preparation, construction, and operation of Fermi 3. The monitoring programs discussed are based on the environmental impacts anticipated during the various stages of project development.

Monitoring programs aimed at the detection of changes to the terrestrial and aquatic ecosystems began prior to the COL application submittal and will continue during site preparation, construction, and operation of Fermi 3. An evaluation of the standardization, adequacy, and accuracy of data collection and analytical methods used in the monitoring programs is included where appropriate.

6.5.1 Terrestrial Ecology and Land Use

The following subsections present information on monitoring programs for terrestrial ecology likely to be affected by site preparation, construction, or operation of Fermi 3. No specific land use monitoring is planned. The monitoring designs are based on anticipated environmental impacts through the various stages of project implementation.

Site features and land use are described in Subsection 2.2.1 and transmission corridors are described in Subsection 2.2.2. Subsection 2.4.1 describes the major plant communities, wildlife and important species, and habitats for the Fermi site and transmission corridors. Descriptions of potential impacts that may affect the existing conditions of the project area are addressed in Subsection 4.3.1.

6.5.1.1 Pre-Application Monitoring

Field studies were conducted on the Fermi site between the fourth quarter of 2006 and mid-2008 to determine the extent and condition of terrestrial communities and important habitats and the status of protected species present. The results of these monitoring activities are presented in Subsection 2.4.1, including a map showing the distribution of major plant communities (Figure 2.4-5). Note that the details of the type and frequency of these observations can be found in the individual reports for the field studies discussed in Subsection 2.4.1. Life history information is also discussed in Subsection 2.4.1. Potential terrestrial impacts associated with modifications from Fermi 3 development, including such items as the construction of the natural draft cooling tower, and parking and storage areas, to the existing terrestrial resources are described in Subsection 4.3.1.

Three state threatened species are known to occur on the Fermi site, American lotus, Eastern fox snake, and the bald eagle, as discussed in Subsection 2.4.1.2. The U.S. Fish and Wildlife Service (USFWS) conducts an annual monitoring of the Fermi site in late winter or early spring to determine whether bald eagles are utilizing any of the nests present on the site. No continuous monitoring is required or being conducted for American lotus or other terrestrial plants and animals on the site. No important species are known to occur in the offsite transmission corridors. Therefore, no pre-application monitoring is expected by ITC*Transmission* in association with the offsite transmission system.

Mitigation for unavoidable impacts to wetlands on the Fermi site will be prepared in consultation with the U.S. Army Corps of Engineers (USACE) and MDEQ pursuant to Federal and State guidelines in accordance with the Clean Water Act Section 404 Permit and Michigan Wetlands Protection Permit, respectively. Monitoring of mitigation success will be defined and implemented in the mitigation plan to be developed following the receipt of a Jurisdictional Determination of the wetlands present. No impacts to wetlands from offsite transmission activities are expected and no monitoring is anticipated to be performed by ITC*Transmission*.

The Detroit River International Wildlife Refuge (DRIWR) Lagoona Beach Unit is located completely within the Fermi site and encompasses approximately half of the site. The plant and animal attributes of the DRIWR are the same as described for the Fermi site in Subsection 2.4.1. No special monitoring is planned for the DRIWR.

6.5.1.2 Site Preparation, Construction and Pre-Operational Monitoring

Construction and pre-operational monitoring activities at this stage of the project relate to the protection of wetlands habitats, terrestrial habitats, and avian collisions associated with elevated construction equipment in work areas. The anticipated impacts to terrestrial resources are described in Subsection 4.3.1. No monitoring is anticipated with regard to offsite transmission system activities by ITC*Transmission* based on discussions in Subsection 4.3.1.5 and Subsection 5.6.1. The pre-operational phase is expected to be short, relative to the construction and operational phases. Therefore, the pre-operation phase is considered to be an extension of the construction phase.

The status of the bald eagle nesting on the Fermi site is expected to be monitored annually by the USFWS in late winter or early spring. The need for monitoring the eagles or restricting activities around the nesting areas during the nesting season will be determined through consultation with the MDNR and USFWS.

The American lotus will be subject to a construction mitigation strategy to be established through consultation with MDNR, as discussed in Subsection 4.3.1.2.1. Accordingly, the need for additional monitoring will be determined in concert with these consultations.

Protective activities to avoid the permanent loss of wetlands are expected to begin concurrently with the project construction. The form, extent of protective activities, and reporting methods will be determined in consultation with the USACE and MDEQ following the issuance of a Jurisdictional Determination of wetlands present on the site. Detroit Edison will be responsible for any monitoring program established in this regard. Wetland areas adjacent to the construction areas will be flagged as ‘no entry’ areas. Where entry is needed to wetlands in temporarily impacted areas, appropriate measures would be taken to avoid or minimize impacts, such as using mats for vehicle access to avoid rutting the ground and damage to vegetation. Wetlands and other terrestrial habitats will be protected by compliance and monitoring activities associated with the NPDES Stormwater Construction Permit, SESC Plan, and PIPP. The site work areas will be inspected during site preparation, construction and pre-operations periods on at least a weekly basis by environmental compliance personnel. The results of the inspections will be provided to project

management weekly and deficiencies addressed immediately. Such compliance is expected to diminish the potential for impacts to the terrestrial environment.

In accordance with baseline studies performed during the pre-application period discussed in Subsection 2.3.3 and Subsection 2.4.1 and consideration of impacts discussed in Subsection 4.3.1, no additional monitoring programs are proposed for the following:

- Bird collisions with plant structures, elevated construction equipment, cooling towers, and transmission structures
- Salt deposition impacts on vegetation and habitats

6.5.1.3 Operational Monitoring

American lotus monitoring will be established, as needed, through consultation with the MDNR, as discussed in Subsection 6.5.1.2.

It is expected that the USFWS will continue annual monitoring of the bald eagle. Accordingly, no monitoring by Detroit Edison is warranted.

The creation, restoration or enhancement of wetlands to mitigate for impacts to these resources is expected to be completed prior to the operational phase of the project. Monitoring the success of these activities will occur over a period of five years and this time period is expected to extend into the operational phase of the project. Mitigation monitoring sampling periods, methods, and success criteria will be established through the preparation of a wetland mitigation monitoring plan in consultation with the USACE and MDEQ during the wetlands permitting process.

