Joseph H. Plona
Site Vice President

6400 N. Dixie Highway, Newport, MI 48166
Tel: 734.586.5910 Fax: 734.586.4172

DTE Energy

June 29, 2011
NRC-11-0018

U.S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, DC 20555

References:	1)	Enrico Fermi Atomic Power Plant, Unit 1 NRC Docket No. 50-16 NRC License Number DPR-9
	2)	Detroit Edison Letter, NRC-09-0017, "Proposed License Amendment License Termination Plan", dated March 25, 2009
	3)	Detroit Edison Letter, NRC-07-0053, "Report on Groundwater Characterization", dated November 9, 2007
	4)	Detroit Edison Letter, NRC-10-0079, "License Termination Plan, Revision 3", dated December 20, 2010

Subject: Enrico Fermi Atomic Power Plant Unit 1
Fermi 1 Groundwater Site Conceptual Model

In Reference 2, Detroit Edison submitted the Fermi 1 (EF1) "License Termination Plan" (LTP) and in Reference 3, Detroit Edison submitted the EF1 "Report on Groundwater Characterization" for review.

In response to questions from the NRC staff's review of the LTP and "Report on Groundwater Characterization," Detroit Edison is submitting a new report on groundwater at the EF1 site, entitled "Site Conceptual Model" documenting the results of an assessment performed by Conestoga-Rovers & Associates. Revision 1 of the "Site Conceptual Model" is the first version of the report being submitted to the NRC.

The “Site Conceptual Model” provides:

1. Information on site geology, hydrogeology, site features, potential sources, and analytical data to characterize subsurface conditions at EF1 and address groundwater flow,
2. A recommendation to install five additional wells to improve condition monitoring based upon an assessment of groundwater flow data and locations of existing wells. Note, the five new wells were installed in spring of 2011.
3. Correction of + 0.18 feet (approximately 2 inches) to the EF1 well elevations identified in an assessment of the datum, or reference, for EF 1, Fermi 2, and the Fermi 3 "Combined Operating License Application". Note, the revision to the EF 1 "License Termination Plan" correcting these elevation changes was submitted in Reference 4.

The “Site Conceptual Model, Revision 1" concludes in part, based on analytical results to date, that impacts from EF1 operation are not likely present in the waters below EF1. Analytical results to date reveal no elevated detections of radionuclides in bedrock groundwater.

The “Site Conceptual Model, Revision 1" confirms the original conclusion of the "Report on Groundwater Characterization," submitted in Reference 3 that historical EF1 operations have not resulted in radiological impacts to groundwater.

This submittal letter also provides:

1. An addendum to the “Site Conceptual Model, Revision 1" providing "Updated Table of Analytical Results and Clarifications." The addendum is also included in Attachment 1. This addendum includes the onsite laboratory analysis results of the five new wells, numbered 11I, 11D, 12I, 12D and 13I.
2. Direct response to the questions raised by the NRC staff reviewers are provided in Attachment 2 and many are incorporated into the “Site Conceptual Model, Revision 1" and its Addendum, "Updated Table of Analytical Results and Clarifications."
3. A table providing additional results from the gross alpha and gross beta analysis results contained in the “Site Conceptual Model, Revision 1" is provided in Attachment 3.
4. As requested by the NRC staff, a sketch of the annulus surrounding the reactor and boring logs for Fermi 2 wells GW-1, GW-2, GW-3 and GW-4 and new Fermi 1 wells 11I, 11D, 12I, 12D and 13I are provided in Attachment 4.

If you have any questions, please contact Lynne S. Goodman, Manager, Fermi 1, at (734) 586-1205.

Sincerely,

Joseph H. Plona

Attachment 1 -“Site Conceptual Model, Revision 1" and Addendum to “Site Conceptual Model, Revision 1" entitled "Updated Table of Analytical Results and Clarifications."
Attachment 2 -Responses to NRC Groundwater Questions
Attachment 3 - Well Samples Analyzed for Gross Alpha and Gross Beta
Attachment 4 - Annulus Sketch and Boring Logs

cc: T. Smith, NRC (w/attachment)
P. Lee, NRC Region III (w/attachment)
NRC Regional Administrator, Region III (w/attachment)
Michigan Department of Natural Resources and Environment
Environmental Resource Management Division-Radiological Protection Section (w/attachment)
NRC Resident Inspector- Fermi 2 (w/o attachment)

Attachment 1

Site Conceptual Model, Revision 1

and

Addendum - Updated Table of Analytical Results and Clarifications

SITE CONCEPTUAL MODEL
(Revision 1)

FERMI-1
DETROIT EDISON - FERMI ENERGY CENTER
6400 NORTH DIXIE HIGHWAY
NEWPORT, MICHIGAN

Prepared For:

Detroit Edison (DTE)

**Prepared by:
Conestoga-Rovers
& Associates**

410 Eagleview Blvd., Ste. 110
Exton, PA 19341
Office: (610) 321-1800
Fax: (610) 321-2766

web: http:\\www.CRAworld.com

JANUARY 2011
REF. NO. 058432 (01)

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1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) prepared this Site Conceptual Model (SCM) to characterize the subsurface conditions at the Detroit Edison (DTE) Fermi 1 Facility (Station) and to identify and describe the groundwater flow and mass transport of potential radiological impacts at the Station.

The SCM serves to consolidate historical information and the Site Characterization completed from November 2003 through December 2006, and more recent sampling completed in 2007 through March 2010. In addition, the SCM focuses on addressing questions and issues recently raised (April 2010) by the Nuclear Regulatory Commission (NRC) in support of the pending Fermi 1 License Termination Process.

The specific objectives of the SCM are to:

- characterize the geologic and hydrogeologic conditions at the Station, including subsurface soil types and the direction and rate of groundwater flow;
- characterize the groundwater/surface water interaction at the Station;
- evaluate groundwater quality at the Station including the vertical and horizontal extent and concentrations;
- identify the sources of any radionuclides releases at the Station; and
- provide recommendations for additional investigations and long-term monitoring.

1.1 SUPPORTING DOCUMENTATION

This SCM report was prepared following a comprehensive review of previously completed technical reports and hydrogeologic studies completed at the Fermi Energy Center (FEC), including Fermi 1, Fermi 2 and Fermi 3. The SCM was based on documents provided by DTE as well as historical and ongoing communications with Station personnel. A complete listing of reference documents used in the preparation of this SCM is presented in the Reference section (Section 9.0).

In summary, the SCM included the consideration of the following material:

- Review of the radiological events as documented by the Station;
- Review of the systems and structures as prepared by DTE;

- Review of various hydrogeologic reports and investigations related to radioactive and non-radioactive constituents;
- Review of siting and licensing documents (Fermi 2 UFSAR, Fermi 3 COLA);
- Review of laboratory analytical results; and
- Review of selected Station drawings, aerial photographs and Station construction photographs.

2.0 STATION BACKGROUND

This section presents background information on the FEC location and setting, construction of the Station and key subsurface structures, and the existing monitoring network. This information is presented as it is relevant to the understanding of groundwater flow and radionuclide migration within the development of the SCM.

Figure 1 presents a Site Location Map showing the FEC complex in relation to Lake Erie and the surrounding area. Figure 2 presents an aerial photograph Site Map including the Fermi 1, Fermi 2 and Fermi 3 facilities.

Figure 3 presents a map of the Fermi 1 Station layout and decommissioning Termination Boundary. The Termination Boundary, to which the NRC and Fermi 1 Station have agreed, is defined by the inside perimeter of the asphalt drive around the perimeter of the power generating complex. Within the Termination Boundary, the building boundaries and fences shown in bold black on Figure 3 constitute the Controlled Area.

The Fermi 1 Datum (datum) is the reference datum used for purposes of this report. For comparison, the Fermi 1 Datum is equal to the International Great Lakes Datum [IGLD] (1955) plus 2.071 feet. For example, an elevation given as 580.00 IGLD 1955 is equal to an elevation of 582.071 feet (Fermi 1 Datum).

2.1 SUMMARY OF STATION OPERATIONS HISTORY

The following presents an overview of the history of the Station.

1950s

Prior to Station construction, the area was undeveloped land. Pre-construction aerial photographs from 1949 and the 1956 license application indicate that the Station was originally situated near the base of a narrow peninsula that was bordered on the west and north by a lagoon that was hydraulically connected to Lake Erie.

Figure 4 presents an aerial photograph (circa 1958) showing the Station during development. Fermi 1 was initially proposed in 1955 and a construction permit was issued by the former Atomic Energy Commission (now the NRC) in August 1956. During construction in the late-1950s and early-1960s, the Station included features and buildings other than those strictly associated with the nuclear generation of electricity. Such features included a visitors building, four diesel powered peaking generators ("peakers"), and one aboveground storage tank that supplied the peakers. Aerial photos also indicate that fill materials were used during Fermi 1 Station construction to extend the western shore of the peninsula, partially filling the lagoon.

In 1958, the Onsite Quarry, located south of Fermi 1, was dug and used to obtain construction material for Fermi 1. The quarry operation was terminated in 1960. CRA identified no information regarding quarry dewatering during this time period; however, dewatering may have occurred.

1960s

Fermi 1 operated from August 1963 to September 1972. The Station was connected to the national grid in 1966. On October 5, 1966, Fermi 1 suffered a partial fuel meltdown, although no radioactive material was released. Following an extended shutdown that involved fuel replacement and cleanup, Fermi 1 continued to operate part-time until September 22, 1972.

Construction of Fermi 2 started. Fermi 2 is located adjacent to Fermi 1 to the north. In addition, in June 1969, Onsite Quarry activities recommenced at the north end of the quarry southwest of Fermi 1. The purpose of the Onsite Quarry operation was to obtain fill material for construction of Fermi 2. The fill material was obtained by quarrying and subsequent crushing of the rock. During quarry operations from 1969 to 1972, the quarry was dewatered by pumping groundwater. Groundwater pumping at an average rate of 770 gallons per minute (gpm) was used to lower the groundwater table in order to allow for blasting and removal of the bedrock.

1970s

Between October 1972 and October 1975, the Station was partially decommissioned to the extent that all radioactive processes ceased and radioactive sodium was drained from the primary system.

With respect to the Station features, storage areas, and conduits that conveyed radioactive waters and air, the decommissioning process included the following:

- Radioactive sodium was drained from the primary system and stored in tanks and drums on-site.
- Non-radioactive sodium was drained from the secondary system and removed from the Station.

- The cut-up and decay pool stainless steel surfaces were cleaned with detergent, followed by a nitric acid and demineralized water rinse then painted.

Fermi 1 was officially decommissioned December 31, 1975. No further operational activities were completed during the 1970s.

Construction of Fermi 2 continued. The lagoon west of Fermi 1 was completely filled in as part of the construction. Operations at the Onsite Quarry (Quarry Lake) are described in detail in Section 3.7.4.

1980s

The station decommissioning status was established as SAFSTOR, a decommissioning method that allows the facility to be safely stored and subsequently decontaminated to levels that permit license termination. The Health Physics Building was demolished in 1980. The slab and entrained plumbing for the Health Physics Building currently remain. Primary sodium was shipped to EBRII in Idaho. The majority of the contents of the liquid waste system were removed; leaving sufficient liquid to ensure the tanks' level indication system was functioning.

Fermi 2 was operational.

1990s

Station decommissioning status continued under the NRC's SAFSTOR program. In 1998, the Industrial Safety Improvement Project to cleanup sodium residues and other hazardous materials onsite commenced. The oil-fired boiler house was removed.

Fermi 2 was operational.

2000s to present

The final stage of SAFSTOR consisting of deferred decontamination commenced with the goal of removing remaining radioactive material to terminate the NRC license.

Fermi 2 is operational.

Plans for the licensing of Fermi 3 began (COLA).

2.2 OVERVIEW OF CONSTRUCTION OF FERMI 1

Figures 4 and 5 present select historical construction photographs at the Station area where excavation was completed during construction. Figure 6 presents an east-west cross-section through the major Station structures. Fermi 1 was constructed in coastal wetlands at the west end of Lake Erie.

Prior to construction, the Station was originally underlain by 16 to 20 feet of glacial deposits that in turn overlie dolomite bedrock. The land surface at the Station prior to construction was approximately 575 feet datum.

Much of the glacial deposits within the area, now defined by the Controlled Area boundary, were removed in order to facilitate construction. To ensure a proper foundation, the native sediments were removed down to bedrock in the area of the Reactor Building and Fuel and Repair Building (FARB). Following the removal of the native glacial deposits and construction of the reactor building in 1956, approximately 27 feet of fill was added to the top of the bedrock in order to bring the ground inside much of the Controlled Area up to an elevation of approximately 585 to 590 feet datum. The Clay Fill within the Station was predominantly locally sourced clays with select areas immediately around significant subsurface structures (e.g., Reactor Building) backfilled with Permeable Fill (aggregate or gravel). Some key features in the FARB were constructed below grade, these include: a) the repair pit; b) the cut-up and decay pools; c) the hot sump; and d) liquid waste tanks. These features were constructed to elevations as low as 559 feet datum, or approximately 3 feet above the top of bedrock. Outside the Controlled Area, approximately 10 feet of Clay Fill was added to raise the natural elevation from 574 feet datum to 584 feet datum. Aerial photos also indicate that fill materials were used during Station construction to extend the western shore of the peninsula, partially filling the lagoon.

2.3 KEY STATION FEATURES

The following presents an overview of the construction of key Station features.

2.3.1 REACTOR BUILDING

During Fermi 1 operations, the Reactor Building contained the reactor, primary loops, primary-to-secondary heat exchangers, and refueling equipment.

Figure 6 presents a cross-section of the Reactor Building and surrounding key structures. Attachment A presents historical photographs of the Station. Included in Attachment A are representative photographs of the construction of the Reactor Building. The Reactor Building is located on the eastern side of the Station and was completed to an invert elevation of approximately 539 feet datum or approximately 17 feet below the top of bedrock. The lower portion of the Reactor Building was filled with concrete from about 539 feet datum to 551 feet datum with a steel basement floor on top. During construction of the Reactor Building, a concrete retaining wall was erected around the steel containment wall, effectively creating a barrier to flow from potential leakage from the unit and from in-leakage from any surrounding water. The resulting annulus space (that space between the steel containment and surrounding concrete wall) is approximately 4-foot, 9-inches. The annular space narrows to 2-foot, 10-inches at the floor level due to the approximately 3-foot high skirt on the exterior of the steel Reactor Building. Outside the concrete wall, is a ring of Permeable Fill at least 2-feet thick, which extends from an elevation of approximately 550 feet datum to the surface (References: 6C721-1906-1 and 6C721-1605-2). The annulus space collects storm water and subsurface water. This water consists predominantly of 'clean' rainwater that has only contacted the Reactor Building dome and surrounding backfill. The water that accumulates at the base of the annulus space is removed by Sump #1, which is located in the adjacent Steam Generator Building and connected to annulus by a drain. The invert of Sump #1 is at elevation of 550.5 feet datum, which is situated in the bedrock but above the bottom of the 12-foot thick concrete Reactor Building floor. Sump #1 pumps water into the storm drain system. Smear samples have been taken quarterly over the years from the sump to identify potential impacts in accordance with plant Technical Specifications; no activity has been detected. Since 2008, periodic water samples have been taken and analyzed from Sump #1; no activity has been detected. The sump pump was removed for repairs in the late-2000s and no detectable activity was identified by direct frisk.

Sump #8 serves the foundation drains around the Reactor Building. The elevation of the foundation drains varies from 558.64 feet datum to 559.65 feet datum (Reference 6C721-1906-1 and 6C721-1605-2). The drains go to the Sump #8 pump discharging into the storm sewer. Since 2008, Sump #8 has been on a periodic sampling regime; however, the sump typically does not contain water to collect a sample.

During plant operation, the Reactor Building systems were filled with heated sodium or gas. There were no water-containing systems in the Reactor Building. Therefore, there was not a source of water to leak into the ground. Any sodium leakage would have resulted in a fire or explosion. During decommissioning, water in the form of steam was used to react with any residual sodium, producing liquid sodium hydroxide. This liquid was contained in the systems with the exception of some leakage onto the metal floor in the Reactor Building basement. The leakage was cleaned up. Additionally, an air conditioning condensate drainage pipe discharged outside and had the potential for contamination. The condensate pipe was monitored for contamination during decommissioning and no contamination detected.

While liquids have been used during decommissioning in the Reactor Building, there are no known releases of contaminants out of the building basement.

2.3.2 TURBINE BUILDING

The Turbine Building contained the main turbine-generator and the conventional power plant equipment. The Turbine Building systems did not contain radioactive material during plant operation. The condenser outfall is partially located underneath the Turbine Building floor.

The Turbine Building was constructed with a reinforced concrete slab foundation. Engineering drawing 6C721-2 indicates a first floor elevation of 582.5 feet datum, with some first floor penetrations extending to approximately 575 feet datum. Two unnumbered sumps were noted on the same drawing, extending to elevations 572.5 feet datum and 576.1 feet datum, both of which are above bedrock. These sumps appear to extend approximately 3 to 4 feet beneath the adjoining first floor surface. The drawing also indicates that concrete footers penetrate to a reference elevation of approximately 554 feet datum, which is in bedrock. Based upon these elevations, with the exception of the building footers/bearing pilings, the Turbine Building footprint lies within backfill.

2.3.3 SODIUM TUNNELS AND GALLERIES

Primary sodium was transferred via piping through the Sodium Tunnel to and from the cold trap room for purification purposes during operations. Secondary sodium was transferred via piping in the galleries from the Reactor Building to and from the Steam Generator Building during operations. The East Sodium Gallery also contained the fission product detection system vapor trap, which was connected via piping to the Fission Product Detector Building.

The Sodium Tunnel extends approximately 100 feet from the Sodium Building to the Reactor Building. The Sodium Tunnel Detail, as provided by drawing 6C721-1610, indicates the Sodium Tunnel is constructed to an approximate invert elevation of

577 feet datum. A 4-foot, 6-inch deep, steel-lined concrete sump, within the base slab of the tunnel, is located at the southern end of the tunnel, near where the Sodium Tunnel intersects the Reactor Building.

The East and West Sodium Galleries base slabs are constructed to an invert elevation of approximately 571 feet datum. A sump, approximately 4-feet deep is noted to exist immediately outside the footprint of the West Sodium Gallery (Sump #3). A floor drain and sump also exists at the southern end of the Eastern Sodium Gallery.

During Station operations, liquid sodium flowed through the pipes within the tunnel and galleries. During decommissioning, sodium hydroxide and neutralized processing liquid flowed through the piping in the tunnel. During decommissioning, a sump pump was used to keep the tunnel dry at times by pumping incoming water to the Reactor Building annulus. As discussed above, the Reactor Building annulus sump has been checked for contamination and water samples have been analyzed without detecting any plant related activity.

During operation, the sodium galleries contained small quantities of tritium in the sodium. The internals of the vapor trap and connecting piping were radioactively contaminated. There was water in the sodium gallery piping only briefly when the pipes were flushed during decommissioning. However, there is groundwater intrusion into both galleries, especially the West Sodium Gallery. The West Sodium Gallery is served by Sump #3 and the East Sodium Gallery by Sump #4. No plant related activity has been identified in the sump samples. The sump samples have been collected since 2008.

2.3.4 FISSION PRODUCTS DETECTION (FPD) BUILDING

The FPD Building contained equipment added during operation to detect fuel damage.

The FPD Building is adjacent to the Reactor Building and above the East Sodium Gallery. The FBD Building was constructed prior to 1966. The FPD Building was constructed as slab on grade on top of the Permeable Fill surrounding the Reactor Building. Permeable Fill has been observed during subsequent excavations on the east side of the FPD Building. Pipe penetrations connected the FPD Building and the East Sodium Gallery.

2.3.5 FORMER HEALTH PHYSICS BUILDING

The Health Physics Building was the entry and exit pathway into the plant during operations. It contained dress-out and decontamination facilities, as well as the chemistry lab. Radioactive drains were routed to the Health Physics Building sump. The discharge line from the sump is addressed in Section 2.3.8. Toilet facilities discharged to the sanitary sewer.

The Former Health Physics Building is located in the northwest corner of the Station. It was demolished in 1980 with removal of the building. The area is currently occupied by a concrete slab (approximately 3-feet thick). The entrained plumbing also remains. Based upon the information provided, the building was constructed as a concrete slab with an approximate invert elevation of 577 feet datum. Structural pilings for the building were driven to the bedrock surface (approximate elevation 554 feet datum). An unnumbered sump is located to the east of the former building footprint (Figure 3). No releases or impacts are associated with this structure.

2.3.6 FUEL AND REPAIR BUILDING (FARB)

The FARB contained fuel cleaning, handling and storage facilities, the liquid waste system and maintenance facilities during operation.

The FARB was constructed upon a concrete and gravel-sand fill base in the bedrock. From Engineering Drawing 6C721-1641-1, the FARB floor lies at an approximate elevation of 558.5 feet datum at it lowest point. Drawings G1940-1, 6C721-1641-4 and 6C721-1641-5 indicate that during the construction of the FARB a maximum excavation depth of approximately 40-feet below grade, reaching an elevation approximately 543 feet datum was achieved. According to these drawings, the maintenance pit sump pit is the lowest portion of the maintenance pit sump. The maintenance pit sump pit is constructed of concrete to an invert depth of 545.5 feet datum and has the dimensions of approximately 2-feet by 2-feet wide and 2-feet, 6-inches deep. Groundwater intrusion is suspected either within the maintenance pit sump or the deeper sump cutout within the maintenance pit sump. The maintenance pit sump and deeper sump cutouts will be dewatered and surveyed as part of the release process for this area. Two additional sumps shown on the drawings were constructed at an approximate elevation of 550 feet datum.

The FARB is also served by Sumps #6, #7, and #12. These sumps are completed in the Clay Fill, and by virtue of their metal-lined concrete construction, are not in direct contact with the subsurface water. Sump #12 collects water from all the drains in the FARB, and is known as the "hot sump". In recent years, its water level had not changed noticeably. The contaminated liquid was pumped out earlier this year. The bottom of Sump #12 is at approximately 553 feet datum (6C721-1250-2 and 6C721-1252-1). Sumps #6 and #7 had been considered abandoned, since they collected any water from the sand underneath the fuel pools, and the pools had been drained during the 1970's. Refer to Figure 3 for numbered sump locations.

Radioactive liquid waste was discharged from the FARB through one waste water line. The line discharged to the 96-inch overflow channel discussed in Section 2.3.10.

2.3.7 FORMER WASTE GAS STACK

The Former Waste Gas Stack was used to vent gases from the Waste Gas Building.

The Former Waste Gas Stack is constructed on a 4-foot concrete slab with an invert elevation of 579 feet datum. It is located in the northeast corner of the FARB. The atmospheres inside the Reactor Building, Waste Gas Building, Inert Gas Building, and the FARB (e.g., evaporation of cut-up and decay pool water) were in contact with low-level radioactive material. In order to minimize airborne radioactivity, these atmospheres were constantly purged and routed to the Waste Gas Stack.

2.3.8 LIQUID RAD WASTE LINE

Fluids that were collected at the Health Physics Building sump were routed around the north side of the FARB to the liquid waste system. The Historical Site Assessment discusses an incident of leakage along a portion of the Liquid Rad Waste Line that was remediated, abandoned and replaced. A portion of the Liquid Rad Waste Line, consisting of carbon steel asphalt coated 2-inch piping, was found to be externally corroded when inspected on May 6, 1968. The line was corroded to the point where complete penetration of the pipe had occurred. Water and soil samples were taken from the soil adjacent to the pipe in the area of known leakage. Concentrations of 1.7E-07 μCi/cc were found in the samples; however, the historical information failed to indicate what radionuclides were detected at that concentration, which may have included natural occurring radioactive material. The original line (150-feet) in the vicinity of the leak was abandoned and a new liquid waste discharge line was routed directly from the Health Physics Building to the west side of the FARB. Contaminated soil was removed from the area of leakage. The Health Physics Building sump liquid waste line will be removed during decommissioning activities.

2.3.9 SHORELINE BARRIERS

Figure 7 presents a map of the FEC with significant construction features, including dikes, shoreline structures, and sheet piling. During the construction of Fermi 1, shore barriers were constructed along the east shore (Lake Erie) and the north shore (lagoon). Details from engineering drawings 6C721-1904-7 indicate the "rock shield" barrier to be constructed roughly from shore/lagoon elevation of 572 feet datum to a height elevation of 582 feet datum, although some construction along the northern periphery was made several feet below existing grade. The rock shield barrier was emplaced in conjunction with the contingent construction of the Intake Channel and associated sheet piling. The shore barrier was comprised of a sloping rock shield supported by rock or earthen fill.

The Lake Erie surface water intake for Fermi 2 is located approximately 200 feet east of the southeastern corner of the Fermi 1 Termination Boundary. The fill materials that form the west and north banks of the embayment at the intake are supported by ½-inch thick steel sheet piling that is keyed into the native glacial clay. The remainder of the intake area, between the jetties that extend eastward into the lake, are protected by riprap composed of the local bedrock.

2.3.10 OVERFLOW CHANNEL

An Overflow Channel leading to the lagoon area was used for permitted discharge of radioactive materials. The Overflow Channel runs north-south along the east side of Fermi 1 beneath the perimeter road, and is 96-inches in diameter. The following describes the discharges to the Overflow Channel:

- The radioactive waste water generated from washing spent fuel rods in the FARB was routed to a series of waste tanks in the FARB basement. Non-septic radioactive waste water from the Health Physics Building (e.g., showers, sinks), including its lab, was routed to the sump at the east end of the building, then discharged via the Liquid Rad Waste Line along the north side of the FARB, and into the FARB on its east side. These fluids were drained into the liquid waste system and discharged along with other waste waters to the Overflow Channel.
- FARB floor drains were routed to a sump. Water was transferred from the sump to the liquid waste system, where they were discharged to the Overflow Channel.

- There was one radioactive liquid waste discharge line from the FARB liquid waste system to the Overflow Channel. The water was diluted with Circulating Water System discharge water that flowed from the Turbine Building, through the Overflow Channel, to its permitted surface water outfall northeast of the FARB, into the lagoon.
- The FARB liquid waste discharges were monitored during plant operation. No discharges have been made since the 1970's.

The Overflow Channel discharged to the lagoon north of Fermi 1. During Fermi 2 construction, the Overflow Channel was lengthened and routed to the northwest, where it discharged to what is currently referred to as the Overflow Canal, which flowed into Swan Creek. The lagoon was backfilled. Fermi 2 general service water screens backwash water is also directed into the Overflow Channel, so the channel is part of the FEC in-service systems.

2.3.11 DIKES

During construction of Fermi 2, artificial barriers (dikes) were installed around the Fermi 2 perimeter and adjacent Fermi 1 boundary to minimize water encroachment during its construction. The dike walls were constructed to an invert elevation of 562 feet datum and constructed to an elevation of approximately 583 feet datum. The clay dewatering dikes were principally composed of reworked Clay Fill and native clay materials found in the overburden around the FEC. The side slopes were covered with quarry stone. These dikes were left in place following construction of Fermi 2, and isolate the overburden in Fermi 1 from Fermi 2. As a result, they also influence groundwater flow in unconsolidated sediments.

2.3.12 SUMP NETWORK

Figure 3 presents a Station map including the locations of the individual numbered sumps for Fermi 1. Table 1 presents a list of the sumps and areas serviced. There are 12 sumps within the Termination Boundary. Three of the sumps are located near the north side of the Steam Generator Building.

Only one sump in this sump network, Sump #1, extends into bedrock. Fermi 1 drawing 6P721-1057-1 indicates that Sump #1, which is designed to remove water from the floor of the annulus outside the reactor building wall, extends into bedrock to an elevation of

550.5 feet datum. The referenced drawing also indicates that the design capacity of the Sump #1 pump is 25 gpm. However, Sump #1 only occasionally pumps (personal communication with Station personnel).

Note that the Health Physics Building sump discussed in Section 2.3.5 is not in the sump network. In addition, the maintenance pit sump discussed in Section 2.3.6 is also not in the sump network. It did not and does not automatically discharge.

2.4 STATION MONITORING WELL NETWORK

In 2003 and 2004, DTE completed a groundwater characterization to support the license termination of Fermi 1 by determining whether former operations resulted in radiological contamination that exceeds background conditions. Sixteen monitoring wells were installed in both overburden and bedrock. Table 2 presents a summary of the construction details of the Fermi 1 monitoring wells. In 2005, the monitoring wells were surveyed by a DTE licensed surveyor to the Fermi 1 Datum (datum). This is the same datum used on Fermi 1 drawings. Figure 3 presents a Station map including the location of the monitoring well network. The existing monitoring well network at the Station consists of 11 overburden monitoring wells and 5 bedrock monitoring wells. Most of the overburden monitoring wells are completed within Clay Fill, with the exception of monitoring well EFT-1I which was screened in the native Glacial Lake Clays. The predominant fill material encountered during the shallow well installation program was Clay Fill, though permeable fill was encountered in some wells. A detailed evaluation of the monitoring well network is presented Section 6.0.

3.0 SETTING, GEOLOGY AND HYDROGEOLOGY

This section presents a description of the location and physiographic setting, topography and surface water drainage, climate, soils, geology, hydrogeology, and groundwater flow at the Station. These are important factors when considering the subsurface migration of radionuclides at the Station. In particular, groundwater flow is largely influenced by the soils and geology, and by the numerous subsurface structures that impede and alter natural groundwater flow.

3.1 LOCATION AND PHYSIOGRAPHIC SETTING

Fermi 1 is located in the City of Newport, Monroe County, Michigan (Figure 1). The 1,260-acre FEC property, which encompasses the Fermi 1 Station, is located within portions of Sections 16, 17, 20, 21, and 27 of Frenchtown Township (Township 6 South, Range 10 East). Fermi 1 is located in the Northwest ¼ of Section 21. The National Oceanic and Atmospheric Administration (NOAA) water level monitoring station No. 9063090 for Lake Erie is located near the eastern Termination Boundary, at the Fermi 2 general service water intake, at the following coordinates: Latitude: 41° 57.6' N, Longitude: 83° 15.4' W.

The FEC is located on the western shore of Lake Erie midway between Pointe Aux Peaux to the south and the mouth of Swan Creek to the north. A 650-acre portion of the FEC is the Lagoona Beach portion of the Detroit River International Wildlife Refuge (DRIWR). Land surrounding the FEC is predominantly non-industrial, marshy land. Swan Creek is located near the FEC to the north.

Land use within 5-miles of the FEC is primarily for agricultural purposes with residential lots dispersed throughout. Residential areas are located approximately one mile north and south of the FEC. The nearest town is Newport, which is approximately 3 miles northwest of the FEC.

Fermi 2 is located to the immediate north of Fermi 1. If constructed, proposed Fermi 3 will be located to the immediate west of Fermi 1.

The Station is located in the Central Lowlands Physiographic Province. The Central Lowland Province is characterized by a low-relief surface formed by glacial till, outwash plains, and glacial-lake plains. The different combinations of clay, silt, sand, and gravel that compose the glacial material were deposited during at least three stages of advance and retreat of the ice. In places where they were directly emplaced by the ice, these deposits, called till, are poorly sorted mixtures of clay, silt, sand, gravel, and boulders and generally are not productive aquifers. Sediments deposited by glacial meltwater consist of coarse sand and gravel that are productive aquifers. Sediments deposited downstream of glacial meltwater in lake environments consists of clays that are not productive aquifers.

3.2 TOPOGRAPHY AND SURFACE WATER DRAINAGE

Topography in the vicinity of the FEC is characterized by relatively flat terrain. The area at the FEC ranges in elevation from approximately 577 to 600 feet datum. The ground surface topography at the Fermi 1 Station is effectively flat. The Station grade is approximately 585 feet datum.

Historically, the FEC was characterized by surface wetlands. Over much of the surrounding area, the wetlands were drained through the installation of drainage tiles in the 1800s to accommodate the development of local agriculture. Surface water drainage from farther inland, naturally flows to the southeast until encountering the natural water ways (e.g., Swan Creek or Lake Erie), or entering engineered conveyances to the west of Fermi 1. There are no flowing surface water bodies within or adjacent to the Fermi 1 Termination Boundary. Swan Creek flows into an estuary on the northern edge of the FEC, which ultimately feeds into Lake Erie.

The lake elevation data can be found at the following NOAA web site: http://glakesonline.nos.noaa.gov/glin.shtml?station_info=9063090+Fermi+Power+Plant,+MI. According to NOAA data for the Fermi 2 Station, Lake Erie typically has an elevation between 571 and 573 feet datum, indicating little fluctuation in water level. The lake level fluctuates not only seasonally, but can also oscillate daily in response to wind speed, direction, and barometric pressure.

3.3 CLIMATE

The following presents climatic data for the 30-year period from 1961 through 1990 based on the National Climatic Data Center weather station located near Milan, Michigan (Station ID: Milan 4ESE) in northwestern Monroe County at approximate latitude/longitude of 42.06°N 83.61°W.

Average Rain Fall

Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	37.5	38.6	63.2	77.7	83	91.9	77.7	87.3	82.8	57.1	71.8	67.8	836.9
inches	1.5	1.5	2.5	3.1	3.3	3.6	3.1	3.4	3.3	2.2	2.8	2.7	32.9

Average Maximum Temperature

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-1	0.7	7.2	14.8	21.4	26.3	28.5	27.3	23.6	17	9.1	1.6	14.7
°F	30.2	33.3	45	58.6	70.5	79.3	83.3	81.1	74.5	62.6	48.4	34.9	58.5

Average Minimum Temperature

Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-10.2	-9.2	-3.5	1.9	7.6	12.6	14.6	13.5	9.8	3.6	-0.8	-6.8	2.7
°F	13.6	15.4	25.7	35.4	45.7	54.7	58.3	56.3	49.6	38.5	30.6	19.8	36.9

3.4 SOIL

According to the Soil Survey of Monroe County, Michigan (USDA, 1981), the regional soils in the area of the FEC are comprised of the Lenawee Series, a series of poorly or very poorly drained, moderately slowly permeable soil on lake plains. These soils formed in loamy and clayey lacustrine deposits with an average 0 to 2 percent slope. All of the soils at the Station, as classified by the USCS, would be categorized as Urban land. This is a reflection of the previously described Clay Fill which was emplaced in the Fermi 1 Station boundary. The Fermi 3 COLA report presents a soils map for the Fermi complex (Fermi 3 COLA Figure 2.5.1-245), which includes the Fermi 1 Station area.

3.5 GEOLOGY

3.5.1 REGIONAL GEOLOGY

Figures 8 and 9 present the regional overburden and bedrock geologic conditions, respectively.

Figure 8, which is an excerpt of the map of Quaternary Geology of Southern Michigan (MDNR, 1987), indicates that the surficial deposits within this portion of Monroe County are predominantly clay and silt that were deposited in a glaciolacustrine (or glacial lake) environment. These deposits were laid down in a low-energy environment far from the former glacial ice edge resulting in sediments that form the flat coastline of Lake Erie. The maximum thickness of glacial deposits in the Monroe County is approximately 160 feet according to the report of Geology for Environmental Planning in Monroe, Michigan. The undisturbed thickness of the glacial deposits that cover Frenchtown Township varies from approximately 10 to 50 feet according to the Hydrogeologic Atlas of Michigan.

Figure 9, created from an excerpt of the map of Bedrock Geology of Southern Michigan (MDNR, 1982), shows that the bedrock immediately beneath the FEC is comprised of the Bass Islands Group of Late Silurian geologic age. The Hydrogeologic Atlas of Michigan indicates that the Bass Islands Group is composed of dolomitic (magnesium-rich) limestones that include the River Raisin Dolomite, which is underlain by the Put-in-Bay Dolomite, with a combined maximum thickness of approximately 700 feet.

3.5.2 STATION GEOLOGY

The following presents a description of the Station geology based upon the review of the Station lithologic logs, the Fermi 2 UFSAR, the Fermi 3 COLA, and historical information.

The Station and the entire western shore of Lake Erie are underlain by unconsolidated deposits composed up to 10 meters (33 feet) of clay-rich glaciolacustrine sediments (Glacial Lake Clay) and glacial till (Glacial Till). The native geologic units at the Station, in descending order, are described as follows:

- 575 feet datum to 568 feet datum: Soft black muck and peat.
- 568 feet datum to 563 feet datum: of Glaciolacustrine laminated gray clay and silt, with traces of humus (Glacial Lake Clay).
- 563 feet datum to 557 feet datum: Hard mottled gray to yellowish sandy clay (Glacial Till).
- <557 feet datum: Dolomite bedrock (Bass Islands Group).

Muck and peat were present at the surface prior to construction of Fermi 1. No information is available for Fermi 1 regarding the muck and peat; however, lithologic information is available from Fermi 3 as part preparation of the COLA. A review of the Fermi 3 lithologic logs indicates that 17 locations indicate the muck and peat are 5 to 10 feet thick. These elevations correspond to the original topographic marsh surface. The muck was primarily described as a black, dilatent fine-grained, saturated, loose material. The peat was described as an organic, black, fibrous to woody material.

The Glacial Lake Clay is typically described as a soft, moist fat clay, with high plasticity, mottled with color variation from yellowish-brown to grey to grey-green in color. In general, in undisturbed areas, the Glacial Lake Clay exists immediately beneath the muck and peat interval. The thickness of the Glacial Lake Clay typically ranges from 5 to 13 feet identified in well logs from the Fermi 1. This is generally consistent with observations at Fermi 2 and Fermi 3.

The Glacial Till is a hard, nearly impermeable silt and clay mixture with varying amounts of gravel and cobbles. The thickness of the Glacial Till typically ranges from 4 to 8 feet identified in well logs from the Fermi 1. The bottom foot of the Glacial Till was noted to contain fragments of the underlying dolomite bedrock. This is consistent with observations at Fermi 2 and Fermi 3.

The Silurian-aged Bass Islands Dolomite is a light gray, massive, locally thin to medium bedded dolomite with minor thin shale seams and anhydrite inclusions (UFSAR, 2000). Occasional soft gray clay seams between 0.25 and 8 inches in thickness occur at random. An oolitic marker bed identifies the upper portion of the unit, while a soft, black shale marker bed identifies the lower portion of the unit. The dolomite is present across the entire FEC, and was quarried for use as the engineered backfill. The Bass Islands Group Dolomite varies from 0 to 50 feet thick, and is underlain by Unit "G" of the Salina Group.

At Fermi 1, the dolomite bedrock is indicated on borings logs at depths typically ranging from 16 to 20 feet below original grade, (559 to 555 feet datum). These depths are in agreement with available information from the construction of the Station structures. The dolomite at Fermi 1 is at least 80 feet thick, and is characteristically tan to light gray, hard, microcrystalline with occasional thin shale seams and anhydrite lenses. The dolomite is described as containing fracture zones and occasional dissolution zones along bedding plane fractures; however, during drilling these fractures were not observed to be a significant factor in providing flow zones in the dolomite.

Outside the major building structures, the current geologic units at the Station, in descending order, are approximately as follows:

- 586 to 566 feet datum: Clay Fill
- 566 to 563 feet datum: Glacial Lake Clay.
- 563 to 557 feet datum: Glacial Till.
- <557 feet datum: Dolomite bedrock (Bass Islands Group).

Due to the construction of Fermi 1, the first 10 to 20 feet below grade within the Controlled Area consists of fill above the natural geology. Based on Fermi 1 construction information, material consisting predominantly of natural clay was used as backfill on top of bedrock within the Controlled Area. Review of the boring logs also confirms that the material used as backfill consists predominantly of Clay Fill. In 1976, borings were drilled by Fermi 2 at Fermi 1 (EF-1, EF-2, EF-3, and EF-4). Boring logs indicate that all of these borings contain Clay Fill, to depths ranging from approximately 8 to 13 feet, consisting of clay or silty clay, with varying fractions of sand and gravel.

Immediately around major Station structures, more Permeable Fill is present. Fermi 1 drawings indicate the designed placement of Permeable Fill materials, including sand and crushed stone, from the surface to depths below the top of bedrock adjacent to some of the deeper structures such as the FARB and Reactor Building.

3.6 HYDROGEOLOGY

3.6.1 REGIONAL HYDROGEOLOGY

Regionally, there are two major hydrogeologic zones: the overburden and bedrock. The overburden typically acts an aquitard. The regional aquifer is present in the underlying bedrock formations.

The overburden, consisting of the muck and peat, Glacial Lake Clays, and Glacial Till, does not readily store and transmit groundwater in Eastern Michigan. Perched water is common in the overburden (Nicholas and others, 1996). Perched water is groundwater that is above the water table and separated from the water table by an unsaturated zone. Perched water typically occurs in sand deposits that are underlain by clay, but perched water may also be present in any overburden deposit where the water level in the bedrock aquifer is below the overburden/bedrock interface.

Groundwater flow in the regional aquifer is through secondary openings in the bedrock consisting of fractures; very little groundwater flow occurs through primary openings (natural pore spaces in the bedrock). Most of the secondary fractures occur along bedding planes, which dip slightly (5 to 10 degrees) to the northwest. Groundwater flow is preferentially within the bedding plane fractures along strike (northeast-southwest). In some areas, secondary fractures are enlarged by dissolution creating large voids.

Historically, groundwater levels in the regional aquifer were above the water level in Lake Erie. Due to quarrying operations, groundwater levels along most of the shoreline in Monroe County have ranged from slightly above lake levels to tens of feet below lake level since 1991. Figure 10 presents a map with regional quarries in Monroe County.

Regional sinks, or areas of groundwater discharge, from the Regional Aquifer System include discharge to wells, discharge to quarries, and discharge to streams, lakes, and other surface water features.

Regional sources, or areas of groundwater recharge, to the Regional Aquifer System include vertical downward leakage from the overlying overburden. Leakage is the term used to describe the supply of water flowing to the bedrock aquifer instead of recharge (from precipitation), because water from the surface must move through the overlying overburden deposits. Leakage to the bedrock aquifer is highest in areas where the water level in the glacial deposits is higher than that in the bedrock aquifer and in areas where the glacial deposits have higher vertical hydraulic conductivity than other areas. Leakage also can be out of the bedrock aquifer to the overlying glacial deposits (particularly near significant surface water bodies like Lake Erie). Regionally, leakage to the bedrock aquifer has not been measured directly in Monroe County.

3.6.2 STATION HYDROGEOLOGY

At the Station, there are three hydrogeologic zones: Shallow, Intermediate and Deep, corresponding to Fill, Glacial Lake Clay and Glacial Till, and Bedrock, respectively.

For comparison, the Fermi 3 COLA defined two hydrogeologic zones at the Site consisting of the overburden and bedrock. It appears that the COLA did not consider multiple hydrogeologic zones in the overburden due to the regional scale of the study, which was the purpose for the license application.

Table 3 presents an overview of the Site-specific hydrogeologic units. The following sections describe the hydrogeologic aspects of each zone.

3.6.2.1 CLAY FILL (SHALLOW)

The Shallow zone at Fermi 1 consists of Clay Fill. The Clay Fill was used to increase the elevation of the Station outside the areas immediately adjacent to the major Station structures. The source of this Clay Fill was the native Glacial Lake Clay excavated from near the FEC. Furthermore, when emplaced the Clay Fill was compacted. Based on this information and site-specific data, the Clay Fill does not readily store and transmit groundwater.

The following presents site-specific and Station-specific hydrogeologic data regarding the Clay Fill.

Hydraulic Conductivity

Hydraulic conductivity is available for the Shallow zone at the Station from the Fermi 1 Groundwater Characterization. As the Clay Fill is only present at Fermi 1, Fermi 2, Fermi 3 and published literature provide no additional data. The table below presents a summary of the hydraulic conductivity values for the Clay Fill.

Clay Fill

Source	Hydraulic Conductivity (ft/day)
Fermi 1 SCR	0.015
Fermi 2 FSAR	NA
Fermi 3 COLA	NA
Literature	NA

Notes:

- Fermi 1 - based on slug tests completed for 4 monitoring wells.
- NA - Not available or not applicable.

The results of the Shallow zone are on the low end of the hydraulic conductivity scale, and typically considered representative of an aquitard. In comparison, engineered barrier walls installed to prevent the horizontal flow of groundwater, are designed to have similar hydraulic conductivities. These data confirm that the Clay Fill at Fermi 1 does not readily store and transmit groundwater. Low-flow sampling and grain size analysis for monitoring wells installed at Fermi 1 also confirm this interpretation.

3.6.2.2 GLACIAL LAKE CLAY AND GLACIAL TILL (INTERMEDIATE)

The Intermediate Zone consists of the Glacial Lake Clay and Glacial Till. The Glacial Lake Clay and Glacial Till are native, undisturbed overburden sediments. They are relatively low-permeability clays that do not readily store and transmit groundwater. From a hydrogeologic standpoint, the Glacial Lake Clay and Glacial Till are an aquitard.

During drilling of the five bedrock monitoring wells at Fermi 1, observations made of the Glacial Lake Clay and Glacial Till revealed no saturation. Only the EFT-1D boring encountered some water in the Glacial Lake Clay; monitoring well EFT-1I was installed in the Glacial Lake Clay.

The Glacial Till is defined in the Fermi 2 FSAR as "The till is dense, tight, and with the possible exception of interbedded sand stringers, does not produce water in appreciable quantities and possibly acts as an aquitard, a confining layer lying unconformably on the Bass Islands Group." Note that water and contaminants can be transmitted through sand stringers.

Hydraulic conductivity is available for the Intermediate zone from the Fermi 3 COLA and published literature. The table below presents a summary of the hydraulic conductivity values for the Intermediate Zone.