No other required continuous monitoring programs are anticipated for terrestrial ecology resources.

6.5.2 Aquatic Ecology

The following subsection provides information regarding potential ecological monitoring for aquatic ecology likely to be affected by site preparation, construction, and operation of Fermi 3. The monitoring program throughout the various stages of project implementation has been designed based on anticipated environmental impacts that may potentially affect important aquatic species and habitats as described in Subsection 2.4.2.

The aquatic resources at the Fermi site and vicinity are described in Subsection 2.4.2. Impacts to aquatic resources from construction of Fermi 3 are described in Subsection 4.3.2. Impacts to aquatic resources from operation of the cooling system are described in Subsection 5.3.1.2 and Subsection 5.3.2.2. In summary, the only important aquatic habitat impacted by Fermi 3 construction and operation is portions of the DRIWR.

American lotus is the only important species that resides within the DRIWR. The monitoring program for the American lotus is discussed in Subsection 6.5.1.

6.5.2.1 Pre-Application Monitoring

This program includes evaluations and analysis made for the licensing and permitting of Fermi 2 and additional current and historical information gathered and reviewed for preparation of this Environmental Report. Pre-application monitoring consisted of evaluating historical Fermi 2 data, data collected and reported in Subsection 2.4.2, and Fermi 2 impingement and entrainment studies. Additional pre-application monitoring includes onsite biological surveys consisting of current Fermi 2 impingement and entrainment studies as described in Subsection 2.3.3, Subsection 2.4.1, and Subsection 2.4.2.

Collectively, these sources provided data describing the ecological resources existing on the Fermi site and in the vicinity. Sampling locations and methods are described in Subsection 2.4.2.

Fermi 2 Current Monitoring

Fermi 2 current monitoring includes the monitoring of chemicals used to control zebra mussel (*Dreissena polymorpha*) densities. As described in Subsection 2.4.2 and Subsection 4.3.2, the zebra mussel is a bio-fouling agent commonly known to clog intake and discharge components of cooling water make-up systems. The monitoring and control program prevents zebra mussel build-up in the intake clarifier and clarifier components of the cooling tower make-up water system. It is anticipated that this monitoring and control program will continue to be implemented in future Fermi NPDES permits.

Summary of Pre-Application Evaluations

The evaluations and surveys described in Subsection 2.4.2 provide established baseline data for the resources located on the Fermi site and in the vicinity to support evaluation of potential impacts, as outlined in Subsection 4.3.2, Subsection 5.3.1, and Subsection 5.3.2.

6.5.2.2 Site Preparation and Construction Monitoring

Site preparation and construction impacts to aquatic habitats (wetlands) are anticipated, as discussed in Subsection 4.3.1.2.2. A mitigation plan will be developed through consultation with the MDEQ and USACE. It is expected that BMPs and associated inspections will be implemented at all construction sites to prevent construction effluent (either planned or accidental) from entering aquatic resources on and near the Fermi site. Candidate BMPs include, but are not limited to, silt fencing and/or hay waddles around fill and soil refuse piles, tarp covers over fill and soil refuse piles when not actively in use, and silt fencing barriers along exterior perimeters of construction projects. An NPDES Stormwater Construction Permit, Soil Erosion and Sedimentation Control (SESC) Plan, and Pollution Incident Prevention Plan (PIPP) would detail measures ensure water quality, and thereby to protect aquatic resources. Proper functionality of BMPs and adherence to the NPDES Stormwater Construction Permit, SESC Plan, and PIPP would be monitored for construction activities at the Fermi site.

Additional aquatic resource monitoring is expected to be limited to the DRIWR, which is the only important aquatic habitat located onsite and in the vicinity. Limited biological surveys within the DRIWR will be considered.

6.5.2.3 Pre-Operational Monitoring

Discharged effluents would continue to be monitored and necessary parameters recorded continuously as established in existing and future NPDES permits. Such monitoring would ensure that cumulative effluents from the construction and operation of Fermi 3 would continue to meet permit standards. These parameters conform to Michigan water quality standards designed to prevent adverse impacts to environmental resources and protect important aquatic species.

6.5.2.4 Operational Monitoring

As discussed in Section 6.1, the MDEQ requires continuous monitoring/recording of discharge water temperature. NPDES permit monitoring/recording of the concentration of chemical constituents in waters discharged at all Fermi permitted outfalls is also required, as discussed in Section 6.6 (see Figure 5.3-1). It is expected that the existing Fermi 2 monitoring requirements will be similarly implemented for the operation of Fermi 3.

The operational monitoring program is anticipated to be a continuation of Fermi 2 operational programs described in Subsection 6.5.2.1 including the zebra mussel monitoring and control program. This is justified because the operational impacts to Lake Erie and the DRIWR are expected to be small. Moreover, with respect to Lake Erie, the previous Fermi 2 fish impingement and entrapment studies did not underscore a need for an operational Fermi 2 monitoring program on Lake Erie. Because the Fermi 3 intake design is comparable to Fermi 2 from the standpoint of fish impingement and entrapment potential, there is similarly no need for an ongoing Fermi 3 operational monitoring program.

6.5.3 References

None.

6.6 Chemical Monitoring

This section describes the chemical monitoring programs to control and minimize adverse impacts to water quality (to surface water and groundwater sources) as a result of the construction and operation of Fermi 3. The NPDES application and permit issuance for wastewater discharges associated with Fermi 3 is not required until a time period closer to the beginning of the construction of Fermi 3. This section describes anticipated water quality monitoring program activities in four phases – pre-application monitoring, construction monitoring, pre-operational monitoring, and operational monitoring. The operational chemical monitoring program for Fermi 3 will be developed in consultation with the MDEQ during the Fermi 3 NPDES permitting process and it is anticipated that the requirements under the modified NPDES permit will be similar to Fermi 2 operational requirements. Each monitoring program will be designed to build upon the methodology and data acquired from the previous program(s) phase. Data collection requirements in each successive monitoring program phase will be based on potential changes in parameters from previous monitoring activities, and the identified need to continue the monitoring program.