Glacial Lake Clay

Source	Hydraulic Conductivity (ft/day)
Fermi 1 SCR	NA
Fermi 2 FSAR	NA
Fermi 3 COLA	0.028 to 0.56
Literature	0.0028 to 0.28

Notes:

- Fermi 3 - data are for both Glacial Lake Clay and Glacial Till. COLA Section 2.3.1.2.2.4.1. Seven slug tests were completed. The data in the above table does not include the value of 16.5 ft/day as this data point appears to be an anomaly.
- Literature - Carbonate Aquifer Recharge in Western Lucas, County, Northwest Ohio, 1999.
- NA - Not available or not applicable.

Glacial Till

Source	Hydraulic Conductivity (ft/day)
Fermi 1 SCR	NA
Fermi 2 FSAR	NA
Fermi 3 COLA	0.028 to 0.56
Literature	0.0028 to 0.28

Notes:

- Fermi 3 - data are for both Glacial Lake Clay and Glacial Till. COLA Section 2.3.1.2.2.4.1. Seven slug tests were completed. The data in the above table does not include the value of 16.5 ft/day as this data point appears to be an anomaly.
- Literature - Carbonate Aquifer Recharge in Western Lucas, County, Northwest Ohio, 1999.
- NA - Not available or not applicable.

3.6.2.3 BASS ISLANDS GROUP BEDROCK (DEEP)

The Deep zone consists of the Bass Islands Group, which constitutes the regional aquifer. Wells completed in the Bass Islands Group at the Site contain groundwater.

The following presents Site-specific and Station-specific hydrogeologic data regarding the Deep zone.

Hydraulic Conductivity

Hydraulic conductivity is available for the Deep zone at the Station from the Fermi 1 Groundwater Characterization, Fermi 2 UFSAR, the Fermi 3 COLA, and published literature. The table below presents a summary of the hydraulic conductivity values for the Deep Zone.

Source	Hydraulic Conductivity (ft/day)
Fermi 1 SCR	12
Fermi 2 FSAR	2
Fermi 3 COLA	3.28 to 6.92
Literature	5

Notes:

- Fermi 1 - based on slug tests completed for 2 bedrock wells.

- Fermi 2 - Section 2.4.13.2 of the UFSAR.
- Fermi 3 - from COLA Section 2.3.1.2.2.4.1.
- Literature - Carbonate Aquifer Recharge in Western Lucas, County, Northwest Ohio, 1999.

3.6.2.4 PERMEABLE FILL AROUND STRUCTURES

In addition to the above hydrogeologic zones at the Station, permeable, well-drained backfill was used immediately adjacent to major Station structures. This backfill penetrates all three hydrogeologic zone: Shallow, Intermediate, and Deep. The permeable backfill provides a significant hydrogeologic pathway to readily store and transmit water in the subsurface at the Station.

Coarse backfill was identified during completion of EFT-7S and EFT-8SR, which were installed at the locations of the Former Health Physics Building drainage sump and the FARB's waste gas stack, respectively.

The table below presents a summary of the hydraulic conductivity values for the Permeable Fill.

Source	Hydraulic Conductivity (ft/day)
Fermi 1 SCR	NA
Fermi 2 FSAR	NA
Fermi 3 COLA	251 to 1,776
Literature	NA

Notes:

- Fermi 3 - values based on Permeable Fill identified during COLA evaluations at the proposed Fermi 3 Station. Although this material may not be identical to the Permeable Fill at Fermi 1, it is believed to be representative.
- NA - Not available or not applicable.

3.7 INFLUENCES ON STATION GROUNDWATER FLOW

Groundwater flow at the Station is influenced by several natural and man-made features at the Station, FEC and surrounding area. These influences include:

- Impermeable Surfaces

- Permeable Fill
- Dikes and Shoreline Barriers
- Onsite Quarry
- Offsite Quarries
- Lake Erie
- Other Potential Influences

Each of these influences is discussed briefly below prior to discussing groundwater flow at the Station.

3.7.1 IMPERMEABLE SURFACES

A large portion of the Station is covered by buildings, asphalt, and concrete, which act as impermeable surfaces preventing downward migration of precipitation. Furthermore, the storm water drainage system captures precipitation that lands on the Station and conveys it to nearby surface water bodies. Based upon review of the aerial photographs, approximately 80% of the Station is covered in asphalt and concrete with only 20% available for recharge. Normal groundwater recharge near the Station is an average 4 inches per year of the total average 33 inches per year of precipitation (Scientific Investigations Report 2005-5284). Assuming conservatively that 2 inches per year recharge the overburden and the approximate permeable area at the Station is approximately 200,000 square feet, approximately 0.50 gpm would be available for recharge (assuming no leakage from drainage) to the overburden soils. Therefore, little to no precipitation directly recharges the overburden.

3.7.2 PERMEABLE FILL

Near major Station structures, Permeable Fill was used immediately adjacent to major Station structures. This backfill penetrates all three hydrogeologic zones. The Permeable Fill is present to depths below the top of bedrock (e.g., 539 feet datum at the Reactor Building). Therefore, the Permeable Fill is a significant influence to water storage and flow in the subsurface at the Station.

3.7.3 DIKES AND SHORELINE BARRIERS

During construction of Fermi 2 (1968 to 1988), artificial barriers (dikes) were installed around the perimeter of Fermi 2 and adjacent to Fermi 1 to minimize water encroachment (Figure 2). The dikes were constructed into the Glacial Till (approximate elevation of 562 feet datum). The dikes are principally composed of reworked Clay Fill and native clay materials found in the overburden around the Site. These dikes were left in place following construction of Fermi 2, and isolate the overburden in Fermi 1 from Fermi 2. As a result, the clay dikes would influence any groundwater flow. For both Fermi 1 and Fermi 2, the dikes serve to minimize lateral groundwater flow in the overburden (where present).

Shoreline barriers were constructed at both Fermi 1 and Fermi 2 along the western shore of Lake Erie. During the construction of Fermi 1, shore barriers were constructed along the east shore (Lake Erie) and the north shore (lagoon) to protect the Station from storm surges. The barriers were constructed primarily at grade, although some barriers extended several feet below grade. The barriers were constructed of soil, gravel, and rock. Based upon their shallow construction, they are not considered an influence on groundwater flow.

Sheet piling around the intake structure at Fermi 1 and Fermi 2 along Lake Erie was also considered in the assessment of groundwater flow. The piling is composed of ½-inch thick carbon steel that is presumably keyed at a minimum into the Glacial Lake Clay or Glacial Till. The only portion that abuts Lake Erie is at the surface water intakes for Fermi 1 and Fermi 2. Although the sheet pile extends into the Glacial Lake Clay or Glacial Till, it is not a significant influence on groundwater flow as it does not extend for a significant distance along the shoreline.

3.7.4 ONSITE QUARRY

The fill used for the construction of Fermi 2 was rock removed from an Onsite Quarry west of Lagoon Boulevard; the quarry has filled with groundwater since the cessation of operations, and is now identified as Quarry Lakes. The location of the Onsite Quarry is shown on Figure 2. The quarry is approximately 22 acres and 25-feet deep (from natural grade of approximately 575 feet datum).

Onsite Quarry activity started at the north end in June 1969. The purpose of the Onsite Quarry operation was to obtain fill material for construction of Fermi 2. The fill material was obtained by quarrying and subsequent crushing of the rock. Groundwater pumping was used to lower the groundwater table in order to allow for blasting and removal of the bedrock. Conventional dewatering by pumping from sumps was employed. Monitoring of observation wells installed around the quarry documented localized declines in the groundwater table. In addition to these observations and reports that localized well failures might have been caused by the quarry dewatering, operations at the Onsite Quarry were terminated in August 1970.

A study was completed to design future quarry operations to minimize potential impacts to offsite well users. The study included the measurement of water levels at Fermi wells and nearby well users who had experienced water shortages. The study concluded there should be no net withdrawal from the quarry (i.e., pumped water from the quarry should be discharged to another portion of the quarry to promote recharge to the groundwater and no net loss). It was also recommended that the quarry be expanded to the south to minimize potential offsite well impacts as the rock was believed to be less permeable than in the previously quarried areas to the north.

Onsite Quarry operations resumed at the south end of the original excavation in November 1970. Two dikes were built in February and April, 1971, to partition the quarry into sections and allow water to fill the isolated sections. After filling the abandoned quarry sections, the Onsite Quarry effectively functioned as groundwater recharge ponds. During operation of the 'new' quarry area, water was pumped at a rate of 2,000 to 2,500 gpm to the abandoned portions. The water level in the abandoned portions was maintained at 569 feet datum, in order to avoid flooding the active portion of the quarry. Under these operations, approximately 30 gpm of surplus water was discharged into the south lagoon (active portion). Based on water level measurements taken in February 1972, which likely represents the most depressed groundwater elevations at the time of quarry operations, bedrock groundwater flow was from Fermi 1 towards the west to the Onsite Quarry. All operations at the Onsite Quarry were terminated in June 1972. After this time the entire quarry was allowed to fill with water. After filling the abandoned quarry sections, the Onsite Quarry effectively functioned as groundwater recharge ponds.

Details of the history of pumping at the Onsite Quarry are as follows:

- October 2, 1969 - Quarry operations started for Fermi 2 construction. Pumping to the south lagoon average 770 gpm.
- August 2 1970 - Quarry pumping ceased due to reports that localized well failures might have been caused by the quarry pumping. A study was completed to design future quarry operations to minimize potential impacts to offsite well users. The study included the measurement of water levels at Fermi wells and nearby well users who had experienced water shortages. The study concluded there should be not net withdrawal from the quarry (i.e., pumped water from the quarry should be discharged to another portion of the quarry to promote recharge to the groundwater

and no net loss). It was also recommended that the quarry be expanded to the south, where the rock was believed to be less permeable than in the previously quarried areas to the north.

- November 19, 1970 - Quarry operations started in the center part of the quarry. Water was pumped at an average rate of 4,200 gpm to the south lagoon in order to maintain the water level at an elevation of 547 feet datum.
- February 23, 1971 - Construction of an earth dike between the north and middle sections of the quarry was completed. Water was pumped from the middle to north section. Average pumping to the south lagoon was 420 gpm.
- August 28, 1971 - Construction of an earth dike between the south and middle sections of the quarry was completed. The middle section of the quarry was ceased, and operation of the south section of the quarry began. Water was pumped from the south section to the middle section.
- October 20, 1971 - The middle section of the quarry filled to an elevation of 569 feet datum. Water from the south lagoon was pumped at an average rate of 30 gpm.
- June 30, 1972 - Quarry operations ceased (Reference EF-2-ER-OL, Fermi 2 Operating License Environmental Report submittal.). The quarry was allowed to fill with groundwater. The quarry is divided into three sections separate by dikes with depths ranging from 20 to 70 feet. The total quarry area is approximately 40 acres.

An analysis completed in June 1975 reviewed the potential impacts of the Onsite Quarry pumping during operations on the groundwater levels and flow near the Site. The analysis concluded that during the operations of the Onsite Quarry:

- There was no impact from the quarry operations 25 miles away (Petersburg; west-southwest) based on observations made in a USGS well.
- There was no impact from the quarry operations 3 miles away as observed in Well 24Q1 completed to 50 feet deep in the Bass Islands dolomite.
- There was an impact from quarry operations less than 1 mile to the west and east of the Quarry based on declining groundwater elevations observed at wells 19B2 and 29B1. The groundwater elevations in these wells returned to normal by the spring of 1973; however, a certain amount of decline and subsequent rise in groundwater elevations was attributed to a significant drought from 1970 through 1972.

Water level observations were made during and after the quarry operations in several observation wells (as shown on Figure 2.5-25 of the Fermi 2 UFSAR Supplement 1 1975). It is likely that during operations groundwater elevations in the quarry were approximately 550 feet datum. During this time, groundwater elevations were lower than Lake Erie, and therefore bedrock groundwater at the Site was influenced by the Onsite Quarry.

In order to estimate the impacts of the Onsite Quarry during its three year operational period, and the groundwater flow velocity from the Station to the quarry was estimated. The horizontal groundwater flow velocity can be estimated using the following form of Darcy's Law (Freeze and Cherry, 1979):

$V = Ki/n_e$; where:

V = average linear flow velocity (ft/day)
K = hydraulic conductivity (ft/day)
i = hydraulic gradient (ft/ft [i.e., unitless])
n_e = effective porosity (percent [i.e., unitless])

Assuming a hydraulic gradient of 0.005 feet/feet (570 feet datum at Fermi 1 minus 550 feet datum at the Onsite Quarry divided by 4,000 feet), and a hydraulic conductivity of 12 feet per day (Fermi 1), and an effective porosity of around 30 percent (Freeze & Cherry, 1979), the estimated groundwater flow velocity in the bedrock aquifer during operation of the Onsite Quarry was 0.20 feet per day, or approximately 73 feet per year. Although the Onsite Quarry did induce a hydraulic gradient from the Station to the west towards the quarry, the estimated flow distance during this time period would have been approximately 220 feet. Therefore, groundwater beneath the Station did not reach the quarry, and the impact of the Onsite Quarry during its operation can be concluded to be minimal on bedrock groundwater flow at Fermi 1.

Since operations ceased in 1972, groundwater elevations in the quarry have been approximately equal to the bedrock aquifer groundwater elevation at Fermi 1 (e.g., 572 feet datum). Therefore, since 1972 the Onsite Quarry has had minimal influence on bedrock groundwater elevations and groundwater flow.

3.7.5 OFFSITE QUARRIES

Quarries have operated in the study area for decades. Aggregate quarries typically dewater the bedrock to provide access for the quarrying equipment and workers. The water pumped from the bedrock aquifer is either used in the other processes at or near the quarry site, or it is discharged to nearby surface water bodies.

From 1985 to 2000, the estimated quarry dewatering has represented approximately 75 percent of the groundwater use in Monroe County. The annualized average total reported discharge for quarries in Monroe County and nearby quarries in Wayne County in 2001 was approximately 23 million gallons per day.

Figure 10 presents a map with regional quarries in Monroe County. The closest offsite quarries are the Rockwood Quarry and Newport Quarry, which are both located approximately 3 miles to the northeast of the Station. The Francestone Quarry is located approximately 8 miles to the southwest. Another major quarry, the Stoneco Denniston Quarry (formerly Hanson Quarry), is located approximately 10 miles to the southwest of the Station. Although no pumping records are currently available for the Stoneco Denniston Quarry, the USGS has estimated that its influence, when pumping, is one-mile inducing flow from Lake Erie toward it and vertical downward gradient in the bedrock. For example, the groundwater level recorded on April 22, 2008 by the USGS for its monitor well number G-17, which is installed in the Bass Islands bedrock adjacent to the Stoneco Denniston Quarry, showed a water elevation of approximately 525 datum, or approximately 45 feet lower than the Fermi 1 bedrock groundwater elevations and Lake Erie during March 2009. Due to its distance from the Site, it is unlikely that the Stoneco Denniston Quarry has directly impacted groundwater flow at the Station. The overall pumping from quarries in Monroe and surrounding counties has resulted in significant groundwater level declines of 10 to 20 feet. These lower groundwater elevations through the County have an influence on bedrock groundwater flow at the FEC For example, wells G-14, G-15, and G-16, located west of the FEC, all show moderate declines of about 10 to 15 feet since 1991. These wells are located approximately midway between the cones of depression associated with the quarries to the north and the south.

The above assessment is consistent with the Fermi 3 COLA that concludes that offsite quarries may influence regional bedrock groundwater, although the magnitude of this impact is unknown. Some bedrock wells at Fermi 3 are completed in the Salina Formation, which underlies the Bass Islands Group. Groundwater elevations in the Salina Formation are lower than the Bass Islands Group. It is possible that the offsite quarries have impacted the Salina Formation creating a downward hydraulic gradient from the Bass Islands and draining the Bass Islands Group to the Salina Formation.

3.7.6 FERMI 2 CONSTRUCTION

During the construction of Fermi 2 (contemporaneous with the Onsite Quarry pumping from 1969 to 1972), dewatering was carried out during construction of Fermi 2 structures that penetrated into bedrock. Dewatering was completed by pumping from bedrock sumps. In order to minimize the dewatering required and minimize the impact to surrounding groundwater elevations, a grout curtain was constructed around the reactor/auxiliary building excavations areas. The grout curtain was completed through the installation of 96 grout holes spaces at 12-foot centers (see Figure 2.5-66 of the Fermi 2 UFSAR, Rev 16, October 2009). The grout curtain and dewatering operation altered groundwater flow outside the excavated area to flow around the grout curtain. Dewatering was used to lower groundwater elevations to approximately 535 feet datum. Water measurements collected at Fermi 2 monitoring wells shows a decrease in groundwater elevation and lack of artesian conditions, which were previously observed (Fermi 2 UFSAR, Rev 16, October 2009). However, the overall impact on groundwater flow from the Fermi 2 construction is not believed to be significant due to the use of the grout curtain. During this time period, the groundwater flow at the Station was from Lake Erie to the west due to the more significant influence of the Onsite Quarry.

3.7.7 LAKE ERIE

Under predevelopment of the County, bedrock groundwater discharged to Lake Erie in the vicinity of the Site. With the development and increased pumping of quarries in the County over the last few decades, bedrock groundwater elevations have declined several tens of feet to below Lake Erie levels. This has induced flow from beneath the lake to local discharge areas (i.e., quarries). Although this has occurred along the western shoreline of Lake Erie, it is not possible to quantify where the reversal in bedrock flow to/from Lake Erie is occurring. It is likely, based on published literature and site-specific data (Fermi 1, Fermi 2 and Fermi 3), that a portion of the bedrock groundwater discharges to Lake Erie.

3.7.8 OTHER POTENTIAL INFLUENCES

There are no production wells at the FEC (all potable and demineralized water is supplied by off-site public water). Four residential potable supply wells are located within a one-mile radius of the FEC, but these wells pump de minimus quantities of water and would not be potential influences on groundwater flow. There are Fermi 1 sumps at elevations below the top of the bedrock, but according to Fermi 1 personnel, one of the sumps pumps only occasionally, and the other below bedrock sumps do not pump. Based on these facts, the production wells and sumps are not significant influences on groundwater flow.

3.8 GROUNDWATER FLOW

The follow presents an overview of groundwater flow at the Station. Groundwater flow is discussed for current conditions, and several historical periods as natural and man-made influences have varied over time. The discussion focuses on current conditions as the most data is available. Figure 11 presents conceptual model figures of groundwater flow over time.

Early-1990s to present - Fermi 1 not operational, Onsite Quarry not pumping, and Offsite Quarries pumping

The following presents an overview of groundwater flow from the early-1990s to the present. During this time Fermi 1 was not operational.. The Onsite Quarry is not pumping during this time period. The offsite quarries are pumping during this time period.

Groundwater flow at the Station occurs primarily in the bedrock (Deep) with little to no continuous, lateral flow in the Clay Backfill (Shallow) and Glacial Lake Clay and Glacial Till (Intermediate). Based on a review of natural and man-made influences, the flow of water in the subsurface is primarily limited to downward percolation in the Permeable Fill immediately surrounding the major Station structures. The Permeable Fill, which is most prevalent laterally and vertically in the middle of the Station (around the Reactor Building), acts as a "funnel" to store and transmit water from the overburden to the bedrock. The relatively impermeable surface at Fermi 1 and the surrounding Fermi 2 dikes minimize water recharge through precipitation and lateral overburden flow in more permeable sediments at Fermi 2, respectively, from recharging the Fermi 1 Shallow and Intermediate zones. Deep groundwater flow is also influenced by offsite quarry operations. During an NRC site visit, it was noted water could be seen in a cutout within the FARB building maintenance pit sump, which is located below the top of bedrock. The water observed below the FARB floor was likely derived from seepage through the Permeable Fill that extends through the Intermediate Zone into bedrock.

Continuous lateral groundwater flow does not occur in the Shallow zone at the Station. This is corroborated by numerous Shallow (-S) monitoring wells that at times do not yield sufficient water to be sampled (e.g., EFT-1S, EFT-8S (often dry), EFT-8SR, and EFT-

9S) and the low hydraulic conductivities of this confining unit. Therefore, no groundwater contour map can be prepared for the Shallow zone.

Table 4 presents groundwater elevation data for Fermi 1 monitoring wells from 2003 through 2006. A comparison of Shallow zone groundwater elevations to Deep zone (Bedrock) groundwater elevations and Lake Erie water elevations are included in the table. Review of groundwater data shows that downward vertical hydraulic head exists from the Shallow zone to the Deep zone at Fermi 1. This comparison is meant to show simply that the water elevation in the Shallow zone is significantly higher than the Deep zone, implying they are not connected hydraulically and that the Shallow zone is perched. The Shallow groundwater elevations are significantly higher (i.e., 5 to 10 feet) than the Lake Erie water elevation, while the Deep groundwater elevations are slightly lower than (i.e., 1 to 2 feet) than the Lake Erie water elevation.

Because the perched water elevations are higher than those of the Bedrock wells and of Lake Erie, the most likely migration path for Shallow water is to penetrate slowly downward through the Clay Fill and into the Glacial Lake Clays and Glacial Till. As the Intermediate zone is also an aquitard, once in the Glacial Lake Clays and Glacial Till further vertical downward leakage is also slow. For example, the USGS has quantified vertical leakage rates in the Glacial Lake Clays on the order of less than 0.001 feet per day. While there may be some lateral groundwater flow in the Shallow zone, it is likely extremely localized and results in flow into more preferred pathways, such as utility corridors and around structures with more Permeable Fill.

Station groundwater contour maps were not created for the Intermediate zone as there is currently only one monitoring well (EFT-1I) in the Glacial Lake Clay; there are no wells constructed in the Glacial Till. Based on information from Fermi 3, it is believed that there would be no continuous flow zone in the Intermediate zone as this zone consists of lean clays with low hydraulic conductivities (page 2-696 and Table 2.4-232, Fermi 3, COLA). Therefore, for the purposes of this report, the Glacial Lake Clay and Glacial Till are not considered an aquifer, since they consist almost entirely of clay and silt. As proposed in Section 6.0, additional Intermediate monitoring wells are proposed.

Figure 12 presents a groundwater contour map of the Bedrock groundwater flow at Fermi 1 for August 31, 2009. This contour map reveals the Bedrock groundwater flow to be to the south to south-southwest. The south-southwest flow in the bedrock at Fermi 1 may be due to regional dewatering of the bedrock aquifer due to offsite quarry operations in Monroe County. In addition, since the Site is located on a peninsula and Lake Erie is to the east and south, this may simply be the natural groundwater flow direction. For comparison, the Fermi 3 COLA also presents contour maps that show Bedrock groundwater flow to the south-southwest.

The Fermi 3 wells are constructed to deeper completion depths within the bedrock as compared to the Fermi 1 bedrock wells. The Fermi 3 groundwater elevations are approximately the same as the Fermi 1 groundwater elevations (see COLA Figure 2.3-36).