As described in other subsections, including Subsection 2.3.3, Subsection 3.6.1, and Subsection 5.2.2, Fermi 2 uses relatively small quantities of chemicals during operations. Existing monitoring programs have demonstrated no significant impacts to Lake Erie or Swan Creek from discharges associated with Fermi 2 operation. Fermi 3 is designed to also use relatively small quantities of chemicals, with similar, anticipated insignificant impacts from discharges associated with the addition of the Fermi 3 operation. The discharges of combined Fermi 2 and Fermi 3 will be regulated by a new or amended NPDES discharge permit, including NRC licensing requirements. The NPDES permit conditions, limitations, and monitoring requirements are expected to be consistent with and similar to those currently in the Fermi 2 NPDES permit.

This section focuses on the potential impacts to Lake Erie and Swan Creek from the construction and operation of Fermi 3. The permitted discharges from the Fermi 3 cooling water, process water, and storm water runoff will be directed to these water bodies. Potential spills or non-routine releases of chemicals are associated with the same surface discharge systems in place for Fermi 2 and ultimately flow toward Lake Erie and Swan Creek. Quantitative data on chemical characteristics of surface water and groundwater at and in the vicinity, including seasonal ranges, averages, and historical extremes, are presented in Subsection 2.3.3.

6.6.1 Pre-Application Monitoring

The purpose of the pre-application monitoring program is to generate a baseline to support the assessment of potential impacts that may result from the construction and operation of Fermi 3. The pre-application monitoring for Fermi 3 primarily consisted of utilizing new and historic data from ongoing Fermi 2 monitoring programs, data collected at various locations in Lake Erie and other water bodies in the vicinity obtained from U.S. EPA's Great Lakes Environmental Database (GLENDA) and STORET database, MDEQ databases, the USGS National Water Information System (NWIS) database (refer to Subsection 2.3.3), surface water and groundwater samples collected in August 2007 in the vicinity, and existing groundwater monitoring programs. Data from these monitoring programs is used to document existing water quality conditions and to support

water quality descriptions provided in Section 2.3, demonstrating the suitability of the Fermi site for the development of Fermi 3.

Fermi 2 is subject to permit limits and conditions and is required to conduct discharge monitoring and obtain flow measurements in accordance with NPDES Permit No. MI0037028 issued by the MDEQ on September 30, 2005 (Reference 6.6-2). This permit expires October 1, 2009. The Fermi 2 NPDES permit requires monitoring at four external outfall locations (see Figure 2.3-47). Monitoring is conducted as follows:

- Outfall 001, Lake Erie - cooling tower blowdown, processed radwaste wastewater, chemical metal cleaning wastes, non-chemical metal cleaning wastes, and residual heat removal system service water excess to Lake Erie. Monitored parameters include flow, temperature (intake and discharge), total residual chlorine, dechlorination reagent, BetzDearborn Spectrus CT-1300 (a zebra mussel control additive), total mercury (intake, discharge, and net discharge), pH, total suspended solids, oil and grease, total copper, and total iron.
- Outfall 009, Swan Creek via an overflow canal - low volume wastes, chemical metal cleaning wastes and non-chemical metal cleaning wastes, and storm water runoff to Swan Creek via an overflow canal. Monitored parameters include flow, total suspended solids, oil and grease, total copper, total iron, total boron, total residual chlorine, dechlorination reagent, and pH.
- Outfall 011, Swan Creek via an overflow canal - oily waste treatment water, service water screen backwash, and storm water runoff to Swan Creek via an overflow canal. Monitored parameters include flow, total mercury, total selenium, pH, total suspended solids, and oil and grease.
- Outfall 013, Lake Erie - settled water from a basin storing material dredged from Lake Erie. Monitored parameters include flow, total suspended solids (intake, discharge, net discharge), and pH.

The existing discharge sampling and monitoring requirements established in the Fermi 2 NPDES permit, including the discharge streams to be sampled, monitored sampling points, constituents to be monitored or sampled, frequency of sampling, type (method) of sample collection (e.g., grab or composite), and time period of required monitoring are listed in Table 6.6-1. The Fermi 2 NPDES permit is used in this section to provide examples of Fermi 3 waste streams that may require monitoring. The waste streams listed above are expected to be representative of Fermi 3 waste streams that will be authorized for discharge under a new/amended permit.

The monitoring and analysis methods for Fermi 2, as required in the Fermi 2 NPDES Permit are performed using EPA or MDEQ approved methods with corresponding quality assurance procedures. The type of monitoring, frequency of testing, quality control, statistical interpretation of results and related quality/adequacy issues are based upon EPA and MDEQ environmental protection regulations, permitting policies, and watershed protection programs that have been incorporated in the NPDES program (Reference 6.6-1, Reference 6.6-3, and Reference 6.6-4).

Automated systems used for Fermi 2 sampling that require instantaneous and totalized monitoring (e.g., flow) and recorder monitoring (e.g., total residual chlorine and temperature) are maintained and calibrated in accordance with the equipment manufacturer's instructions to verify and ensure accuracy.

Analysis of Fermi 2 samples for constituents that are not monitored using automated systems may be performed by Detroit Edison or an independent third-party laboratory. Detroit Edison and the independent third-party laboratory comply with the necessary sampling, sampling preservation methods, analytical methods, data quality objectives, quality assurance procedures, quality control methods, and statistical methods to interpret analytical results in accordance with 40 CFR 136.

As described in Subsection 2.3.3, based on the Fermi 1 and 2 monitoring results to date, no discernible adverse impacts to groundwater quality have been detected. Groundwater sampling for a variety of physical and chemical parameters was conducted in August 2007. The results are summarized in Table 2.3-63 through Table 2.3-66.

In addition to the data presented in the paragraphs above, as discussed in Subsection 2.3.3, two surface water samples were collected in the vicinity of the Fermi site in August 2007. One sample was collected from the canal that discharges to Swan Creek and one sample was collected from Lake Erie near the plant gauging station. These data are provided in Table 2.3-43. The sampling locations are identified in Figure 2.3-57. Data from onsite wells sampled in August 2007 are presented in Table 2.3-63 through Table 2.3-66. The surface water and groundwater sampling locations are identified in Figure 2.3-57. Field testing recorded groundwater quality parameters; collected groundwater level measurements; and collected and analyzed surface water samples and groundwater samples from existing groundwater monitoring wells. Appropriate sampling procedures and quality assurance/quality control measures were used.

Sufficient and adequate data to accomplish the goals of the monitoring programs will be demonstrated by compliance with the NPDES permit and NRC requirements. The available water quality data (as shown in Subsection 2.3.3) is adequate to describe and establish the baseline conditions in the Lake Erie and Swan Creek water and groundwater at the site, with respect to chemical parameters monitored. Subsection 2.3.2 describes water use in the area, and Section 3.3 describes water use within the Fermi site.

6.6.2 Construction Monitoring

Coverage under the NPDES Stormwater Construction Permit may require an additional construction monitoring program to be instituted for the construction activities associated with Fermi 3 to assess water quality changes resulting from construction. Before the Fermi 3 construction activities are authorized under the NPDES Stormwater Construction Permit, a Soil Erosion and Sedimentation Control (SESC) Plan and Pollution Incident Prevention Plan (PIPP) must be developed, as described in Subsection 4.2.1. However, it is not anticipated that a water quality sampling program would be required.

Construction impacts are reduced through development and implementation of the site-specific SESC Plan and PIPP. Inspections will be periodically performed to ensure that the control measures in these plans are installed and maintained.

6.6.3 Pre-Operational Monitoring

Additional pre-operational water quality monitoring is not anticipated to be necessary. The pre-application data provides an adequate water-quality baseline; however, if required by the NRC or MDEQ, Detroit Edison could conduct additional monitoring to establish a baseline for identifying and assessing environmental impacts resulting from plant operation. Data from ongoing monitoring programs for Fermi 2, and data collected during any pre-application monitoring would be evaluated and used as appropriate. The pre-operational monitoring program would be an extension of the existing, continuing water quality and discharge monitoring programs.

6.6.4 Operational Monitoring

Operational monitoring would be used to establish the impacts of operation of Fermi 2 and Fermi 3 and detect any unexpected impacts arising from operation. This monitoring would be utilized to evaluate the potential impact of chemical waste discharges on water quality, and to assess the potential impact associated with alteration of chemical and sediment transport during operation of Fermi 3. The effectiveness of effluent treatment and control systems would be assessed as a part of the monitoring program, providing the ability to predict failures in or reductions of effectiveness of these systems.

Sampling locations, parameter analyses, frequency and intensity of the sampling required, sampling equipment and number of samples, statistical reliability, and quality assurance programs would meet NPDES permit criteria applicable at the time of operation. The quality and quantity of the waste streams are expected to be very similar to the existing monitoring conducted for Fermi 2 as described above and as summarized in Table 6.6-1, including the potential for radioactivity release as discussed above and in Section 5.4 and Section 5.5.

As stated in Subsection 6.6.1, Fermi 2 is subject to permit limits and conditions and is required to conduct discharge monitoring and obtain flow measurements in accordance with NPDES Permit No. MI0037028. The Fermi 2 NPDES permit is used in this section to provide examples of Fermi 3 waste streams that may require monitoring. The composition of combined waste streams and discharges from Fermi 2 and Fermi 3 are expected to be similar based upon anticipated Fermi 3 design and operating conditions, and monitoring requirements are also expected to be similar to those in the existing NPDES permit. Table 6.6-2 lists expected Fermi 3 waste streams and monitoring requirements. The current Fermi 2 NPDES permit requires monitoring at four external outfall locations which are described above in the pre-application monitoring section. Specific monitoring points may change due to discharge configuration and/or site grading modifications that may alter or add discharge point locations or storm water runoff drainage systems.

The monitoring and analysis methods for Fermi 2, as required in the current NPDES permit are performed using EPA or MDEQ approved methods with corresponding quality assurance procedures. These methods will also be used for Fermi 3. The type of monitoring, frequency of

testing, quality control, interpretation of results, calibration standards/accuracy verification, and related quality/adequacy issues for Fermi 3 will be based upon EPA and MDEQ environmental protection regulations, permitting policies, and watershed protection programs that have been incorporated in the NPDES program (Reference 6.6-1, Reference 6.6-3, and Reference 6.6-4).

Automated systems used for Fermi 3 sampling that require instantaneous and totalized monitoring (e.g., flow) and recorder monitoring (e.g., total residual chlorine and temperature), as with those automated systems used for Fermi 2, will be maintained and calibrated in accordance with the equipment manufacturer's instructions to verify and ensure accuracy. Analysis of Fermi 3 samples for constituents that are not monitored using automated systems may be performed by Detroit Edison or an independent third-party laboratory. Detroit Edison and the independent third-party laboratory will comply with the necessary sampling, sampling preservation methods, analytical methods, data quality objectives, quality assurance procedures, quality control methods, and statistical methods to interpret analytical results in accordance with 40 CFR 136.

The potential for the release of radioactivity at Fermi 3 will be monitored as it is for Fermi 2 in compliance with the NRC license and NRC regulations. It is expected that the aquatic monitoring program for Fermi 2 and Fermi 3 will consist of sampling raw municipal drinking water, surface water**,** lake sediments and fish for radioactivity. Groundwater samples will also continue to be collected and analyzed (see Section 6.3). The details of this monitoring program and the quality assurance program are discussed in Subsection 6.6.1 and Subsection 5.5.2.

The design and operations of Fermi 2 present minimal chances of impact to groundwater quality and, similarly, no impacts are expected from operations of Fermi 3. This is due to design and implementation of aspects and safeguards such as limited storage and use of chemicals and other potential pollutants, process operations and materials storage in sealed buildings, and an active spill prevention/storm water pollution prevention program.

Fermi 2 maintains records of the use of such chemical additives as coagulants, flocculants, biocides, corrosion inhibitors, dechlorination chemicals and related materials used in cooling and process waters in accordance with the NPDES permit. Additives may not be discharged without approval from the MDEQ. Similar use of these materials with documentation of usage is expected for Fermi 3. Section 3.6 provides additional information related to the chemical usage at Fermi 2 and that planned for Fermi 3.