Note that the Quarry Lakes (former Onsite Quarry) located southwest of Fermi 3 was not operational during this time period. The Quarry Lakes provide a direct hydraulic connection to the bedrock aquifer. As a result the water level in the Quarry Lakes is currently at the same approximate elevation as bedrock groundwater (572 feet datum).

In summary, as there is no significant groundwater flow in the Shallow and Intermediate zones, preferential downward migration of groundwater at Fermi 1 occurs through preferential pathways located in more Permeable Fill around major Station structures. Once in the Bedrock, groundwater tends to flow to the south-southwest.

1972 to early-1990s - Fermi 1 not operational, Onsite Quarry not pumping, and Offsite Quarries pumping

The following presents an overview of groundwater flow from the 1972 to the early-1990s. During this time Fermi 1 was not operational. The Onsite Quarry was not pumping during this time period. Pumping of the offsite quarries had not resulted in bedrock groundwater elevations below Lake Erie levels.

During this period of time, groundwater flow in the Shallow and Intermediate zone was similar to the present; primarily downward vertical migration to the Deep zone.

The groundwater flow in the bedrock was to Lake Erie. The Onsite Quarry operations had ceased, and the water level in the Quarry Lakes equilibrated to the bedrock groundwater elevation. Also, the offsite quarries had not lowered regional bedrock groundwater elevations below Lake Erie levels.

1969 to 1972 - Fermi 1 operational, Onsite Quarry pumping, and Offsite Quarries pumping

The following presents an overview of groundwater flow from the 1969 to 1972. During this time Fermi 1 was operational. The Onsite Quarry was pumping as Fermi 2 was being constructed. Pumping of the offsite quarries had not resulted in regional bedrock groundwater elevations below Lake Erie levels.

During this period of time, groundwater flow in the Shallow and Intermediate zone was similar to the present. At this time, Fermi 2 was being built by filling in the lagoon to the north and west and the construction of overburden dikes around the perimeter. These events had little impact on Shallow and Intermediate zones as there is little water movement in these materials.

The groundwater flow in the bedrock was likely influenced by the Onsite Quarry pumping (and perhaps Fermi 2 dewatering) during operations from 1969 to 1972. This would have resulted in bedrock groundwater flow from the Station toward the Onsite Quarry during this period of time; however, as discussed in Section 3.7.4, groundwater flow velocities were not significantly higher during this time period to cause migration of bedrock groundwater at Fermi 1 to reach the Onsite Quarry.

1956 to 1969 - Fermi 1 Construction, Startup and Testing, Onsite Quarry not pumping, and Offsite Quarries pumping

The following presents an overview of groundwater flow from the 1956 to 1969. During this time Fermi 1 was constructed, started and testing was performed. The Onsite Quarry did not exist. Pumping of the offsite quarries had not resulted in regional bedrock groundwater elevations below Lake Erie levels.

During this period of time, groundwater flow in the Shallow and Intermediate zone was similar to the present. At this time, lagoons existed to the north and west. These lagoons had little impact on Shallow and Intermediate zones as there is little water movement in these materials. The groundwater flow in the bedrock was to Lake Erie.

Prior to 1956 - Prior to Station Construction, Onsite Quarry not pumping, and Offsite Quarries pumping

The following presents an overview of groundwater flow prior to 1956. During this time Fermi 1 was not operational. The Onsite Quarry did not exist. Pumping of the offsite quarries had not resulted in bedrock groundwater elevations below Lake Erie levels.

During this period of time, the Shallow zone was not present. The muck and peat were present at the surface underlain by native Glacial Lake Clay and Glacial Till (Intermediate zone). The water table existed within the muck and peat horizon near the land surface approximately equal to the Lake Erie level. The groundwater flow in the bedrock was to Lake Erie.

4.0 RADIONUCLIDE ANALYTICAL RESULTS

This section presents an overview of radionuclide analytical results. An evaluation of these results in context of their possible fate and transport is presented in Section 5.0 (Potential Migration of Radionuclides) of this report.

4.1 RADIONUCLIDES OF CONCERN

Based on discussions with Fermi 1 personnel and a review of the radionuclides contained in the American Nuclear Society's Fermi 1 compilation (1979), the radionuclides of concern (ROCs) identified at the Station during the groundwater monitoring planning were:

- Tritium (^{3}H)
- ^{22}Na
- ^{60}Co
- ^{90}Sr
- ^{99}Tc
- ^{137}Cs
- ^{226}Ra
- ^{228}Ra
- Uranium Isotopes

An integral part in the development of the site-specific Derived Concentration Guideline Levels for the Fermi 1 License Termination Plan (LTP) was the identification of potential radionuclides present at the time of Final Status Survey (FSS), which will contribute to the dose based assessment of the radiological status of the site. Radionuclide selection for LTP is a systematic approach to the identification of the potential nuclides and a deselecting of those nuclides which would not be present or would be present in insignificant concentrations. A theoretical suite of radionuclides that would be present in a reactor at shutdown was formulated utilizing the guidance contained within NUREG/CR-3474, Long-lived Activation Products in Reactor Materials, results of past analyses, as well as activation analyses performed. Nuclides with half-lives less than 2 years were discounted as well as those that contributed less than 0.1% to the total activity, and those that were absent from past analyses.

The final suite of nuclides for the LTP was determined to be:

- Tritium
- ^{14}C
- ^{22}Na
- ^{55}Fe
- ^{59}Ni
- ^{60}Co
- ^{63}Ni
- ^{90}Sr
- ^{94}Nb
- ^{99}Tc
- ^{108m}Ag
- ^{125}Sb
- ^{134}Cs
- ^{137}Cs
- ^{152}Eu
- ^{154}Eu
- ^{155}Eu
- ^{238}Pu
- $^{239/240}Pu$
- ^{241}Pu
- ^{241}Am
- $^{242/243}Cm$

Typically, when considering ROCs for groundwater monitoring, radionuclides that are weak adsorbers are usually selected since the travel-time transport model would show that these were the most mobile in the subsurface. This type of monitoring is used in Detection Monitoring as part of an Optimal Groundwater Monitoring System. When developing ROCs for use in the LTP the suite of nuclides are developed by the process of elimination as described earlier, independent of the adsorption and retention of the nuclides on the geologic material. In addition to the ROCs specifically monitored as part of the groundwater monitoring, gross alpha was analyzed during the late 2009/early 2010 round of sampling, as shown in Table 6. The gross alpha analysis would have identified the other weak adsorbers in the LTP suite, such as the listed plutonium isotopes.

4.2 GROUNDWATER RESULTS

Groundwater samples for radionuclide analysis have been collected since April 2004 as part of the decommissioning. Groundwater analyses were performed by the Fermi 2 laboratory and one set and some additional selected samples were sent to an independent laboratory.

Table 5 presents a summary of the radionuclide results for the groundwater samples collected at Fermi 1. The table includes only the analytes of most concern; however, other isotopes were also analyzed. Results from the groundwater sampling indicate no detectable levels of these select radionuclides within the Station monitoring well network for the sampling period.

4.2.1 QUANTITATIVE COMPARISON TO BACKGROUND

Table 6 presents a summary of the uranium and radium radionuclide results for groundwater samples collected at Fermi 1 compared to background locations. The locations and samples are further classified as either overburden or bedrock. Each of the analytical results are compared to background levels using statistical analysis. The background wells used are identified in the table. The Upper Tolerance Limits (UTLs) were calculated at a 95% confidence level for a 90 percentile inclusion. This means that one can expect 10 percent of samples in a background population to exceed such a UTL.

Uranium Results

Based upon the results summarized in Table 6, uranium isotope analytical results for the overburden wells at the Station monitoring wells indicate only one sample, from location EFT-9S (January 2010) being slightly above the established background UTLs. Monitoring well EFT-9S is located immediately to the north of the FARB and is constructed within the clay backfill.

Results for bedrock analytical results for uranium indicate no results at the Station monitoring wells in exceedance of the established background UTLs. The maximum bedrock monitoring well total uranium activity was 1.28 pCi/L at EFT-6D in 2006. EFT-6D is located immediately outside the northeast corner of the Turbine Building.

Radium Results

Based upon the results summarized in Table 6, radium isotope analytical results for the overburden wells from the Station monitoring wells indicate no results above the established background UTLs. The maximum monitoring well total radium activity was 1.98 pCi/L at EFT-5S in 2009.

Results for bedrock analytical results for radium indicate no results at the Station monitoring wells in exceedance of the established background UTLs. Station monitoring wells EFT-4D and EFT-5D routinely exhibit the maximum total radium activity levels. These wells are positioned to the northeast of the Reactor Building and East Sodium Gallery.

Naturally-occurring Radium-226 isotope is routinely detected above the LLD in the majority of background and Station overburden and bedrock monitoring wells.

4.3 SUMP WATER

Sump samples for radionuclide analysis have been collected routinely since 2008 as part of the decommissioning. Radionuclide results for the sump sampling locations are 'non-detect'. A number of sumps are routinely dry, including Sump # 8 which collects Reactor Building foundation drains.

Fermi 1 historically monitored the maintenance pit sump in the FARB. No radiological activity has been detected in the water. Some low level of contamination has been detected in the sediment only that was deposited in the water. In addition, not including the FARB "hot sump", Fermi 1 monitored water collected by various other sumps, including the sump that yields water from the fill surrounding the Reactor Building basement, and has had no detections of radiologic activity above background in the water. Note that the decay and cutup fuel pools were drained in the mid-1970s, so their sumps have been considered abandoned and are not being monitored periodically.

4.4 SOIL

During Fermi drilling, soil samples were routinely collected and screened for radioactivity using a frisker. No radioactivity was detected in any of the soil samples collected.

5.0 POTENTIAL MIGRATION OF RADIONUCLIDES

This section presents a general discussion of the potential migration of radionuclides at the Station. Migration of radionuclides is also considered in Section 6 as part of the evaluation of the existing monitoring well and sump network.

If radionuclides are released to the Shallow and Intermediate zones at Fermi 1, they would migrate primarily vertically downward at a rate based on their respective retardation factor and the magnitude of the release. Table 7 presents the retardation factor and associated migration rate through clay/silt material for the ROCs listed in Section 4. The migration rate for the majority of the ROCs would be extremely slow. The only exception to this is tritium, which would migrate essentially at the same rate as water (little to no retardation). However, even the vertical movement of water would be extremely slow based on the limited groundwater recharge and the fact that the Shallow and Intermediate zones are comprised primarily of clay (Fill and native Glacial Lake Clay and Glacial Till).

Minimal lateral migration will also occur in the Shallow and Intermediate zones. The only exception to this would be along preferential flow paths around utility corridors and toward Station structures that are surrounded by Permeable Fill. In areas where the Shallow and Intermediate zones are absent (i.e., immediately adjacent to Station structures), a radionuclide release would migrate vertically downward through the Permeable Fill into the underlying bedrock.

If radionuclides migrate or are released to the Deep zone (bedrock) at Fermi 1, they would migrate laterally in the direction of groundwater flow in the bedrock (south, southwest). As documented in Section 3.7 and 3.8, bedrock groundwater flow has historically been influenced by both local and regional influences. The major influences would have included Lake Erie, and the Onsite Quarry dewatering during a brief time period from 1969 to 1972. During the operation of the Onsite Quarry, the bedrock groundwater flow was to the west due to an increased hydraulic gradient. An estimated groundwater velocity of 74 feet per year was calculated based on the hydraulic gradient at that time (see Section 3.7.4). As a result of this estimate, an ROC release that occurred from 1969 to 1972 had the potential to migrate approximately 220 feet. In any event, it would not have reached the Onsite Quarry. As shown on Figure 12, groundwater flow in the Bedrock at Fermi 1 is south to south-southwest with discharge to Lake Erie or the lowland area.

6.0 EVALUATION OF WELL NETWORK IN COMPARISON TO POTENTIAL SOURCES

This section presents an evaluation of the well network in comparison to potential radionuclide sources and potential migration. The evaluation was based upon a review of information concerning confirmed or potential historical releases, historic investigations, the systems at the Station that had/have the potential for release of radioactively-contaminated liquids, and an understanding of groundwater flow at the Station.

The following presents a summary of the Areas of Concern (AOCs) for potential radionuclide sources.

- Reactor Building
- Sodium Tunnel and Galleries
- Fission Products Detection (FPD) Building
- Former Health Physics Building
- Fuel and Repair Building (FARB)
- Waste Gas Stack
- Liquid Radioactive Waste Line

Figure 13 presents a map with the existing monitoring wells and proposed additional monitoring wells. Table 8 presents a list of the existing and proposed additional monitoring wells and rationale. The following presents a review of the wells with respect to monitoring potential AOCs.

6.1 REACTOR BUILDING

The Reactor Building is a significant factor in determining groundwater flow at the Station due to its relative central position and depth. Emissions from the Reactor Building are a potential primary source of radionuclide releases or impacts. In addition to the Reactor Building itself, Fermi 1 identified a condensate drainage pipe that discharged potentially radioactive condensate from the aboveground containment structure.

One notable recent event was a fire in the Reactor Building basement on May 20, 2008. A small sodium fire occurred in the basement. The basement was subsequently posted as contaminated. The contamination was measured to be <500 to 2,000 dpm/100cm^2 general area and up to 30,000 dpm in pits under 30-inch pipes. The area was decontaminated, except in areas where contaminated work was being performed. The basement is presently posted as contaminated to support decommissioning activities. The basement will be remediated as necessary and radiologically surveyed.

Several wells (EFT-6S, EFT-6D, and EFT-10S) near the Reactor Building monitor for possible releases from the Reactor Building and the air conditioning condensate line, which was on the east side of the Station north of the FPD Building.

Potential releases or impacts from the Reactor Building are monitored by EFT-6S and EFT-10S in the Shallow zone. Monitoring well EFT-6S, located approximately 12 to 15 feet east from the FPD Building, is screened from elevation 573 to 578 feet datum within a sandy backfill material. The air conditioning condensate line, which was constructed at an approximate invert elevation of 590 feet datum, runs to approximately 1-foot below grade and then descends to greater than 4-feet below grade near the east fence. The air conditioning condensate line is at a higher elevation than the screened interval to the EFT-6S well, and as such, any prior releases from the air conditioning condensate line could be monitored by this nearby well. No activity was detectable when the portion of the condensate line outside the building above grade was removed. Monitoring well EFT-10S was constructed with a 3-foot long screen interval with a screen elevation of approximately 569 to 572 feet datum. The well is positioned southwest of the Reactor Building and constructed within the lean clay backfill of building. EFT-10S would monitor for any potential releases above the building floor in the immediate vicinity of the Reactor Building wall.

Potential releases or impacts from the Reactor Building are monitored by EFT-6D in the bedrock when the flow is to the south and southeast. EFT-6D, located approximately 50 feet southeast of the Reactor Building, is screened from 551 to 556 feet datum. This monitoring well monitors the vertical zone immediately at and above the 12-foot concrete Reactor Building floor (551 feet datum).

Sump # 1 serves the Reactor Building. Sump #1, which collects water in that annulus space around the Reactor Building at an invert depth of 551 feet datum, monitors the Reactor Building annulus.

Based upon our understanding of the construction of the Reactor Building, the existing monitoring well and sump network is sufficient to monitor any historical or ongoing releases from the Reactor Building or the ancillary air conditioning condensate line. However, additional proposed monitoring wells in the intermediate zone (EFT-11I and

EFT-12I) and deep zone (EFT-11D and EFT-12D) would be beneficial to provide hydraulic data and sentinel monitoring points. The proposed depths for EFT-11D and EFT-12D are 530 feet datum to 540 feet datum so that they are below the invert of the Reactor Building.

Releases from the Reactor Building and vicinity would likely enter the bedrock groundwater flow system relatively quickly as the Reactor Building is completed within bedrock and surrounded by permeable fill. Assuming upon entering the bedrock groundwater, the approximate groundwater migration velocity would be 0.32 feet per day, or approximately 117 feet per year. This is based on a hydraulic gradient of 0.005 feet/feet (570 feet datum to 568 feet datum divided by 250 feet from the Reactor Building to the new bedrock wells), and a hydraulic conductivity of 12 feet per day (Fermi 1), and an effective porosity of around 30 percent (Freeze & Cherry, 1979). Therefore, the bedrock groundwater travel time from the Reactor Building to the bedrock sentinel wells would be approximately 2 years. Releases would be detected sooner by the existing monitoring wells located immediately around to the Reactor Building. Historical releases (prior to 2000) would have discharged into Lake Erie.

6.2 SODIUM TUNNEL AND GALLERIES

Historically, there were no known releases of primary sodium in the tunnel or secondary sodium in the galleries. Although there were no known releases of primary sodium in the tunnel, possible leakage from the tunnel during operations is a potential source. Recently, contamination was found in the west portion of the sodium tunnel, adjacent to the cold trap room. The extent of contamination is under investigation. Although there were no known releases of the secondary sodium system, the sodium galleries piping did contain small quantities of tritium, and therefore also are considered a potential radionuclides source.

On January 14, 2009, there was a spill in Primary Sodium Storage Tank room. The spill occurred as a result of tank overflow while transferring liquid. There were no cracks observed in the floor or drains in the area of the spill. The average measured contamination was 2000dpm/100cm2 fixed. The spill area will be remediated and radiologically surveyed.

Various small spills have occurred in the Cold Trap room during the processing of sodium. The room has a metal liner and is currently posted as contaminated area. The average measured contamination was of 1000 dpm/100cm2 loose surface. The spill area will be remediated, as necessary, and rad surveyed.

Several wells (EFT-5S, EFT-5D, EFT-6S, and EFT-10S) near the Sodium Tunnel and Galleries monitor for possible releases from these areas.

Based on the invert elevation of the Sodium Tunnel and the construction of the nearby monitoring wells, any potential releases or impacts from the Sodium Tunnel are monitored by EFT-5S, EFT-6S and EFT-10S in the Shallow zone. Monitoring well EFT-5S monitors possible past leakage from the tunnel when groundwater flow is to the southeast. The monitoring locations are situated downgradient from the highest concentration of bends in the primary sodium conduits. Monitoring well EFT-10S monitors any potential releases or impacts from the tunnel to the south. Potential releases or impacts from the Sodium Galleries are monitored by EFT-6S to the east, and EFT-10S to the south and southwest in the Shallow zone.

Potential releases or impacts from the Sodium Tunnel and Galleries are monitored by EFT-6D in the deep zone to the southeast. EFT-6D, located approximately 75 to 100 feet southeast of the Sodium Galleries and Tunnel.

Sumps #3, #4, #8, and #11 monitor West Sodium Gallery, East Sodium Gallery, West Yard, and East Sodium Gallery, respectively. Each of these sumps are constructed within overburden material.

Based upon our understanding of the construction of the Sodium Tunnel and Galleries, the existing monitoring well and sump network is sufficient to monitor any historical or ongoing releases from these areas.

6.3 FISSION PRODUCTS DETECTION (FPD) BUILDING

Fermi 1 identified a drainage pipe on the east side of the FPD Building that discharged condensate potentially radioactively contaminated from the building interior. The drainage pipe was constructed to a depth of approximately 2 feet below grade. Therefore, the location where the drainage pipe exited the FPD Building is a potential radionuclides source. Note that the drainage pipe is no longer in service.

The drainage pipe terminated in the rock/gravel slope outside the fence to the east of the FPD Building. No contamination was detected when the line was removed.

Several wells (EFT-6S, EFT-6D, and EFT-10S) near the FPD Building monitor for possible releases from the FPD and the drainage pipe.

Potential releases or impacts from the FPD Building are monitored by EFT-6S and EFT-10S in the shallow zone. Monitoring well EFT-6S, which is adjacent near the FPD building to the east, monitors the potential release point from the drainage pipe. Monitoring well EFT-10S monitors this potential source to the south or south-southwest if leakage contacted the Steam Generator Building or Turbine Building wall.

Potential releases or impacts from the FPD Building are monitored by EFT-6D in the deep zone. Monitoring well EFT-6D monitors this potential source to the south or south-southwest if leakage contacted the Steam Generator Building or Turbine Building wall and then flowed east.

A monitoring well cannot be installed immediately to the south or southwest of the FPD due to the presence of the underground East Sodium Gallery. If there was leakage to the south, it would likely migrate along the top of the Sodium Gallery. Sump #4 (drawing number G1331-1) and Sump #11, which collect water south of the FBD Building at an invert depth of 551 feet datum, serve this area.

Based upon our understanding of the construction of the FPD Building, the existing monitoring well and sump network is sufficient to monitor any potential releases from the FPD Building or from the drainage pipe.

6.4 FORMER HEALTH PHYSICS BUILDING

The Health Physics Building was demolished in 1980. No drains have been in service since that time. During operation, drains from several employee wash locations, the laundry and the laboratory, drained to an unnumbered sump located at the east end of the former building.

Several wells (EFT-1S. EFT-1D, and EFT-7S) monitor for possible releases from the Former Health Physics Building and surrounding area.

Potential releases or impacts from the Former Health Physics Building and associated drains are monitored by EFT-1S and EFT-7S in the shallow zone. EFT-7S monitors for possible leakage from the sump on the east side of the Former Health Physics Building. EFT-1S monitors for possible leakage to the south-southwest or south, depending on the impact of the Sodium Storage Building foundation on groundwater flow direction.

An additional monitoring well is proposed in the Intermediate zone (EFT-13I) approximately 25 feet south-of the existing eastside sump. This well will be beneficial to monitor potential releases from the building and sump which may have percolated downward. The rationale for this well is described in more detail in Section 6.7 (Liquid Rad Waste Line). Based upon our understanding of the construction of the Former Health Physics Building and with the addition of EFT-13I, the monitoring well and sump network will be sufficient to monitor any historical or ongoing releases from this area.

Note that the drainage lines which carried contaminated liquid will be monitored and removed during the embedded pipe surveys. The unidentified sump, located at the east end of the building, is being removed and any excavation will be monitored per the Final Status Survey program.

6.5 FUEL AND REPAIR BUILDING (FARB)

The Hot Sump, the Cut-Up and Decay Pools, the repair pit, and the waste tanks in the FARB are potential radionuclide sources.

On March 11, 2009, a spill between the railroad tracks occurred from inter-modal in the FARB. The water leaked out of the box containing the OHM and sweep mechanism onto the floor; no cracks were observed to be present in floor in the area of the spill. The spill water was cleaned up. Concentrations of the spill water were measured at 1 million dpm/100cm2 fixed. The area of the spill will be remediated and rad surveyed.

Various minor leaks of sodium have occurred in the Trestle way during transport of fuel from transport container. There were no cracks observed in the floor in the area of the spill. One area was painted and will require removal of paint prior to a radiologically survey. The measured contamination was 2,000 to 14,000 dpm/100cm2 fixed.

Historically, there was no indication identified during the Historical Site Assessment that the fuel pools experienced leakage. Water samples have been taken from the maintenance pit sump, no activity has been detected in the water. Inspection and surveying of the leak detection drain lines will occur after they are uncovered and during the Final Status Survey. The pools have been dry except for minor roof leakage since the 1970's decommissioning.