Sufficient and adequate data to accomplish the goals of the monitoring programs will be demonstrated by compliance with the NPDES permit as described in Section 5.2. The available water quality data (as shown in Subsection 2.3.3) is adequate to describe and establish the baseline conditions in the Lake Erie and Swan Creek water and groundwater at the site, with respect to chemical parameters monitored. Subsection 2.3.2 describes water use in the area, and Section 3.3 describes water use for Fermi 3.

The following subsections provide additional information:

- Subsection 3.3.1 discusses plant water use and includes water consumption by the various cooling systems and the discharges from these systems.

- Subsection 3.3.2 discusses methods of water treatment used in the plant.
- Subsection 3.3.2.1, Subsection 3.3.2.2, and Subsection 3.3.2.3, respectively, discuss the chemicals that are injected into the station water system, the circulating water system, and the plant service water system.
- Table 3.6-1 and Table 3.6-2 list those chemicals currently used and the effluent chemical concentrations within the waste streams discharged from the facility. Figure 3.3-1 provides estimates of water use.
- Subsection 3.5.2.1 discusses the liquid radioactive waste management system.
- Section 3.6 addresses nonradioactive waste systems. Table 3.6-1 lists each chemical and biocide added to the receiving water by the discharge stream.

6.6.5 References

6.6-1 U.S. Environmental Protection Agency, “Guidelines for Establishing Test Procedures for the Analysis of Pollutants,” 40 CFR 136.

6.6-2 Michigan Department of Environmental Quality, “NPDES Permit No. MI0037028, Detroit Edison Company, Fermi 2 Power Plant,” 2005.

6.6-3 Michigan Department of Environmental Quality, Water Bureau, “Water Resources Protection, Part 8, Water Quality-Based Effluent Limit Development for Toxic Substances.”

6.6-4 Michigan Department of Environmental Quality, Water Bureau, “Water Resources Protection, Part 21, Wastewater Discharge Permits.”

Table 6.6-1 Surface Water Quality Monitoring Program Information from Fermi 2 NPDES Permit No. MI0037028 (Sheet 1 of 3)

Monitoring Point	Flow Limit	Constituents	Units	Monitoring Frequency	Sample Type
Monitoring Point 001A: Discharge through Outfall 001 to Lake Erie	45.1 MGD of cooling tower blowdown, processed radwaste wastewater, and chemical metal cleaning wastes and non-chemical metal cleaning wastes	Flow	MGD	Daily	Report Total Daily Flow
		Temperature			
		Intake	°F	Daily	Reading
		Discharge	°F	Daily	Reading
		Total Residual Chlorine	ug/l	5 X Weekly	Grab
		Dechlorination Reagent	lbs/day	Daily	Calculation
		BetzDearborn Spectrus CT-1300	ug/l	During Discharge	Grab
		Total Mercury			
		Intake	ng/l	Monthly	Grab
		Discharge	ng/l	Monthly	Grab
		Net Discharge	ng/l	Monthly	Calculation
		Outfall Observation		Daily	Visual
		pH	s.u.	Weekly	Grab
Monitoring Point 001B: Discharge through Outfall 001 to Lake Erie	1.44 MGD of residual heat removal system service water	Flow	MGD	Daily	Grab
		BetzDearborn Spectrus CT-1300	ug/l	During Discharge	Grab
Monitoring Point 001D: Discharge through Outfall 001 to Lake Erie	0.216 MGD of processed radwaste wastewater	Flow	MGD	Daily per occurrence	Grab
		Total Suspended Solids	mg/l	Weekly per occurrence	Grab
		Oil and Grease	mg/l	2 X Monthly per occurrence	Grab

Table 6.6-1 Surface Water Quality Monitoring Program Information from Fermi 2 NPDES Permit No. MI0037028 (Sheet 2 of 3)

Monitoring Point	Flow Limit	Constituents	Units	Monitoring Frequency	Sample Type
Monitoring Point 001E: Discharge through Outfall 001 to Lake Erie	0.5 MGD of treated chemical metal cleaning wastes and non-chemical metal cleaning wastes	Flow	MGD	Daily per occurrence	Grab
		Total Suspended Solids	mg/l	Weekly per occurrence	Grab
		Oil and Grease	mg/l	2 X Monthly per occurrence	Grab
		Total Copper	mg/l	Daily per occurrence	Grab
		Total Iron	mg/l	Daily per occurrence	Grab
Monitoring Outfall 009A: Discharges to Swan Creek via an overflow canal	0.72 MGD of low volume wastes, chemical metal cleaning wastes and non-chemical metal cleaning wastes and an unspecified amount of storm water runoff	Flow	MGD	Daily	Report Total Daily Flow
		Total Suspended Solids	mg/l	Daily	Grab
		Oil and Grease	mg/l	Daily	Grab
		Total Copper	ug/l	Daily	Grab Composite
		Total Iron	mg/l	Daily during discharge of metal cleaning wastes	Grab Composite
		Total Boron	ug/l	Daily	Grab Composite
		Total Residual Chlorine	ug/l	Required only if a discharge occurs within one week of chlorine application	Grab
		Dechlorination Reagent	lbs/day	Daily	Calculation
		Outfall Observation		Daily	Visual
		pH	s.u.	Daily	Grab

Table 6.6-1 Surface Water Quality Monitoring Program Information from Fermi 2 NPDES Permit No. MI0037028 (Sheet 3 of 3)

Monitoring Point	Flow Limit	Constituents	Units	Monitoring Frequency	Sample Type
Monitoring Outfall 011A: Discharges to Swan Creek via an overflow canal	1.8 MGD of oily waste treatment water, service water screen back wash and an unspecified amount of storm water runoff	Flow	MGD	Daily	Report Total Daily Flow
		Total Mercury	lbs/day, ng/l	Monthly	Grab
		Total Selenium	ug/l	Quarterly	24-hr Composite
		Outfall Observation		Daily	Visual
		pH	s.u.	Daily	Grab
Monitoring Outfall 011C: Discharges to Swan Creek via an overflow canal	0.216 MGD of treated oily wastewater	Flow	MGD	Weekly	Report Total Daily Flow
		Total Suspended Solids	mg/l	Weekly	Grab
		Oil and Grease	mg/l	2 X Monthly	Grab
Monitoring Outfall 013A: Outfall 013 discharges to Lake Erie	450 MGY of settled water from dredged material storage basin storing material dredged from Lake Erie	Flow	MGD	Daily	Report Total Daily Flow
		Total Suspended Solids			
		Intake	mg/l	Daily	Grab
		Discharge	mg/l	Daily	Grab
		Net Discharge	mg/l	Daily	Grab
		Outfall Observation		Daily	Visual
		pH	s.u.	Daily	Grab

Source: Reference 6.6-2

Table 6.6-2 Anticipated Fermi 3 Surface Water Quality Monitoring Program Derived from Fermi 2 NPDES Permit No. MI0037028 Requirements (Sheet 1 of 3)

Monitoring Point	Constituents	Units	Monitoring Frequency	Sample Type
Proposed Monitoring Point: Discharge through Outfall to Lake Erie – Cooling Tower blowdown, Plant Service Water blowdown	Flow	MGD	Daily	Report Total Daily Flow
	Temperature			
	Intake	°F	Daily	Reading
	Discharge	°F	Daily	Reading
	Total Residual Chlorine	ug/l	5 X Weekly	Grab
	Dechlorination Reagent	lbs/day	Daily	Calculation
	BetzDearborn Spectrus CT-1300	ug/l	During Discharge	Grab
	Total Mercury			
	Intake	ng/l	Monthly	Grab
	Discharge	ng/l	Monthly	Grab
	Net Discharge	ng/l	Monthly	Calculation
	Outfall Observation		Daily	Visual
	pH	s.u.	Weekly	Grab
Proposed Monitoring Point: Discharge through Outfall to Lake Erie – Processed Radwaste wastewater	Flow	MGD	Daily per occurrence	Report Total Daily Flow
	Total Suspended Solids	mg/l	Weekly per occurrence	Grab
	Oil and Grease	mg/l	2 X Monthly per occurrence	Grab

Table 6.6-2 Anticipated Fermi 3 Surface Water Quality Monitoring Program Derived from Fermi 2 NPDES Permit No. MI0037028 Requirements (Sheet 2 of 3)

Monitoring Point	Constituents	Units	Monitoring Frequency	Sample Type
Proposed Monitoring Point: Discharge through Outfall to Lake Erie – Treated chemical metal cleaning wastes and non-chemical metal cleaning wastes	Flow	MGD	Daily per occurrence	Report Total Daily Flow
	Total Suspended Solids	mg/l	Weekly per occurrence	Grab
	Oil and Grease	mg/l	2 X Monthly per occurrence	Grab
	Total Copper	mg/l	Daily per occurrence	Grab
	Total Iron	mg/l	Daily per occurrence	Grab
Proposed Monitoring Outfall Discharges to Swan Creek via an overflow canal – Low volume wastes, chemical metal cleaning wastes and non-chemical metal cleaning wastes and an unspecified amount of storm water runoff	Flow	MGD	Daily	Report Total Daily Flow
	Total Suspended Solids	mg/l	Daily	Grab
	Oil and Grease	mg/l	Daily	Grab
	Total Copper	ug/l	Daily	Grab Composite
	Total Iron	mg/l	Daily during discharge of metal cleaning wastes	Grab Composite
	Total Boron	ug/l	Daily	Grab Composite
	Total Residual Chlorine	ug/l	Required only if a discharge occurs within one week of chlorine application	Grab
	Dechlorination Reagent	lbs/day	Daily	Calculation
	Outfall Observation		Daily	Visual
	pH	s.u.	Daily	Grab

Table 6.6-2 Anticipated Fermi 3 Surface Water Quality Monitoring Program Derived from Fermi 2 NPDES Permit No. MI0037028 Requirements (Sheet 3 of 3)

Monitoring Point	Constituents	Units	Monitoring Frequency	Sample Type
Proposed Monitoring Outfall Discharges to Swan Creek via an overflow canal – Oily waste treatment water, storm water runoff	Flow	MGD	Daily	Report Total Daily Flow
	Total Mercury	lbs/day, ng/l	Monthly	Grab
	Total Selenium	ug/l	Quarterly	24-hr Composite
	Outfall Observation		Daily	Visual
	pH	s.u.	Daily	Grab
Proposed Monitoring Outfall Discharges to Swan Creek via an overflow canal – Treated oily wastewater	Flow	MGD	Weekly	Report Total Daily Flow
	Total Suspended Solids	mg/l	Weekly	Grab
	Oil and Grease	mg/l	2 X Monthly	Grab

6.7 Summary of Monitoring Programs

This section reviews and summarizes the requirements of the various Fermi 3 site monitoring programs. Six specific areas of monitoring were discussed in previous sections as follows:

- Section 6.1 Thermal Monitoring Program
- Section 6.2 Radiological Monitoring Program
- Section 6.3 Hydrological Monitoring Program
- Section 6.4 Meteorological Monitoring Program
- Section 6.5 Ecological Monitoring Program (Terrestrial and Aquatic Ecosystems)
- Section 6.6 Chemical Monitoring Program

In addition to monitoring programs discussed in Section 6.1 through Section 6.6, noise monitoring was discussed in Section 5.8 and is included in this summary. Refer to Table 6.7-1 through Table 6.7-8 for summaries of the monitoring programs listed above, as well as the Noise Monitoring Program.

The summary tables presented in this section are current monitoring actions for four phases of construction and operation: (1) pre-application monitoring; (2) site preparation and construction monitoring; (3) pre-operational monitoring; and (4) operational monitoring. These phases are described in more detail in Subsection 6.7.1 through Subsection 6.7.4.

6.7.1 Pre-Application Monitoring

This program provided baseline data for the Fermi 3 site to support environmental descriptions and assessment of site environmental suitability throughout this Environmental Report. Fermi 3 pre-application monitoring includes monitoring at the site in preparation for Fermi 3 COL preparation and Fermi 2 operational monitoring.