Several wells (EFT-2S, EFT-2D, EFT-4S, EFT-4D, EFT-5S, EFT-5D, EFT-7S, EFT-8S, and EFT-9S) monitor for possible releases from this area.

Potential releases or impacts from the FARB are monitored by EFT-2S, EFT-4S, EFT-5S, EFT-7S, EFT-8S and EFT-9S in the shallow zone. Monitoring wells EFT-2S and EFT-5S monitor to the east of the FARB. Monitoring well EFT-4S monitors to the southeast of the FARB. EFT-8S monitors to the northeast and EFT-9S monitors to the north. Additionally, well EFT-7S monitors to the west of the FARB.

Potential releases or impacts from the FARB are monitored by EFT-2D, EFT-4D, and EFT-5D in the deep zone. Monitoring wells EFT-2D to the east and EFT-4D and EFT-5D monitor to the southeast of the FARB.

Based upon our understanding of the construction of the FARB, the existing monitoring well and sump network is sufficient to monitor any historical or ongoing releases from this area.

6.6 FORMER WASTE GAS STACK

Possible releases of radioactive condensate may have precipitated from waste gases from the waste gas stack during Station operations.

Several wells (EFT-2S, EFT-2D, and EFT-8S) monitor for possible releases from this area.

Potential releases or impacts from the Former Waste Gas Stack are monitored by EFT-2S and EFT-8S in the shallow zone. Monitor well EFT-8S was installed at the Former Waste Gas Stack location to test for radioactivity due to possible releases of radioactive condensate that may have precipitated from waste gases. Note that a second well (EFT-8SR) was installed at location EFT-8S due to lack of water in the first well. Monitoring well EFT-2S monitors for potential releases to the southeast or south.

Potential releases or impacts from the Former Waste Gas Stack are monitored by EFT-2D in the deep zone. Monitoring well EFT-2D monitors for potential releases to the southeast or south.

Based upon our understanding of the construction of the Former Waste Gas Stack, the existing monitoring well network is sufficient to monitor any historical or ongoing releases from this area.

6.7 LIQUID RAD WASTE LINE

Fluids that were collected at the Former Health Physics Building sump were routed around the north side of the FARB in the Liquid Rad Waste Line. The Historical Site Assessment identified leakage along a portion of the line that was excavated and abandoned; however, isotopes were not identified, as discussed in Section 2.3.8. This line will be excavated and removed during decommissioning activities. Fermi will be remediating the Rad Waste Discharge line from the Former Health Physics Building along its route to the FARB. During remedation, the area remediated will be rad surveyed.

Several wells (EFT-2S, EFT-2D, EFT-7S, EFT-8S/8SR, and EFT-9S) monitor for possible radionuclide releases along the Liquid Rad Waste Line.

Potential releases or impacts from Liquid Rad Waste Line are monitored by EFT-2S, EFT-7S, EFT-8S/8SR, and EFT-9S in the shallow zone. EFT-2S monitors for potential releases to the east. EFT-7S monitors for potential release to the south-southwest. EFT-8S monitors for potential release to the northeast. EFT-9S monitors for potential releases in the vicinity of the previous degradation. Potential releases or impacts from Liquid Rad Waste Line are also monitored by EFT-2D in the deep zone. EFT-2D monitors for potential release to the east.

Based upon our understanding of the construction of the Liquid Rad Waste Line, the existing monitoring well network and the addition of well EFT-13I (see below) is sufficient to monitor potential releases from the Liquid Rad Waste Line.

EFT-13I will be installed northeast of the Sodium Storage Building to monitor groundwater flow in the Intermediate zone. It will be located near the southeast corner of the Former Health Physics Building and approximately 25 feet south from the sump which exists on the east side of the Former Health Physics Building.

Releases from the Rad Waste Discharge Line and the sump would likely migrate vertically downward through the clay overburden at very slow rates. There may a more permeable zone at the overburden-bedrock interface (at the bottom of the Intermediate zone). Assuming upon entering the Intermediate zone, the approximate groundwater migration velocity would be 0.02 feet per day, or approximately 7 feet per year. This is based on a hydraulic gradient of 0.01 feet/feet (1-foot divided by 100 feet from the sump to the new Intermediate well), and a hydraulic conductivity of 0.56 feet per day (Fermi 3), and an effective porosity of around 30 percent (Freeze & Cherry, 1979). Therefore, the overburden groundwater travel time from the sump to the Intermediate well would be approximately 14 years. The above calculation is based on the premise that there is horizontal flow in the Intermediate zone. To date, there is no evidence that this is true. The installation of EFT-13I and two other Intermediate zone wells (EFT-11I and EFT-12I) will provide data to evaluate groundwater flow (if any) in this zone.

7.0 CONCLUSIONS

Based on the findings of this SCM, CRA concludes the following:

- The geologic and hydrogeologic conditions at the Station have been characterized, including subsurface soil types and the direction and rate of groundwater flow. In addition, the groundwater/surface water interaction at the Station has been characterized.
- The groundwater quality at the Station has been characterized through sampling of monitoring well and sumps at the Station.
- Based on a review of radionuclide concentrations detected in water samples collected at sumps and monitoring wells, impacts from Station operations are not likely present in the waters beneath the Station. Based on a review of the analytical results, there are no current leaks of any radionuclides releases at the Station.
- Groundwater availability is limited under natural conditions due to the low hydraulic gradient and low permeability Clay Fill material present at Fermi 1. Therefore, lateral groundwater flow offsite is limited. Groundwater tends to remain in the Clay Fill, which slowly allows for downward vertical infiltration to the underlying bedrock.
- There is lack of monitoring wells in the Glacial Lake Clay and Glacial Till (Intermediate). Future wells installed in this zone should focus on the suspected relatively, more permeable zone at the base of the glacial till (i.e., the bedrock interface), as it has some potential to store and transmit groundwater.
- The bedrock (Deep) is capable of storing and transmitting limited quantities of groundwater. Groundwater flow in the bedrock is to the south-southeast-south-southwest to the south-southwest quadrant.
- Some overburden monitoring wells at Fermi 1 are completed in Permeable Fill. As this material readily stores and transmits water and penetrates the Shallow, Intermediate and Deep zones, it allows vertical downward migration of water.
- There is low potential for migration of radionuclides in the overburden materials (Shallow and Intermediate) due to their low permeability and retardation of the ROCs. If there is a release of radioactive material in the overburden materials, the most likely flow component would likely be downward towards the bedrock.
- There is potential for migration of radionuclides in the bedrock due to the fact that some Station structures are completed into the bedrock and that the bedrock can store and transmit limited quantities of groundwater. However, analytical results to date reveal no elevated detections of radionuclides in bedrock groundwater.

8.0 RECOMENDATIONS

CRA recommends the installation of additional monitoring wells at the Station. The purpose of the monitoring wells is to provide Intermediate and Deep monitoring points to the southeast and southwest and to provide additional control points for groundwater contouring. After installation, CRA recommends additional rounds of groundwater samples and synoptic water level measurements be collected from all Station monitoring wells. Groundwater samples should be analyzed for the groundwater radioactive isotopes presented in Section 4. Statistical analysis should be updated.

Figure 13 presents a map of the recommended additional monitoring well locations. Locations shown are approximate, since underground structures and other interferences need to be considered when siting the wells. Table 8 presents the rationale for the recommended additional monitoring wells. Details are presented in Section 6.0. Fermi 1 should consider the placement of two separate clusters (EFT-11 I/D and EFT-12 I/D) of wells in the southern portion of the Station to further define both bedrock flow in the Deep zone and evaluate the potential for groundwater flow in the Intermediate zone. The wells should be positioned in the southwest and southeast corners of the Station. The screen interval for wells EFT-11I and EFT-12I should include the one-foot zone at the base of the glacial till (on top of bedrock), which is presumably more permeable than the overlying Glacial Lake Clays and Clay Fill. A final determination of the Intermediate screened interval will be made based on field observations (e.g., if only the bottom one-foot zone yields water, then the well screen will be restricted to this interval). The completion interval for wells EFT-11D and EFT-12D should be deep enough to extend below the invert depths of the Station structures. Fermi 1 will also install an additional monitoring well (EFT-13I) in the intermediate zone near the Health Physics Building and associate sump. The well screen will be placed below the invert depth of the sump and extend to the top of bedrock.

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Bedrock Geology of Southern Michigan, MDNR, 1982.

USDA, 1981.

Nicholas and others, 1996.

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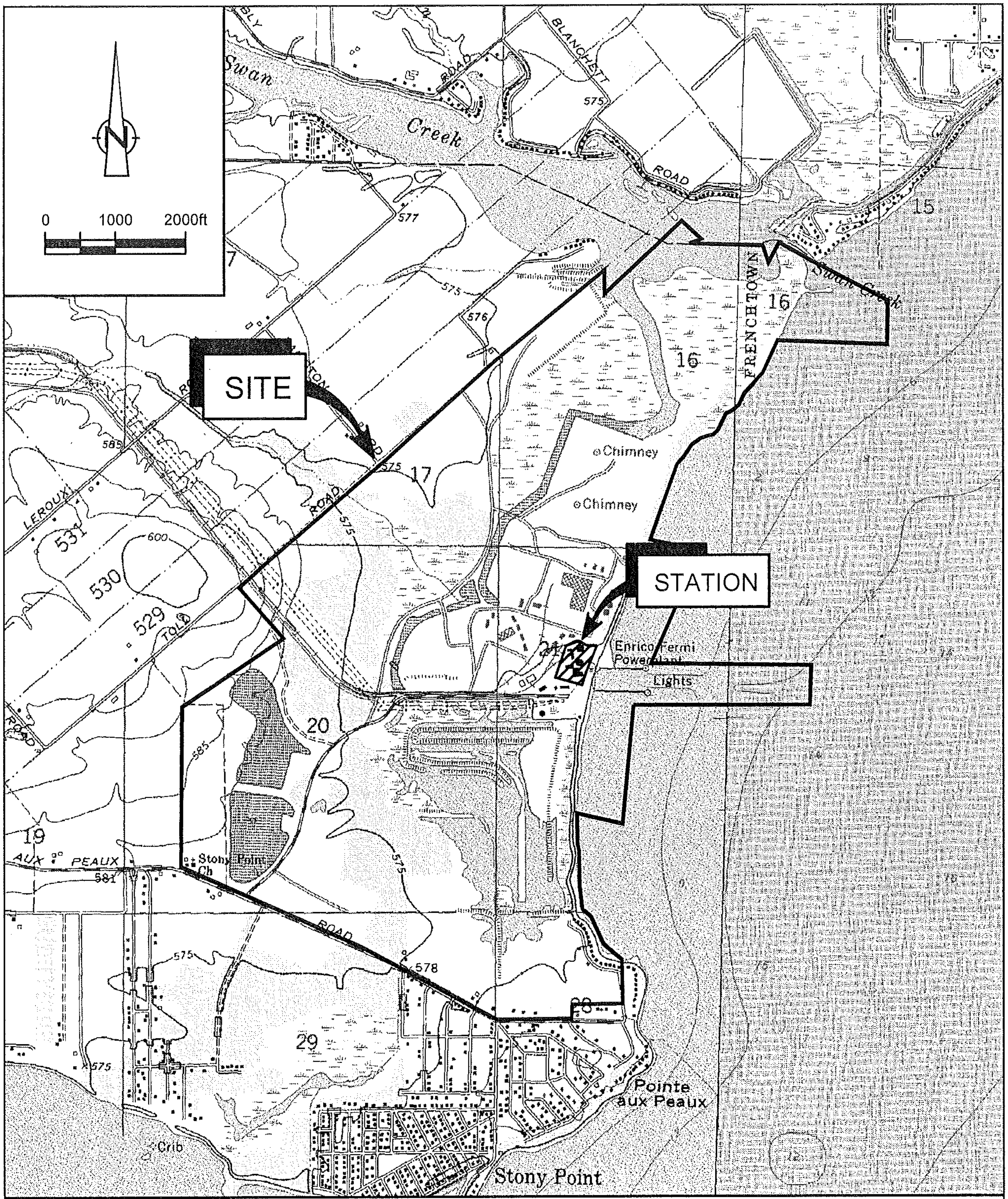


SOURCE: USGS QUADRANGLE MAP;
STONY POINT, MICHIGAN: DATE: 1967; REVISED: 1973
ESTRAL BEACH, MICHIGAN: DATE: 1962; REVISED: 1981

figure 1

SITE LOCATION MAP
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

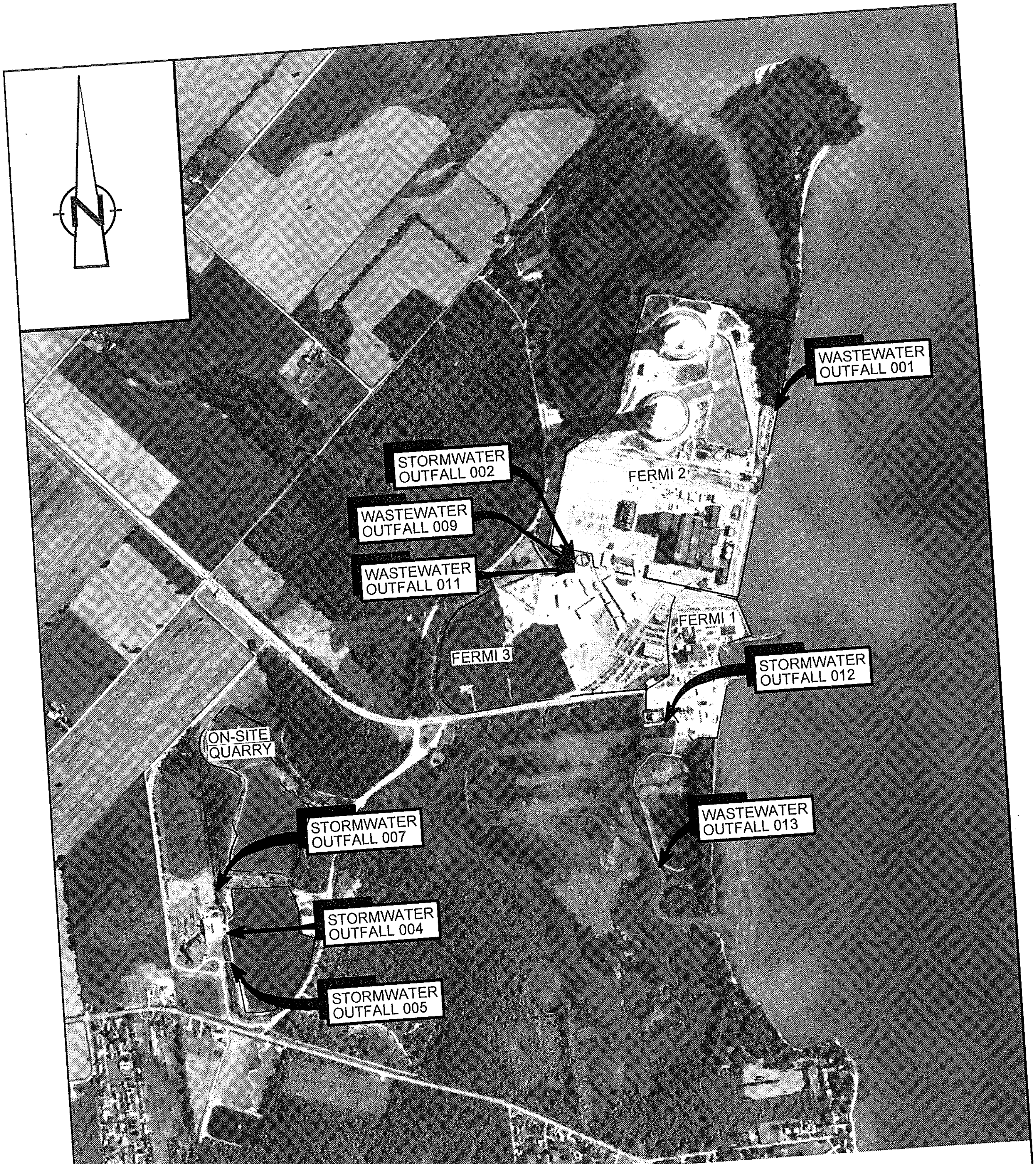


figure 2

AERIAL PHOTOGRAPH SITE MAP
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

058432-02(001)GN-DE002 AUG 25/2010

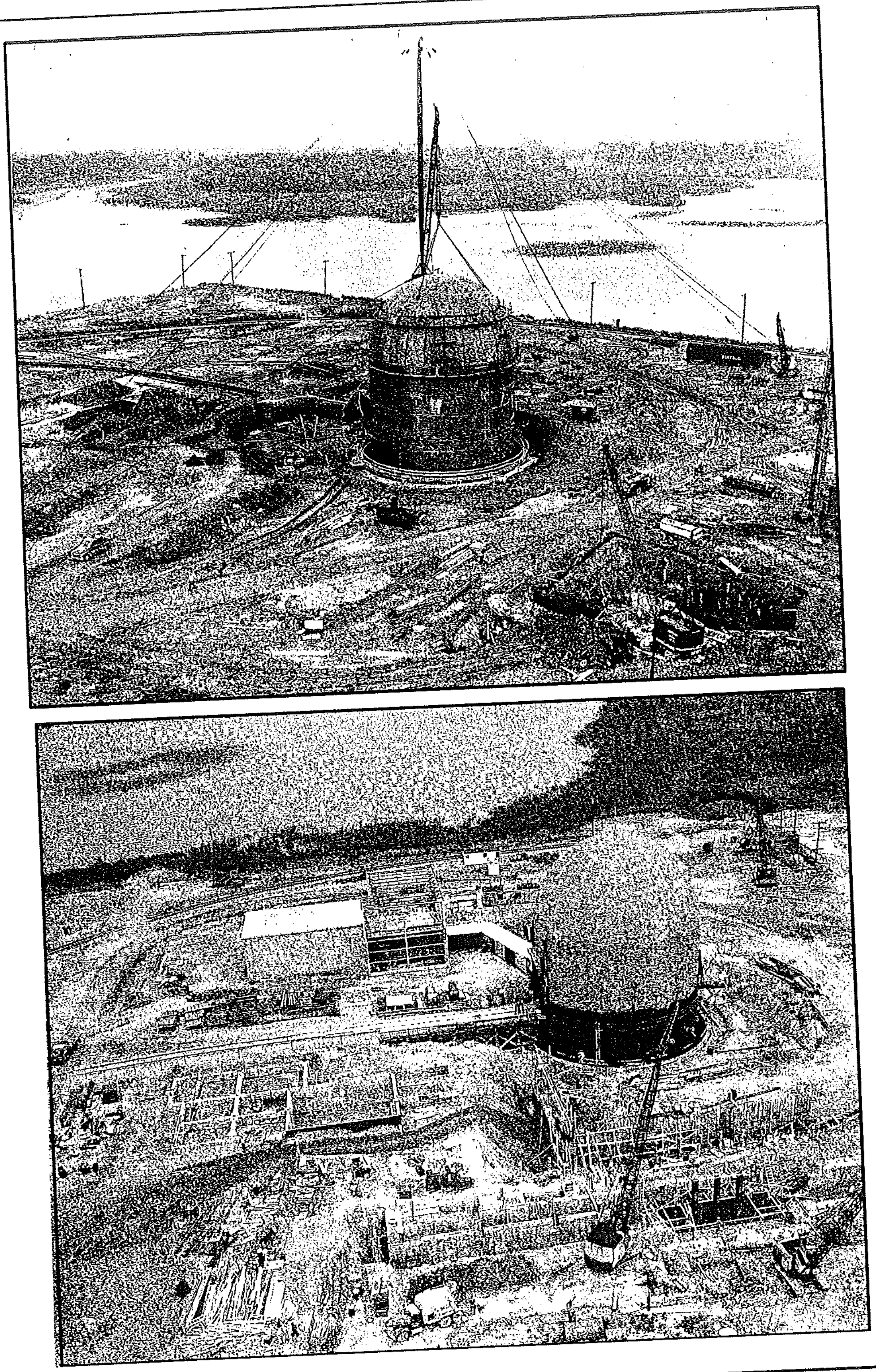
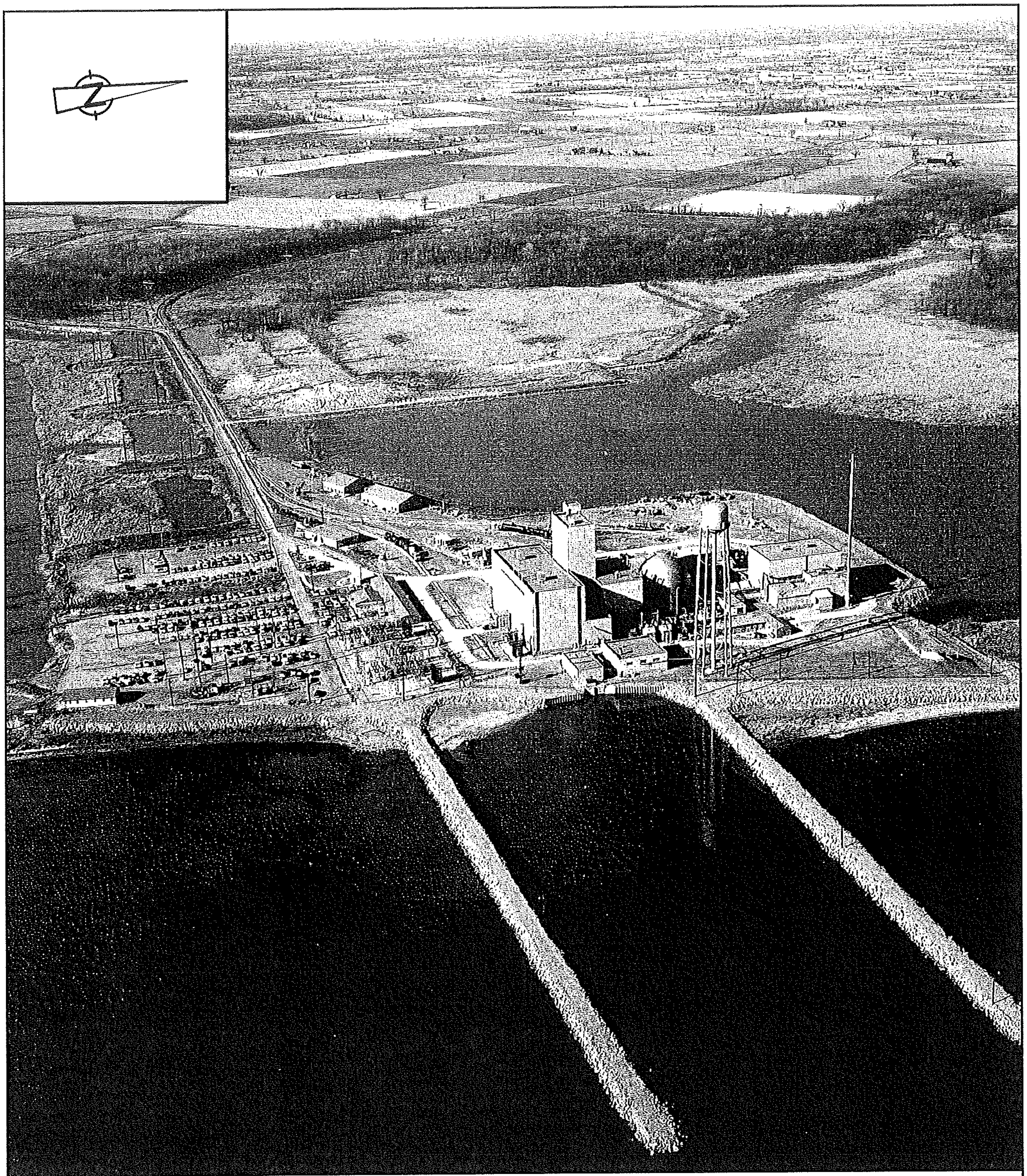


figure 4

SOURCE:

AERIAL PHOTOGRAPH DURING SITE DEVELOPMENT (CIRCA 1950)
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan



SOURCE:

figure 5

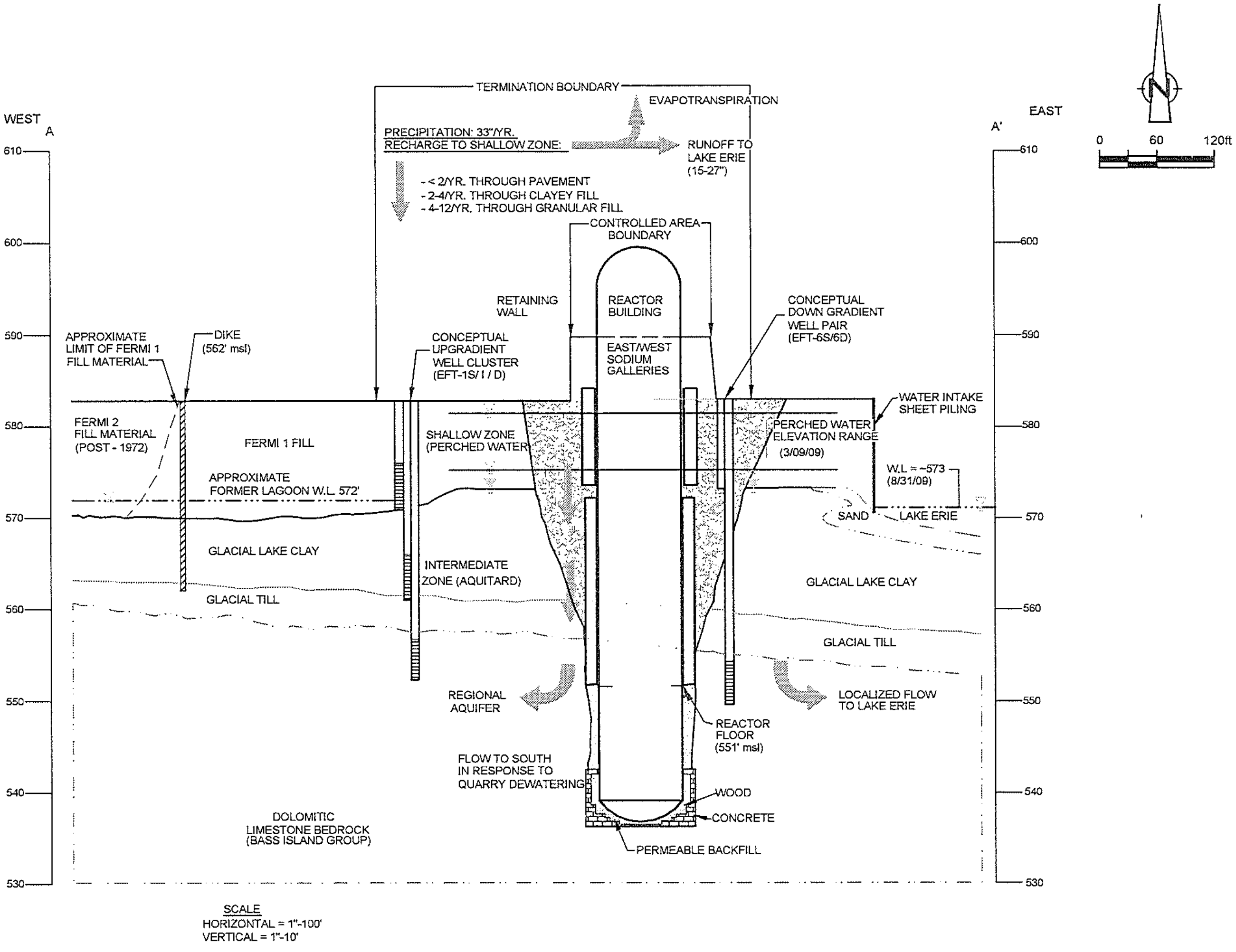
AERIAL PHOTOGRAPH DURING FERMI 1 OPERATIONS
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

LEGEND

- APPROXIMATE WATER TABLE ELEVATION (SHALLOW ZONE)
- APPROXIMATE POTENTIOMETRIC ELEVATION (BEDROCK))
- MONITORING WELL WITH SCREEN INTERVAL (TYP)
- FORMER GEOLOGIC CONTACT (PER - EF1 CONSTRUCTION)
- CONCEPTUAL GROUNDWATER FLOW PATH

REFERENCES

1. POSITIONS OF REACTOR BUILDING AND SODIUM GALLERIES ADOPTED FROM DETROIT EDISON DRAWING NO. 6E721-43-1.
2. GEOLOGIC PROFILES OBTAINED FROM LOGS FOR EF1 BORINGS A-3 (TD=150'), C-3 (TD=30') ON DETROIT EDISON DRAWING NO. 6C721-1902-3 (FEB. 1962), AND EF-2 BORING EF-1 (TD=20') IB DETRIOT EDISON DRAWING NO. 6C721W-7 (SEPT. 1976)

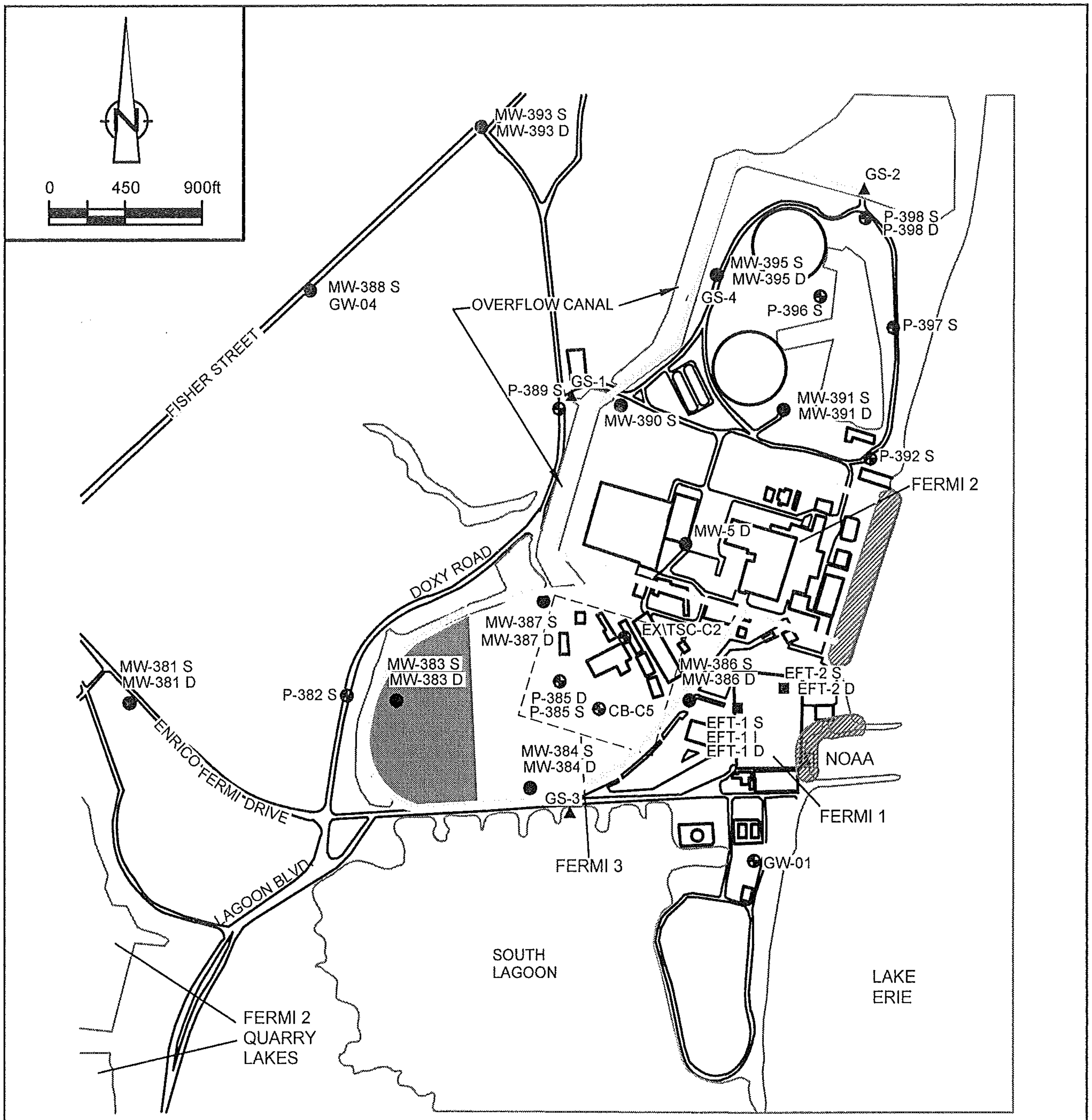


SCALE
HORIZONTAL = 1"-100'
VERTICAL = 1"-10'

figure 6

CROSS-SECTION THROUGH STATION STRUCTURES
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

058432-02(001)GN-DE007 JAN 04/2011



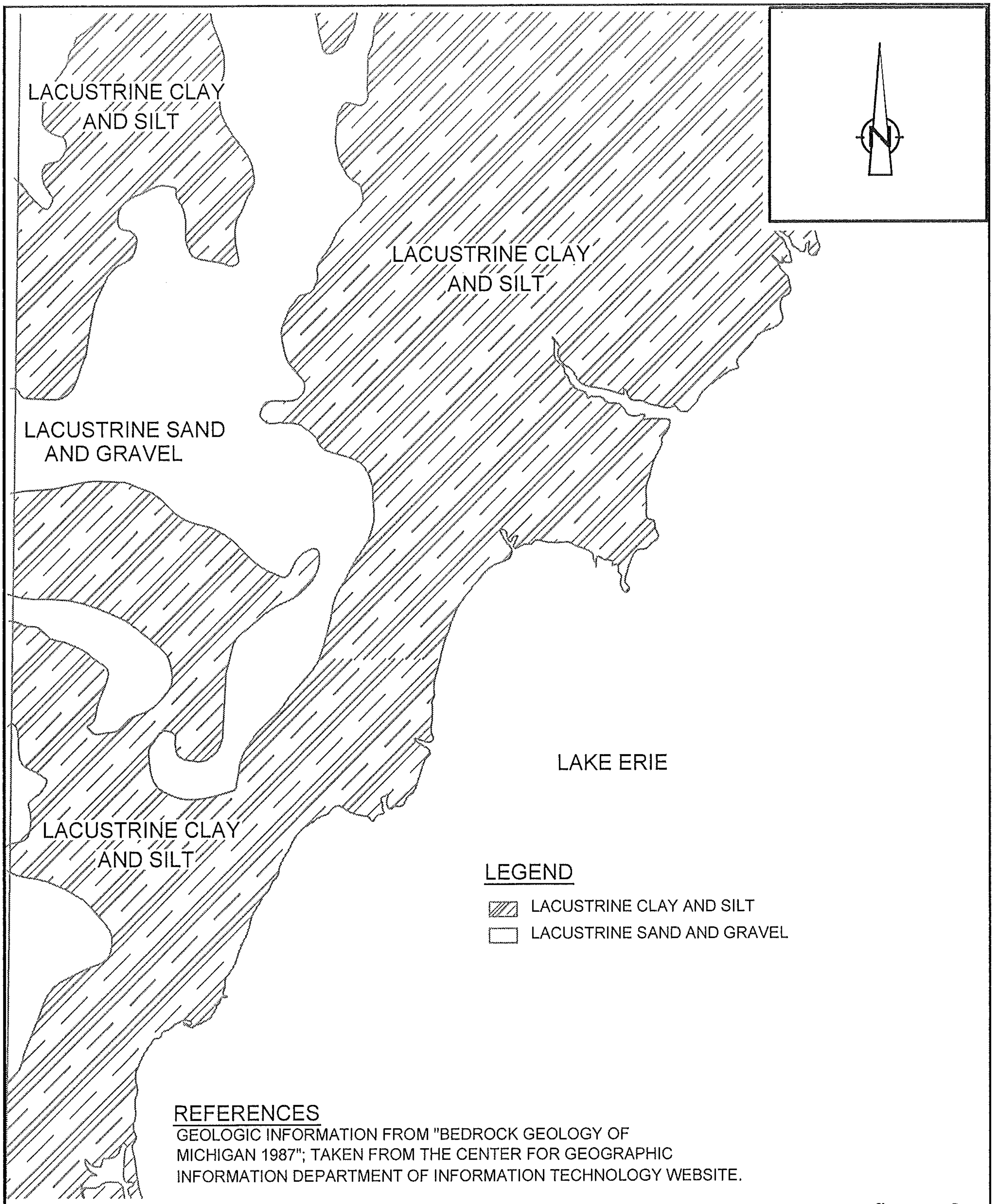
LEGEND

- NOAA FERMI POWER PLANT GAUGE STATION
- EFT-1 S ■ DTE MONITORING WELLS
- MW-384 S ● FERMI 3 COLA MONITORING WELLS
- P-385 D ⊕ FERMI 3 COLA PIEZOMETERS
- GS-3 ▲ FERMI 3 COLA GUAGE STATIONS
- CLAY DIKE
- CULVERT
- ▨ BEACH BARRIER
- ⬚ FERMI 3
- ▩ MUCK DISPOSAL AREA

figure 7

SITE MAP WITH DIKES AND FERMI 2 AND FERMI 3 FEATURES SITE CONCEPTUAL MODEL DTE FERMI 1

Newport, Michigan



LEGEND

▨ LACUSTRINE CLAY AND SILT

☐ LACUSTRINE SAND AND GRAVEL

REFERENCES

GEOLOGIC INFORMATION FROM "BEDROCK GEOLOGY OF MICHIGAN 1987"; TAKEN FROM THE CENTER FOR GEOGRAPHIC INFORMATION DEPARTMENT OF INFORMATION TECHNOLOGY WEBSITE.

figure 8

SURFACE GLACIAL GEOLOGY MAP
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

058432-02(001)GN-DE010 AUG 25/2010

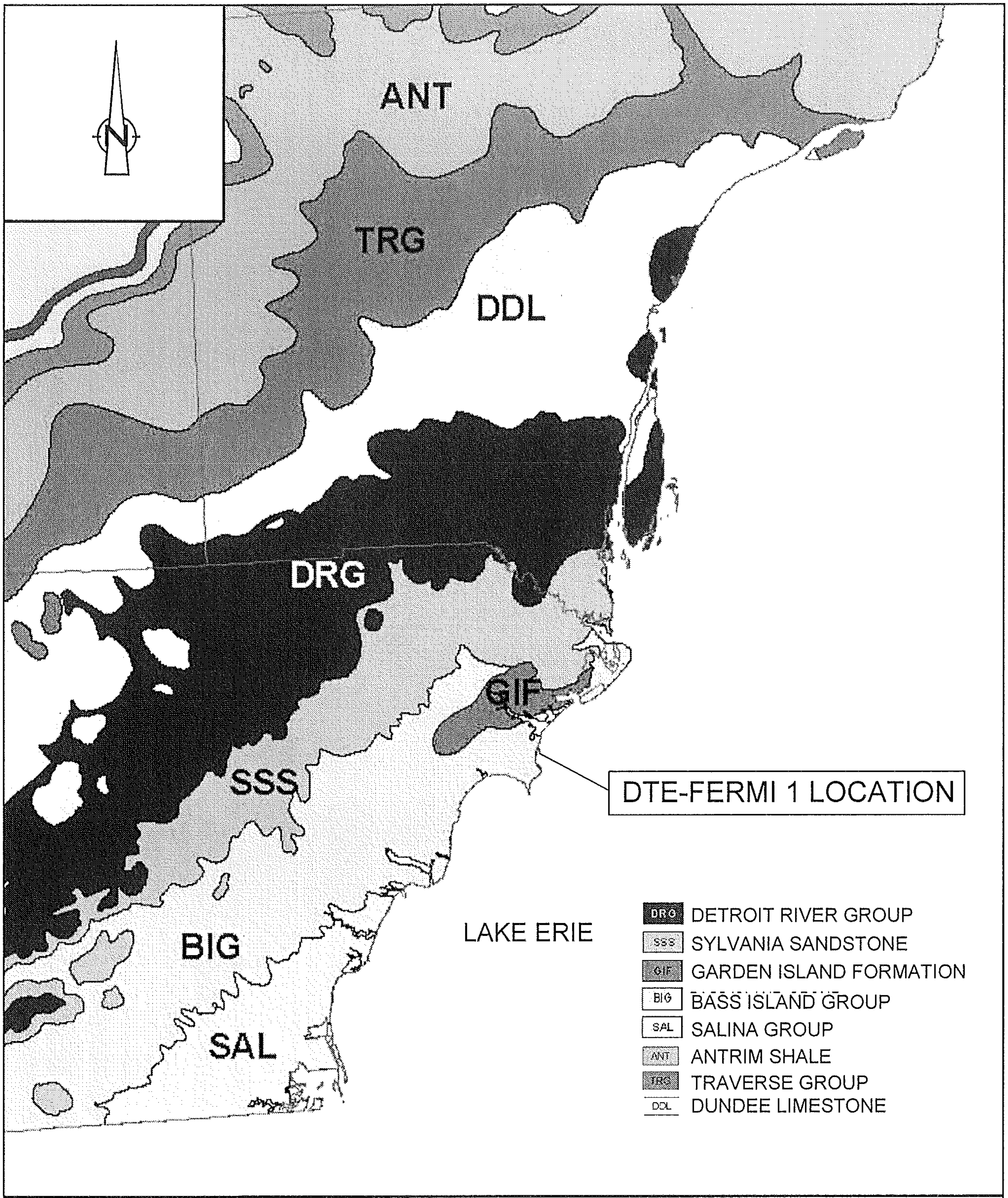
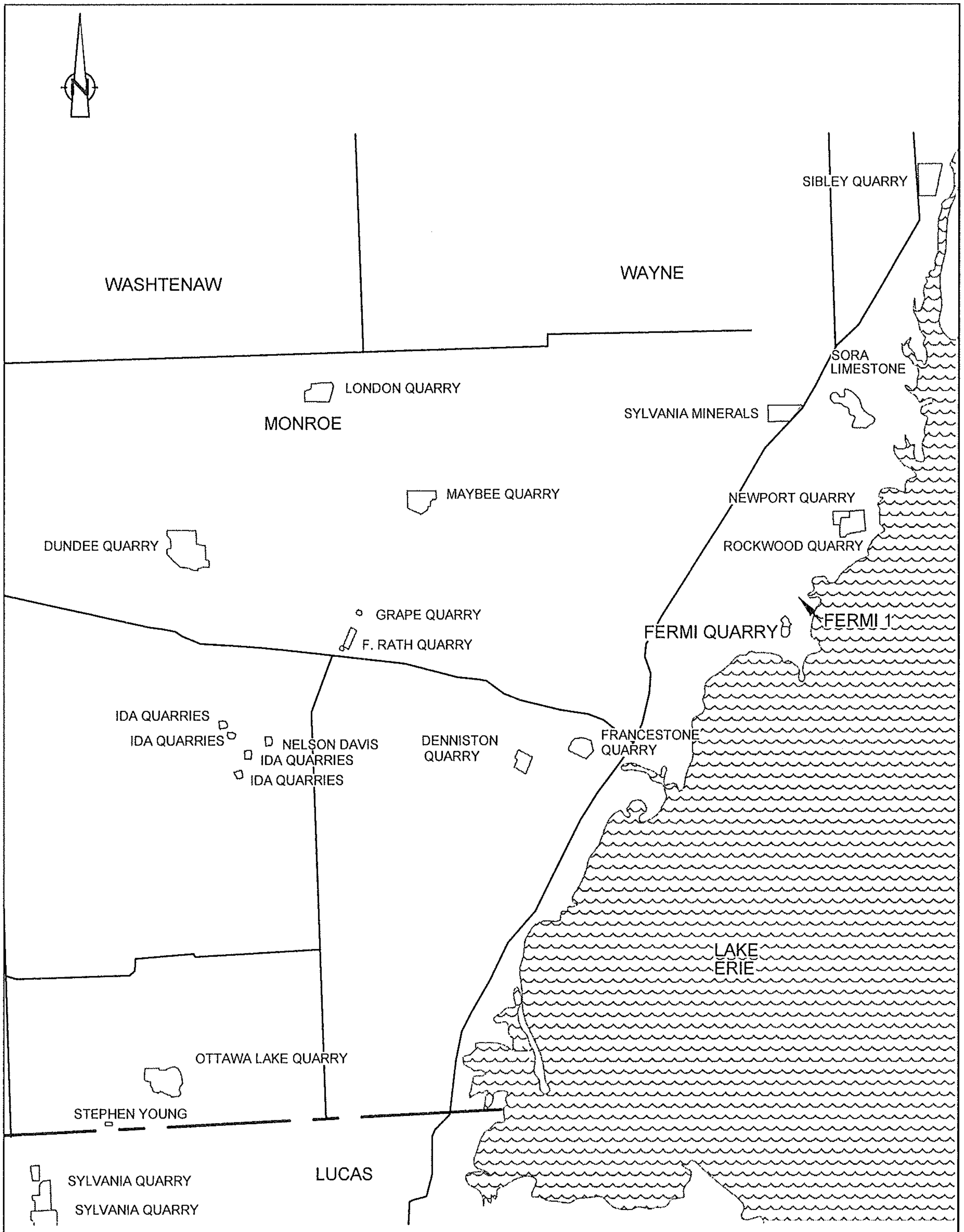


figure 9

BEDROCK GEOLOGIC MAP
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

REFERENCES

GEOLOGIC INFORMATION FROM "BEDROCK GEOLOGY OF MICHIGAN 1987"; TAKEN FROM THE CENTER FOR GEOGRAPHIC INFORMATION DEPARTMENT OF INFORMATION TECHNOLOGY WEBSITE.