6.7.2 Site Preparation and Construction Monitoring

Site preparation and construction monitoring is used when specific adverse impacts from site preparation and construction are predicted. The purpose of this monitoring program is to provide data necessary to assess impacts from the construction of Fermi 3. This monitoring includes additional pre-construction monitoring when necessary to establish a baseline. The duration of sampling for each parameter is appropriate to the period of expected change. Data is collected at defined locations, times, and frequencies such that subsequent data collected can be compared, and construction impacts assessed and mitigated as required.

6.7.3 Pre-Operational Monitoring

The purpose of this monitoring program is to provide baseline data such that the later operational monitoring program can detect impacts resulting from continued operation of a new facility. It is anticipated that this monitoring would be consistent with existing Fermi 2 monitoring programs, and would include a logical extension of the pre-application and site preparation and construction monitoring programs, as appropriate.

6.7.4 **Operational Monitoring**

The purpose of the operational monitoring program is to identify and assess the magnitude of impacts from continued Fermi 3 operation during its service life. This information is also used to assess the effectiveness of waste treatment systems, assess the quality of effluents, and to provide real time warnings of any failures in effluent treatment systems. Operational monitoring programs are primarily constrained by the permit requirements for operation of a new facility, such as the NPDES permit for wastewater discharges.

Future regulatory requirements or agency consultations could cause revisions to existing Fermi 2 and potential Fermi 3 operational monitoring programs. Specifications for Fermi 3 monitoring will be established before Fermi 3 operation and will be refined based on operational experience with Fermi 3.

6.7.5 **References**

None.

Table 6.7-1 Thermal Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application	Discharge Temperature Measurements - NPDES requires thermal monitoring of plant discharges into Lake Erie from Outfall 001	Continuous	MDEQ Fermi 2 NPDES permit
	Lake Erie Temperature Monitoring - Fermi primarily uses the data collected on an ongoing basis by the NOAA LEOFS for a point approximately 2 km east of Fermi.	Continuous	MDEQ Fermi 2 NPDES permit
Site Preparation and Construction Monitoring	Site preparation and construction monitoring will be a continuation of the pre-application program, as required by the MDEQ for Fermi 2.	Continuous	MDEQ General construction NPDES permit
Pre-Operational	Pre-operational monitoring will be a continuation of the pre-application program, as required by the MDEQ for Fermi 2.	Continuous	MDEQ General construction NPDES permit
Operational	Fermi 3 will use a natural draft cooling tower. Thermal monitoring will be performed at the outfall discharge structure for Fermi 3 and will comply with the requirements of the Fermi 3 NPDES permit. The discharge temperature for both Fermi 2 and Fermi 3 will be monitored on a continuous basis in accordance with the NPDES permits. The monitoring activities conducted by NOAA and in association with the NPDES permit by the MDEQ are extensive and complete; additional monitoring of thermal effluents is not warranted for Fermi 2 and Fermi 3. The location of the Fermi 3 thermal monitoring station is assumed to be near the Fermi 3 intake structure.	Continuous	MDEQ Fermi 3 NPDES permit

Table 6.7-2 Radiological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application (Fermi 2 REMP)	Airborne: 1. Radioiodine (I-131) 2. Air particulates a. Gross beta radiation b. Gamma radiation	1. Weekly 2a. After filter change 2b. Quarterly	NRC
	Direct Radiation: 1. TLDs a. mR exposure	1. Quarterly	NRC
	Waterborne: 1. Surface Water Sample a. Gamma isotopic and Sr 89/90 b. Tritium 2. Groundwater Sample a. Gamma isotopic and tritium 3. Sediment Sample a. Gamma isotopic and Sr 89/90	1a. Monthly 1b. Quarterly based on combined monthly samples (1a) 2. Quarterly 3. Semiannually	NRC
	Ingestion: 1. Milk Sample (Land Use Census) a. Gamma isotopic, Sr 89/90, and I-131 2. Garden Sample (Land Use Census) a. Gamma isotopic and I-131 3. Drinking Water Sample a. Gamma isotopic and Sr 89/90 b. Tritium 4. Fish Sample a. Gamma isotopic and Sr 89/90 analysis on edible portions	1. Monthly to SemiMonthly 2. Monthly 3a. Monthly 3b. Quarterly based on combined monthly samples (3a) 4. Semiannually	NRC
Site Preparation and Construction Monitoring	Not applicable	Not applicable	
Pre-Operational	Not applicable	Not applicable	
Operational	Same as pre-application program.	Same as the pre-application program.	NRC

Table 6.7-3 Hydrological Monitoring (Sheet 1 of 2)

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application	Discharge monitoring: Surface water sampling and flow measurements (analytical monitoring).	Samples are collected from Lake Erie in area of plant gaging station, and other specific locations.	NRC
	Groundwater monitoring: Existing groundwater level monitoring at Fermi 2 performed as part of the REMP. Monitoring of four groundwater wells included in its REMP.	Quarterly Groundwater wells monitored monthly for water levels. Quarterly for radionuclide and sensitivities.	NRC
	Groundwater level monitoring	Levels were measured in boreholes during course of field investigation. Groundwater or drilling fluid level was recorded at start of workday for borings in progress and at completion of drilling. Levels in piezometers and monitoring wells were measured monthly for one year. Groundwater elevations in piezometers and monitoring wells, and surface water elevations at the gaging stations, were generally measured on the same working day.	NRC
Site Preparation and Construction Monitoring	Inspections will be performed to ensure that the control measures outlined by the NPDES Stormwater Construction Permit, SESC Permit, and PIPP are installed and maintained.	As per NPDES Stormwater Construction and SESC Plans.	NPDES, MDEQ
	Groundwater level monitoring	Piezometers will be monitored at frequent intervals when construction dewatering begins. Frequency is reduced after dewatering levels have stabilized.	
Pre-Operational	Same as operational program	Same as the operational program.	SESC, MDEQ, NPDES, NRC

Table 6.7-3 Hydrological Monitoring (Sheet 2 of 2)

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Operational	Periodic readings of Lake Erie water levels during plant operation	During times of operation per MDEQ and NPDES permits.	SWPPP, MDEQ, NPDES, NRC
	Groundwater level monitoring	Quarterly	