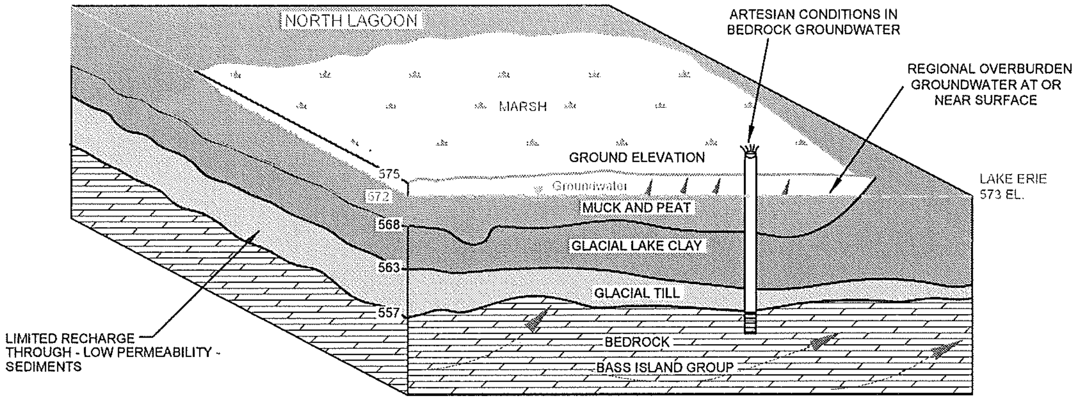


REFERENCE:
ADAPTED FROM FERMI 3, COLA.

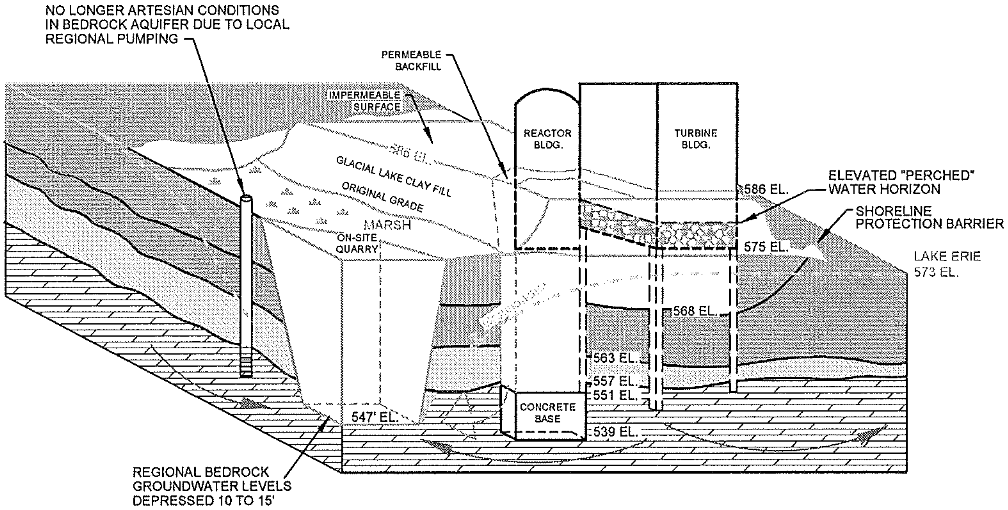
Figure 10

REGIONAL QUARRIES MAP
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

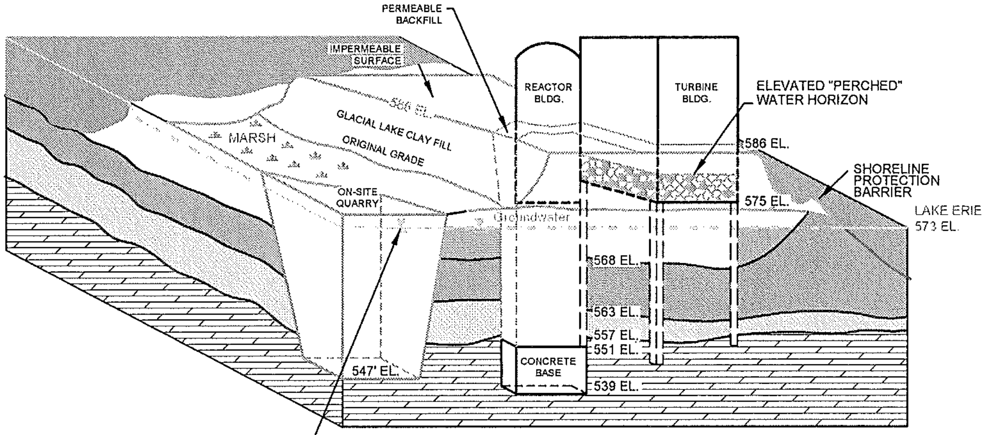
058432-02(001)GN-DE013 AUG 25/2010



PRIOR TO STATION CONSTRUCTION



STATION CONSTRUCTION, ON-SITE AND REGIONAL QUARRY PUMPING

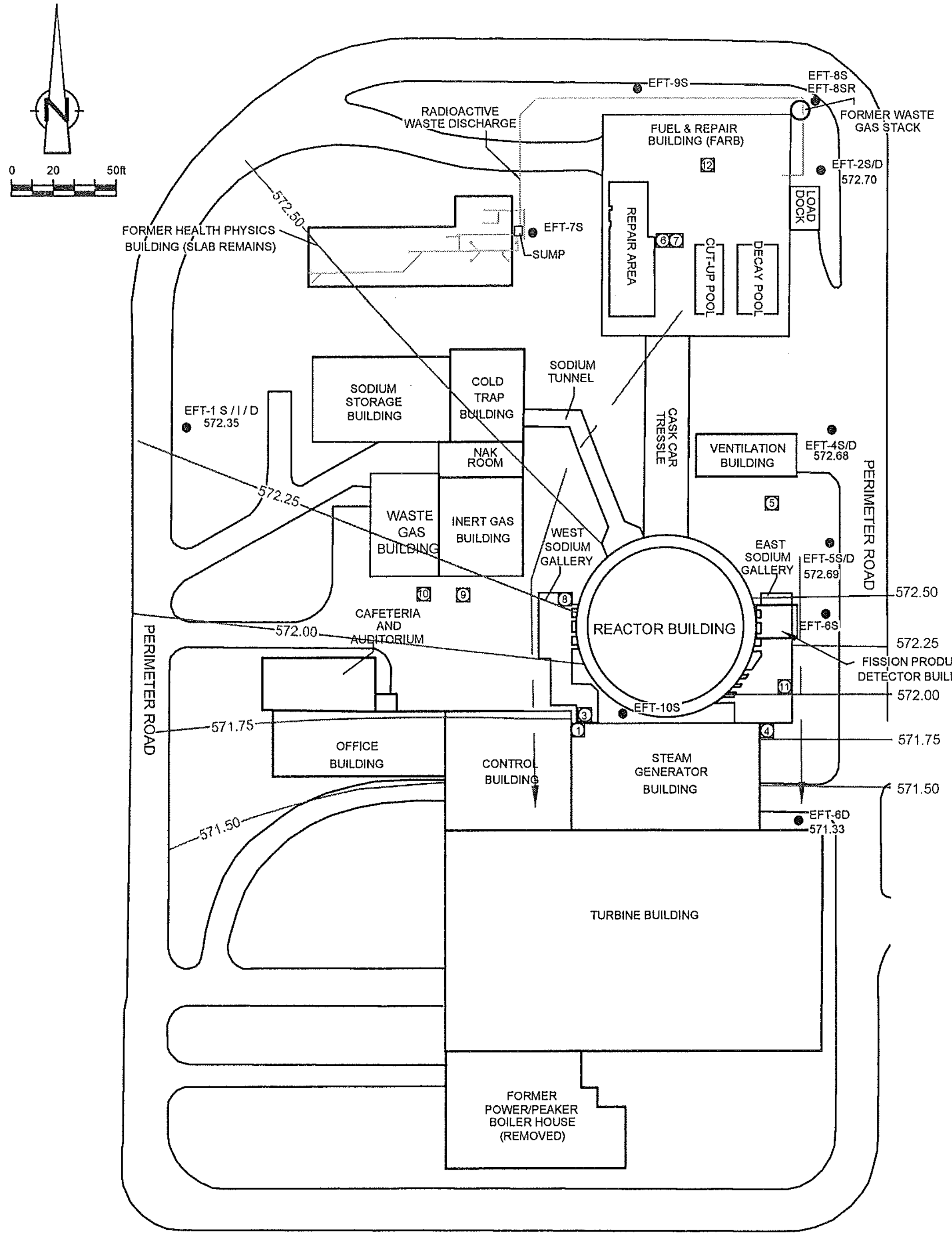


STATION CONSTRUCTION, ON-SITE QUARRY NOT PUMPING AND REGIONAL QUARRIES PUMPING.

figure 11

CONCEPTUAL MODEL FIGURES OF GROUNDWATER FLOW OVER TIME
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

058432-02(001)GN-DE014 JAN 04/2011



NOTES:

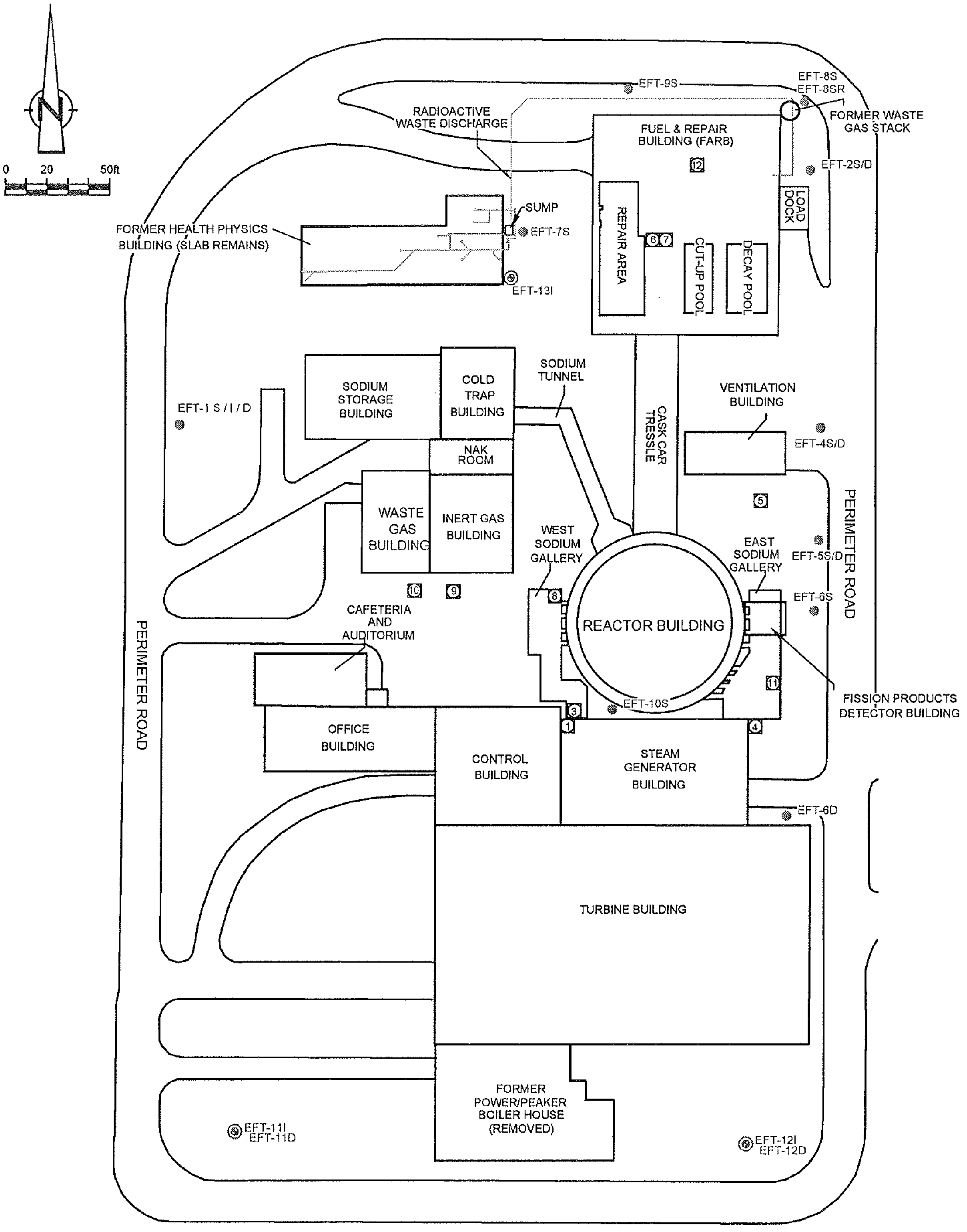
1. DRAWING IS ADAPTED FROM THE FOLLOWING DETROIT EDISON COMPANY DRAWINGS:
   - 6E721-56 (PERIMETER ROAD AND GENERAL BUILDING LAYOUT)
   - 6E721-43-1 (SCALED DIMENSIONS OF SODIUM/GAS BUILDINGS, REACTOR AND FARB)
   - 6P721-1074-1 (SODIUM TUNNEL)
   - 6C721-1640-1 (FARB INTERIOR)
   - 6E721-57-4 (EAST SODIUM GALLERY)
   - 6E721-57-5 (WEST SODIUM GALLERY)
   - 6P721-1117-1 (HEALTH PHYSICS BUILDING AND DRAINS)
   - 6P721-1118-1 (RADIOACTIVE WASTE DISCHARGE LINE)
   - 6P721-1836-20 (FISSION PRODUCTS DETECTOR BUILDING)

LEGEND

5	SUMP
● EFT-1 S / I / D	MONITORING WELL LOCATIONS
572.87	GROUNDWATER ELEVATION
——572.00——	GROUNDWATER CONTOUR

figure 12

BEDROCK GROUNDWATER PIEZOMETER
CONTOUR MAP, AUGUST 31, 2009
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan



NOTES:

1. DRAWING IS ADAPTED FROM THE FOLLOWING DETROIT EDISON COMPANY DRAWINGS:
   - 6E721-56 (PERIMETER ROAD AND GENERAL BUILDING LAYOUT)
   - 6E721-43-1 (SCALED DIMENSIONS OF SODIUM/GAS BUILDINGS, REACTOR AND FARB)
   - 6P721-1074-1 (SODIUM TUNNEL)
   - 6C721-1640-1 (FARB INTERIOR)
   - 6E721-57-4 (EAST SODIUM GALLERY)
   - 6E721-57-5 (WEST SODIUM GALLERY)
   - 6P721-1117-1 (HEALTH PHYSICS BUILDING AND DRAINS)
   - 6P721-1118-1 (RADIOACTIVE WASTE DISCHARGE LINE)
   - 6P721-1836-20 (FISSION PRODUCTS DETECTOR BUILDING)

LEGEND

5	SUMP
● EFT-1 S / I / D	MONITORING WELL LOCATIONS
◉ EFT-12D	PROPOSED WELL LOCATIONS

figure 13

RECOMMENDED MONITORING WELL LOCATIONS
SITE CONCEPTUAL MODEL
DTE FERMI 1
Newport, Michigan

TABLES

TABLE 1

DESCRIPTION OF SUMPS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Sump No.	*Location*	*Area serviced*
1	Steam Generator Building No. 3 Cell at North Wall	Reactor Building Annulus
3	Southwest of Reactor Building	West Sodium Gallery
4	Southeast of Reactor Building	East Sodium Gallery
5	East of Reactor Building Between Axial Fan Pads	Reactor Building Below Floor Cooling Duct Annular Area
6	Fuel and Repair Building Pool Leakage Gallery East of Repair Pit North End of Gallery	Cut-up Pool
7	Fuel and Repair Building Pool Leakage Gallery East of Repair Pit North End of Gallery	Decay Pool
8	West of Reactor Building	West Yard
9	South of Recirculation Gas Tank Room	Gas Tunnel
10	Waste Gas Valve Room Entrance	Waste Gas Building Basement
11	East of Reactor Building Emergency Exit	East Sodium Gallery
12	Fuel and Repair Building Hot Sump	FARB

NOTE: Sumps Nos. 6 and 7 are inactive when the cut-up pool and decay pool, respectively, are drained. If one or both pools are refilled, the respective sump(s) will become active.

TABLE 2

WELL CONSTRUCTION SUMMARY
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Location	*Unit*	*Ground Surface*	*Total Depth*	*Depth to Bedrock*	*Top of Screen*	*Bottom of Screen*
		(feet) [1]	*(feet-bgs.)* [1]	*(feet-bgs.)* [1]	*(feet)* [1]	*(feet)* [1]
EFT-1S	Overburden--Clay Fill	582.38	10.0	n.e.	578.32	573.32
EFT-1I	Overburden--Clay Fill	582.38	21.5	n.e.	565.82	560.82
EFT-1D	Bedrock	582.38	35.5	27.5	551.82	546.82
EFT-2S	Overburden--Clay Fill	583.58	10.0	n.e.	579.58	574.58
EFT-2D	Bedrock	583.58	38.5	30.5	550.58	545.58
EFT-4S	Overburden--Clay Fill	584.78	10.0	n.e.	579.78	574.78
EFT-4D	Bedrock	584.78	40.0	32.0	549.78	544.78
EFT-5S	Overburden--Clay Fill	584.38	10.0	n.e.	580.38	575.38
EFT-5D	Bedrock	584.38	40.5	31.5	551.88	543.88
EFT-6S	Overburden--Permeable Fill	583.18	12.5	n.e.	578.18	573.18
EFT-6D	Bedrock	583.18	46.0	25.0	556.18	551.18
EFT-7S	Overburden--Permeable Fill	582.48	8.0	n.e.	579.98	574.98
EFT-8S	Overburden--Clay Fill	583.18	10.0	n.e.	578.18	573.18
EFT-8SR	Overburden--Permeable Fill	583.18	10.0	n.e.	578.18	573.18
EFT-9S	Overburden--Clay Fill	583.28	12.0	n.e.	578.28	573.28
EFT-10S	Overburden--Permeable and Clay Fill	588.68	20.0	n.e.	571.68	568.68

Notes:

Elevations are given to the Fermi 1 Datum.

1: Source: Golder Associates: Record of Borehole Logs. Elevation values were adjusted to the Fermi 1 Datum (+0.18 feet).

bgs = below ground surface.

n.e. = not encountered.

TABLE 3

HYDROGEOLOGIC UNITS
SITE CONCEPTUAL MODEL
DETROIT EDISON – FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Zone	*Hydraulic Unit*	*Formation*	*Age (Yrs)*	*Lithology*	*Source & Mode of Deposition*	*Thickness (ft)*	*Permeability*	*Description*
Shallow	Perched water bearing zone	Fill	Emplaced during the 1950s; age depends on type of fill	Mostly reworked fine-grained glacial deposits from Intermediate Zone formations (see below) that were excavated during EF1 construction.	Used where granular fill was not needed around subsurface structures. Some sand fill used around the FARB.	9 - 17	Low; On-site tests show geometric mean of 5×10^{-6} cm/sec (0.014 ft/day) hydraulic conductivity	Limited meteoric recharge occurs into subsurface; most precipitation runs off; perched water accumulates in discontinuous pockets of permeable fill adjacent to former and existing subsurface structures. Perched water levels in Shallow Zone are 3 to 6 feet higher than groundwater potentiometric elevations in Bedrock, indicating downward hydraulic gradient across aquitard.
				Crushed dolomitic limestone from the on-site quarry in the Bass Islands bedrock.	Crushed stone surrounds and/or underlies select features that require good drainage.	>25 feet adjacent to reactor and FARB basements	High; (no on-site measurements have been made)	
Intermediate	Aquitard	Glacial Lake Clay	Holocene (<12,000)	Laminated silty clay	Glacial lake	19	Low; (e.g., < 10^{-7} cm/sec (<0.0003 ft/day) hydraulic conductivity; no on-site measurements have been made)	Slow downward penetration of perched water from the Shallow zone. No laterally continuous permeable zones available for lateral groundwater movement. EFT-1I is the only monitor well in the Intermediate Zone.
		Glacial Till	Pleistocene (<2 million)	Unsorted sandy silty clay	Sub-glacial; lodgment till	6		
Deep (Bedrock)	Aquifer	Bass Islands Group	Late Silurian (420 Million)	Dolomitic Limestone; microcrystalline, occasional vugs, stylolites, and fractures	Shallow quiescent marine	700	Moderate; On-site tests show geometric mean of 4×10^{-3} cm/sec (11.34 ft/day) hydraulic conductivity	Groundwater movement is primary lateral.