Table 6.7-4 Meteorological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application (Fermi 2 meteorological monitoring program)	Sensors on the onsite meteorological tower monitor: Wind Direction, Wind Speed, Ambient Temperature, Dew-point Temperature, Precipitation, and Vertical Temperature Difference between the 10-m and 60-m levels	Continuous	NRC Regulatory Guide 1.23
Site Preparation and Construction Monitoring	Not applicable	Not applicable	
Pre-Operational	Not applicable	Not applicable	
Operational	Sensors on the onsite meteorological tower monitor: Wind Direction, Wind Speed, Ambient Temperature, Dew-point Temperature, Precipitation, and Vertical Temperature Difference between the 10-m and 60-m levels	Continuous	NRC Regulatory Guide 1.23

Table 6.7-5 Terrestrial Ecological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application	None	N/A	N/A
Site Preparation and Construction Monitoring	Bald eagle nesting	Annually during April to June	USFWS
	American lotus	To be determined	USACE, MDEQ, MDNR
	Wetland monitoring to be determined as part of mitigation plan development following Jurisdictional Determination by USACE	To be determined	USACE, MDEQ
	Construction activities/BMP Inspections	Weekly or after rainfall	MDEQ, NPDES
Pre-Operational	N/A	–	–
Operational	American lotus	To be determined	USACE, MDEQ, MDNR
	Wetland monitoring to be determined as part of mitigation plan development following Jurisdictional Determination by USACE.	To be determined	USACE, MDEQ

Table 6.7-6 Aquatic Ecological Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application	This program includes evaluations and analysis made for the licensing and permitting of the existing Fermi 2 and additional current and historical information gathered and reviewed for preparation of this document. Impingement and entrainment studies will be evaluated.	Once	Various agencies
Site Preparation and Construction Monitoring	It is expected that BMPs and BMP inspections will be implemented at all construction sites to prevent construction effluent (either planned or accidental) from entering aquatic resources at and near the Fermi site. Proper functionality of these BMPs and adherence to the NPDES Stormwater Construction Permit, SESC Permit, and PIPP would be monitored for construction activities at the Fermi site.	During construction activities	NPDES, SESC Permit, PIPP
Pre-Operational	Discharged effluents would continue to be monitored and necessary parameters recorded continuously as established in existing and future MDEQ NPDES permits for the Fermi cooling water intake and storm water and wastewater discharge systems.	During Fermi 2 operation per MDEQ and NPDES permits.	MDEQ, NPDES
Operational	The operational program is anticipated to be a continuation of the pre-operational program and would conform to applicable NPDES permit requirements at the time of operation. Discharge water temperature, chemical content, and other measures will be evaluated.	During Fermi 3 operation per MDEQ and NPDES permits.	MDEQ, NPDES Permit

Table 6.7-7 Chemical Monitoring (Sheet 1 of 2)

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application	Effluent limitations for Fermi 3 are expected to be similar to those required by the Fermi 2 NPDES permit.	Monitoring at the plant outfalls occurs daily, weekly, and monthly as required by the Fermi 2 NPDES permit.	Effluent limitations established in the NPDES Permit No. MI0037028.
	Measure radiation and radioactivity in the surrounding areas according to the Fermi 2 REMP.	A variety of environmental samples are collected as part of the Fermi 2 REMP.	The Fermi 2 – 2006, Radioactive Effluent Release and Radiological Environmental Operating Program
Site Preparation and Construction Monitoring	NPDES Stormwater Construction permit does not anticipate an additional construction program to be instituted at the site in order to assess water quality changes resulting from construction of the proposed project.	N/A	MDEQ, SESC Permit, PIPP
Pre-Operational	Effluent limitations for Fermi 3 are expected to be similar to those required under the Fermi 2 NPDES permit.	Monitoring at the plant outfalls occurs daily, weekly, and monthly as required by the Fermi 2 NPDES permit.	NPDES Permit No. MI0037028.
Operational	Discharge sampling and monitoring according to the NPDES permit.* Outfall 001, Lake Erie - cooling tower blowdown, processed radwaste wastewater, chemical metal cleaning wastes, non-chemical metal cleaning wastes, and residual heat removal system service water excess to Lake Erie. Monitored parameters include flow, temperature (intake and discharge), total residual chlorine, dechlorination reagent, BetzDearborn Spectrus CT-1300, total mercury (intake, discharge, net discharge), pH, total suspended solids, oil and grease, total copper, and total iron.	Monitoring at the plant outfalls occurs daily, weekly and monthly as required by the Fermi 3 NPDES permit.	MDEQ, NPDES permit

Table 6.7-7 Chemical Monitoring (Sheet 2 of 2)

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
	Outfall 009, Swan Creek via an overflow canal - low volume wastes, chemical metal cleaning wastes and non-chemical metal cleaning wastes, and storm water runoff to Swan Creek via an overflow canal. Monitored parameters include flow, total suspended solids, oil and grease, total copper, total iron, total boron, total residual chlorine, dechlorination reagent, and pH. Outfall 011, Swan Creek via an overflow canal - oily waste treatment water, service water screen back wash, and storm water runoff to Swan Creek via an overflow canal. Monitored parameters include flow, total mercury, total selenium, pH, total suspended solids, and oil and grease. Outfall 013, Lake Erie - settled water from a basin storing material dredged from Lake Erie to Lake Erie. Monitored parameters include flow, total suspended solids (intake, discharge, net discharge), and pH.		

*Operational monitoring actions listed above are for Fermi 2. Operational monitoring actions for Fermi 3 are expected to be similar to those for Fermi 2. For example, the new Lake Erie outfall for Fermi 3 is likely to have discharge limits similar to Outfall 001 for Fermi 2.

Table 6.7-8 Noise Monitoring

Phase	Monitoring Actions	Monitoring Frequency	Agency and Permit/ Requirement
Pre-Application	None	N/A	N/A
Site Preparation and Construction Monitoring	Monitor noise levels at nearby residences during daytime and nighttime construction activities.	Once	None
Pre-Operational	None	N/A	N/A
Operational	Monitoring of noise levels at nearby residences during daytime and nighttime construction activities.	Once	None