TABLE 4

GROUNDWATER ELEVATIONS

SITE CONCEPTUAL MODEL

DETROIT EDISON - FERMI ENERGY CENTER

NEWPORT, MICHIGAN

Well:	1S	1D	Head Difference (feet)	2S	2D	Head Difference (feet)	4S	4D	Head Difference (feet)	5S	5D	Head Difference (feet)	6S	6D	Head Difference (feet)	7S	8S	8SR	9S	10S	Lake Erie (Note 5)
Casing Elev 1: (12-03-03)	**584.69**	**584.68**		**583.15**			**586.98**	**587.16**		**586.38**	**586.71**						**582.68**		**582.83**		
Casing Elev 1: (corrected Fermi 1)	**584.87**	**584.86**		**583.33**			**587.16**	**587.34**		**586.56**	**586.89**						**582.86**		**583.01**		
Casing Elev 2: (04-15-05)	**584.72**	**584.72**		**583.14**			**587.07**	**587.16**		**586.54**	**586.74**		**585.53**	**585.55**		**584.82**	**582.68**	**582.77**	**582.92**	**591.38**	
Casing Elev 2: (corrected Fermi 1)	**584.90**	**584.90**		**583.32**			**587.25**	**587.34**		**586.72**	**586.92**		**585.71**	**585.73**		**585.00**	**582.86**	**582.95**	**583.10**	**591.56**	
11/17/03 (11:24)	Dry	570.86		579.57	570.92	8.65				581.88	570.59	11.29									
11/17/03 (13:30)	Dry	570.83		579.60	570.95	8.65				NM	NM										
11/17/03 (15:30)	Dry	570.94		579.55	570.94	8.61				581.86	570.57	11.29									
11/17/03 (16:30)	Dry	570.91		579.58	570.97	8.61				581.86	570.59	11.27									
11/18/03 (08:20)	572.36	571.00	1.36	579.55	571.04	8.51				581.69	570.53	11.16									
11/18/03 (12:20)	572.47	571.02	1.45	579.56	571.06	8.50				581.62	570.60	11.02									
11/19/03	572.65	571.01	1.64	579.54	571.08	8.46				582.30	570.69	11.61									
11/25/03	574.68	570.93	3.75	579.57	571.05	8.52				581.73	570.94	10.79					Dry		574.60		
12/1/03	575.39	571.19	4.20	579.49	571.37	8.12	582.79	571.36	11.43	581.62	571.31	10.31				579.75	Dry		575.27		
12/4/03	575.39	571.27	4.12	578.61	571.38	7.23	581.05	571.34	9.71	581.17	571.28	9.89				NM	Dry		NM		
12/8/03	575.53	571.25	4.28	578.17	571.31	6.86	NM	570.58		NM	570.60					NM	NM		575.02		
2/25/04	575.84	571.47	4.37	575.90	572.85	3.05	580.81	571.14	9.67	581.75	570.99	10.76				576.34	NM		575.72		
4/29 - 5/13/04	577.05	572.71	4.34	578.25	573.06	5.19	580.32	571.69	8.63	580.80	571.56	9.24				578.34	Dry		577.90		
7/28 - 8/05-04	577.85	572.14	5.71	578.48	572.63	5.85	581.85	572.66	9.19	581.34	572.63	8.71	578.52	570.34	8.18	579.82	Dry		576.08		
10/19 - 11/23/04	576.75	571.55	5.20	577.72	571.59	6.13	580.15	571.81	8.34	581.11	571.78	9.33	578.56	569.89	8.67	579.77	Dry	573.19	575.27		
2/1/05	576.07	572.74	3.33	Dry	570.72		580.51	572.59	7.92	580.75	572.58	8.17	578.03	570.83	7.20	578.07	Dry	573.18	NM		
4/19/05	576.97	572.68	4.29	576.31	572.72	3.59	578.20	572.64	5.56	579.06	572.60	6.46	577.57	571.07	6.50	NM	NM	579.71	579.71		
9/22/05	577.11	570.30	6.81	578.64	571.12	7.52	579.49	569.75	9.74	580.37	570.73	9.64	578.03	568.90	9.13	579.58	NM	576.01	579.25	570.67	
2/7/06	576.91	572.73	4.18	575.75	573.14	2.61	582.94	573.13	9.81	581.87	573.09	8.78	579.41	570.93	8.48	578.29	575.30	574.43	578.44	575.47	
6/6/06	577.82	573.05	4.77	578.52	573.19	5.33	581.25	573.04	8.21	581.46	573.12	8.34	579.06	571.78	7.28	578.20	576.14	574.10	579.00	574.96	
12/11/06	578.68	572.85	5.83	576.93	572.87	4.06	580.78	572.82	7.96	580.97	572.81	8.16	578.34	571.50	6.84	578.92	575.54	573.43	578.20	574.24	
8/31/09	578.81	572.35	6.46	579.11	572.70	6.41	580.86	572.68	8.18	581.21	572.69	8.52	578.40	571.33	7.07	579.13	576.06	574.19	578.69	575.35	573.141
Head Difference to Lake Erie (on 8/31/2009)	5.67	-0.79		5.97	-0.44		7.72	-0.46		8.07	-0.45		5.26	-1.81		5.99	2.92	1.05	5.55	2.21	

NOTES:

1. Well numbers are preceded by the prefix "EFT-"
2. Elevations recorded in feet above mean sea level (MSL). TOC elevations provided by Detroit Edison Company.
3. NM = Not Measured
4. Shaded cell indicates that the well had not yet been installed.
5. Lake Erie value posted for August 31, 2009 was a daily average (Reference: http://tidesandcurrents.noaa.gov/; NOAA Station ID: 9063090 at Fermi Power Plant.)

TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #1 (Located near NTC) (GIV-3)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GIV-2)*	*Background #3 (Located by Firing Range) (GIV-4)*	*Background #3 (Located by Firing Range) (GIV-4)*	*Background #3 (Located by Firing Range) (GIV-4)*	*Background #3 (Located by Firing Range) (GIV-4)*	*Background #3 (Located by Firing Range) (GIV-4)*	*Background #3 (Located by Firing Range) (GIV-4)*	*Background #3 (Located by Firing Range) (GIV-4)*
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*June-2007*	*December-2007*	*March-2008*	*March-2009*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*June-2007*	*December-2007*	*March-2008*	*March-2009*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*
Date Analyzed																														
Parameter	Units																													
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.82E-07* <1.12E-06	<3.80E-07	<4.30E-07	<4.30E-07	<4.40E-07	<4.20E-07	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<3.80E-07	<4.30E-07	<4.30E-07	<4.40E-07	<4.30E-07	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<3.80E-07
Na-22	µCi/cc	<8.3260E-09	<1.1768E-08	<1.1929E-08	<1.0235E-08	<9.3854E-09	<3.99E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	<1.1094E-08	<1.1222E-08	<1.2313E-08	<1.2188E-08	<1.2171E-08	<3.71E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	<9.8033E-09	<1.0131E-08	<1.0784E-08	<1.0392E-08	<1.0506E-08	<3.79E-09* Not Reported	Not Reported
Co-60	µCi/cc	<1.2821E-08	<1.1915E-08	<1.0760E-08	<1.1448E-08	<1.3298E-08	<4.60E-09* <6.10E-09	<5.80E-09	<2.80E-09	<5.20E-09	<7.90E-09	<7.90E-09	<1.2236E-08	<1.3055E-08	<1.2897E-08	<1.2301E-08	<1.1514E-08	<3.36E-09* <5.20E-09	<4.60E-09	<4.40E-09	<6.40E-09	<7.10E-09	<8.60E-09	<1.1228E-08	<1.2311E-08	<1.2352E-08	<1.2468E-08	<1.4441E-08	<3.48E-09* <4.50E-09	<4.50E-09
Cs-137	µCi/cc	<8.9032E-09	<9.7535E-09	<8.9682E-09	<9.6380E-09	<1.0172E-08	<3.67E-09* <4.90E-09	<5.70E-09	<2.70E-09	<5.10E-09	<6.30E-09	<7.40E-09	<9.4135E-09	<8.8600E-09	<7.9696E-09	<9.4438E-09	<8.9271E-09	<3.58E-09* <5.20E-09	<4.30E-09	<4.10E-09	<4.70E-09	<6.80E-09	<6.60E-09	<1.0670E-08	<8.7213E-09	<7.5394E-09	<8.1238E-09	<1.1569E-08	<3.45E-09* <5.80E-09	<4.80E-09
Sr-90	pCi/L																													

Notes:
NA = Not analyzed
ND = Not detected
DL = Detectable Level
* = Results reported from General Engineering Laboratories, LLC (GEL)
< = sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	Background #3 (Located by Firing Range) (GW-4)	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1S	EFT-1I	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D	EFT-1D
Date Sampled		June-2007	December-2007	March-2008	March-2009	April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	January-2010	January-2010	April-2004	July-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	July-2007	April-2008	March-2009	September-2009	January-2010
Date Analyzed																		February-10	February-10													February-10
Parameter	Units																	GEL Results	GEL Results									Duplicate				GEL Results
H-3	µCi/cc	<4.20E-07	<4.30E-07	<4.40E-07	<4.30E-07	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<4.85E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	NA	<1.20E-06	<1.41E-06	<1.08E-06	<1.25E-06	<1.18E-06	<4.87E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA
Na-22	µCi/cc	Not Reported	Not Reported	Not Reported	Not Reported	<1.0086E-08	<8.4090E-09	<9.9637E-09	<1.0751E-08	<7.8844E-09	<9.1733E-09	<2.51E-09* <1.1822E-08	<9.5580E-09	<5.5124E-09	<5.3526E-09	<7.9078E-09	<6.4882E-09	NA	NA	<1.0320E-08	<7.8619E-09	<9.0777E-09	<1.1321E-08	<1.2143E-08	<2.80E-09* <1.4078E-08	<9.3654E-09	<1.0331E-08	<8.2444E-09	<6.7178E-09	<7.2134E-09	<1.0735E-08	NA
Co-60	µCi/cc	<2.70E-09	<4.70E-09	<7.70E-09	<8.10E-09	<1.1063E-08	<1.2497E-08	<1.1037E-08	<1.2852E-08	<1.0587E-08	<1.0667E-08	<2.21E-09* <1.3478E-08	<6.6331E-09	<9.3011E-09	<9.2103E-09	<8.5598E-09	<9.2520E-09	NA	NA	<1.3046E-08	<1.2810E-08	<1.2278E-08	<1.3402E-08	<1.4276E-08	<2.93E-09* <8.2906E-09	<1.2187E-08	<9.3008E-09	<9.9910E-09	<9.6580E-09	<1.0387E-08	<8.5320E-09	NA
Cs-137	µCi/cc	<2.70E-09	<3.80E-09	<7.10E-09	<7.40E-09	<9.7608E-09	<9.1448E-09	<8.4271E-09	<1.1096E-08	<1.0602E-08	<9.6622E-09	<2.32E-09* <9.7049E-09	<7.9238E-09	<8.1314E-09	<8.5046E-09	<7.9151E-09	<7.3685E-09	NA	NA	<9.5493E-09	<9.4406E-09	<9.9089E-09	<1.0879E-08	<1.0171E-08	<2.80E-09* <8.9010E-09	<9.3495E-09	<8.2578E-09	<8.4241E-09	<7.8385E-09	<8.1651E-09	<9.3764E-09	NA
Sr-90	pCi/L																	ND	<DL													ND

Notes:
NA = Not analyzed
ND = Not detected
DL = Detectable Level
* = Results reported from Gene
< = sample activity was below t

TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S	EFT-2S
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009
Date Analyzed													
Parameter	Units												
H-3	μCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	DRY	<1.25E-06	DRY	<4.87E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06
Na-22	μCi/cc	<1.0497E-08	<1.0178E-08	<9.1869E-09		<9.6864E-09		<2.05E-09* <1.1379E-08	<4.7855E-09	<7.4184E-09	<1.0288E-08	<6.4658E-09	<7.4678E-09
Co-60	μCi/cc	<1.3569E-08	<1.1138E-08	<8.6360E-09		<1.1308E-08		<2.12E-09* <1.1956E-08	<9.5573E-09	<1.0316E-08	<1.0201E-08	<8.6624E-09	<9.4302E-09
Cs-137	μCi/cc	<8.6460E-09	<8.1008E-09	<9.2891E-09		<6.1138E-09		<1.93E-09* <3.2764E-09	<9.5321E-09	<6.7670E-09	<6.9424E-09	<7.3340E-09	<9.0637E-09
Sr-90	pCi/L												

Well ID		EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D	EFT-2D
Date Sampled		April-2004	April-2004	July-2004	October-2004	November-2004	February-2005	September-2005	February-2006	February-2006	June-2006	December-2006	July-2007	April-2008	March-2009	September-2009	January-2010
Date Analyzed																	February-10
Parameter	Units		Duplicate							Duplicate							GEL Results
H-3	μCi/cc	<1.20E-06	<1.20E-06	<1.41E-06	<1.22E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<1.13E-06	<4.85E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA
Na-22	μCi/cc	<9.6289E-09	<1.0438E-08	<9.4942E-09	<1.1906E-08	<9.4260E-09	<9.7954E-09	<1.0476E-08	<1.0568E-08	<1.0342E-08	<2.09E-09* <1.5904E-08	<1.0902E-08	<1.1650E-08	<7.8808E-09	<9.9496E-09	<9.6978E-09	NA
Co-60	μCi/cc	<1.1704E-08	<1.0097E-08	<1.4079E-08	<1.5042E-08	<1.1037E-08	<1.0389E-08	<1.3085E-08	<1.0851E-08	<1.4306E-08	<1.88E-09* <1.1447E-08	<1.2098E-08	<1.0316E-08	<9.7815E-09	<1.1696E-08	<8.9898E-09	NA
Cs-137	μCi/cc	<9.3513E-09	<6.7600E-09	<1.0681E-08	<8.8931E-09	<9.6981E-09	<9.6680E-09	<8.0124E-09	<9.9376E-09	<1.0840E-08	<1.72E-09* <7.3761E-09	<8.5369E-09	<9.0380E-09	<8.3196E-09	<7.3076E-09	<7.9751E-09	NA
Sr-90	pCi/L																ND

Well ID		EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S	EFT-4S
Date Sampled		April-2004	July-2004	October-2004	February-2005	September-2005	February-2006	June-2006
Date Analyzed								
Parameter	Units							
H-3	μCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<4.85E-07* <1.12E-06
Na-22	μCi/cc	<1.0841E-08	<7.8101E-09	<1.0145E-08	<9.7669E-09	<1.2322E-08	<1.0315E-08	<3.98E-09* <1.0011E-08
Co-60	μCi/cc	<1.2678E-08	<1.3461E-08	<1.0208E-08	<1.0091E-08	<1.5519E-08	<1.1380E-08	<4.29E-09* <1.2594E-08
Cs-137	μCi/cc	<9.8021E-09	<8.1678E-09	<9.1254E-09	<9.6594E-09	<1.0487E-08	<1.2541E-08	<3.67E-09* <8.9335E-09
Sr-90	pCi/L							

Notes:
NA = Not analyzed
ND = Not detected
DL = Detectable Level
* = Results reported from Gene
< = sample activity was below t

TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*
Date Sampled		*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*June-2006*
Date Analyzed															
Parameter	Units														*Duplicate*
H-3	μCi/cc	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.20E-06	<1.37E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<4.84E-07* <1.12E-06
Na-22	μCi/cc	<7.4412E-09	<8.4466E-09	<1.0389E-08	<9.6679E-09	<7.6616 E-09	NA	<1.0169E-08	<8.3089E-09	<1.1935E-08	<9.3931E-09	<9.8071E-09	<1.1508E-08	<3.50E-09* <1.3470E-08	<3.56E-09* <1.0393E-08
Co-60	μCi/cc	<1.0900E-08	<8.9259E-09	<8.2588E-09	<1.0954E-08	<9.2386E-09	NA	<1.1981E-08	<1.1611E-08	<1.0259E-08	<1.2979E-08	<1.2998E-08	<1.2268E-08	<3.68E-09* <1.2313E-08	<3.72E-09* <1.0128E-08
Cs-137	μCi/cc	<8.4829E-09	<8.8156E-09	<8.2304E-09	<8.6006E-09	<9.0753E-09	NA	<8.6459E-09	<7.2827E-09	<6.9107E-09	<1.0868E-08	<1.0589E-08	<1.0005E-08	<3.35E-09* <9.4605E-09	<3.55E-09* <6.1486E-09
Sr-90	pCi/L						NA								

Well ID		*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*
Date Sampled		*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*
Date Analyzed							*February-10*						
Parameter	Units						GEL Results						
H-3	μCi/cc	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.29E-06	<1.10E-06
Na-22	μCi/cc	<8.9950E-09	<8.9316E-09	<9.1459E-09	<6.9588E-09	<8.7548E-09	NA	<1.2267E-08	<1.0827E-08	<1.0156E-08	<1.0087E-08	<1.1347E-08	<1.3134E-08
Co-60	μCi/cc	<8.3117E-09	<8.8466E-09	<1.0023E-08	<9.6977E-09	<9.8457E-09	NA	<1.0968E-08	<1.1448E-08	<1.0691E-08	<1.4063E-08	<9.2084E-09	<1.2518E-08
Cs-137	μCi/cc	<9.2439E-09	<8.4863E-09	<8.7263E-09	<8.8013E-09	<7.0717E-09	NA	<9.9056E-09	<7.0427E-09	<9.5432E-09	<8.8377E-09	<8.4928E-09	<1.0614E-08
Sr-90	pCi/L						ND						

Well ID		*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5D*
Date Sampled		*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*April-2004*
Date Analyzed								*February-10*	
Parameter	Units							GEL Results	
H-3	μCi/cc	<4.92E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.20E-06
Na-22	μCi/cc	<1.84E-09* <1.1425E-08	<1.1072E-08	<9.7962E-09	<8.8609E-09	<7.9452E-09	<9.2133E-09	NA	<7.9238E-09
Co-60	μCi/cc	<1.98E-09* <1.1150E-08	<1.0052E-08	<9.1024E-09	<9.0657E-09	<9.5254E-09	<6.1753E-09	NA	<1.1440E-08
Cs-137	μCi/cc	<1.87E-09* <7.0719E-09	<7.2689E-09	<8.3949E-09	<8.5134E-09	<1.0150E-08	<7.8665E-09	NA	<9.9193E-09
Sr-90	pCi/L							<DL	

Notes:
NA = Not analyzed
ND = Not detected
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* = Results reported from Gene
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TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*
Date Analyzed														*February-10*
Parameter	Units				Duplicate									GEL Results
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.93E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA
Na-22	µCi/cc	<1.0875E-08	<1.2568E-08	<1.0362E-08	<7.7359E-09	<1.1353E-08	<1.0687E-08	<2.40E-09* <1.1295E-08	<1.0634E-08	<9.6624E-09	<1.0031E-08	<7.5168E-09	<9.1260E-09	NA
Co-60	µCi/cc	<1.0748E-08	<1.2204E-08	<1.2107E-08	<1.1624E-08	<1.2502E-08	<1.2956E-08	<2.34E-09* <1.1046E-08	<9.7632E-09	<1.2708E-08	<9.6523E-09	<9.6361E-09	<7.2827E-09	NA
Cs-137	µCi/cc	<8.4313E-09	<9.5826E-09	<1.1570E-08	<9.9670E-09	<1.0344E-08	<1.0007E-08	<2.14E-09* <9.5759E-09	<8.3723E-09	<8.2371E-09	<8.0682E-09	<8.6436E-09	<7.9105E-09	NA
Sr-90	pCi/L													ND

Well ID		*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*
Date Sampled		*July-2004*	*October-2004*	*February-2006*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*August-2009*	*December-2009*
Date Analyzed													*February-10*
Parameter	Units												GEL Results
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.84E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.10E-06	<1.12E-06	<1.20E-06	NA
Na-22	µCi/cc	<1.2405E-08	<9.2077E-09	<1.1005E-08	<1.2600E-08	<1.2452E-08	<4.37E-09* <1.2169E-08	<1.1646E-08	<7.7428E-09	<8.0792E-09	<8.8664E-09	<8.3924E-09	NA
Co-60	µCi/cc	<1.3624E-08	<1.1987E-08	<1.2262E-08	<9.7660E-09	<1.3875E-08	<3.78E-09* <1.1451E-08	<1.2410E-08	<7.1883E-09	<9.6521E-09	<9.9537E-09	<8.1703E-09	NA
Cs-137	µCi/cc	<9.5382E-09	<9.2034E-09	<9.6692E-09	<9.9529E-09	<8.5905E-09	<3.46E-09* <7.5852E-09	<8.1554E-09	<6.5449E-09	<7.9303E-09	<9.0845E-09	<7.0120E-09	NA
Sr-90	pCi/L												ND

Well ID		*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*
Date Sampled		*July-2004*	*July-2004*	*October-2004*	*October-2004*	*February-2005*	*September-2005*	*September-2005*	*February-2006*	*June-2006*
Date Analyzed										
Parameter	Units		Duplicate			Duplicate		Duplicate		
H-3	µCi/cc	<1.41E-06	<1.41E-06	<1.22E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.25E-06	<1.13E-06	<4.85E-07* <1.12E-06
Na-22	µCi/cc	<1.0323E-08	<8.3389E-09	<7.3284E-09	<1.0716E-08	<8.9670E-09	<9.0835E-09	<1.0728E-08	<1.2956E-08	<1.97E-09* <1.0060E-08
Co-60	µCi/cc	<1.4667E-08	<1.3759E-08	<1.1373E-08	<1.4557E-08	<1.1331E-08	<1.4880E-08	<1.1991E-08	<1.3676E-08	<2.13E-09* <1.1469E-08
Cs-137	µCi/cc	<7.7276E-09	<9.3965E-09	<8.4927E-09	<1.0527E-08	<8.9498E-09	<9.9425E-09	<9.2431E-09	<1.1844E-08	<1.83E-09* <7.2416E-09
Sr-90	pCi/L									

Notes:
NA = Not analyzed
ND = Not detected
DL = Detectable Level
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TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*
Date Sampled		*December-2006*	*July-2007*	*April-2008*	*March-2009*	*March-2009*	*August-2009*	*December-2009*
Date Analyzed								*February-10*
Parameter	Units					*Duplicate*		GEL Results
H-3	µCi/cc	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.12E-06	<1.20E-06	NA
Na-22	µCi/cc	<1.0978E-08	<6.9531E-09	<7.3800E-09	<9.2786E-09	<8.8553E-09	<8.1058E-09	NA
Co-60	µCi/cc	<9.1155E-09	<9.1080E-09	<1.1316E-08	<8.1625E-09	<7.5742E-09	<8.9149E-09	NA
Cs-137	µCi/cc	<1.0272E-08	<9.5955E-09	<7.0228E-09	<7.8757E-09	<8.6477E-09	<7.8617E-09	NA
Sr-90	pCi/L							ND

Well ID		*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*January-2008*	*March-2009*	*September-2009*	*January-2010*
Date Analyzed														*February-10*
Parameter	Units													GEL Results
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<6.88E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.14E-06	Not Sampled due to radioactive waste shipment.	<1.20E-06	NA
Na-22	µCi/cc	<1.0688E-08	<6.3803E-09	<1.0185E-08	<9.6176E-09	<1.0723E-08	<1.1291E-08	<1.97E-09* <9.7765E-09	<9.1456E-09	<7.4899E-09	<8.6995E-09		<7.5472E-09	NA
Co-60	µCi/cc	<1.3601E-08	<1.2139E-08	<1.1196E-08	<1.3703E-08	<1.1250E-08	<1.3566E-08	<2.01E-09* <1.1678E-08	<8.6767E-09	<9.1024E-09	<7.7048E-09		<1.1047E-08	NA
Cs-137	µCi/cc	<7.7272E-09	<9.8696E-09	<1.0263E-08	<8.3787E-09	<1.1287E-08	<9.8752E-09	<1.87E-09* <8.8174E-09	<7.7653E-09	<9.1347E-09	<8.9034E-09		<6.6524E-09	NA
Sr-90	pCi/L													ND

Well ID		*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8SNew*	*EFT-9S*	*EFT-9S*	*EFT-9S*
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009 (Old Well)*	*January-2010*	*July-2004*	*October-2004*	*February-2005*
Date Analyzed													*February-10*			
Parameter	Units												GEL Results			
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	DRY - No sample	<4.83E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.22E-06	<1.22E-06	DRY - No sample
Na-22	µCi/cc	<7.6018E-09	<8.4427E-09	<1.1498E-08	<1.0235E-08		<1.68E-09* Not Reported	<1.1224E-08	<1.0725E-08	<7.5504E-09	<8.4483E-09	<8.1074E-09	NA	<9.1340E-09	<9.7325E-09	
Co-60	µCi/cc	<9.3478E-09	<1.4382E-08	<1.1870E-08	<9.9156E-09		<1.66E-09* Not Reported	<1.1204E-08	<9.3730E-09	<9.5269E-09	<9.6307E-09	<9.6939E-09	NA	<1.3087E-08	<1.1806E-08	
Cs-137	µCi/cc	<7.1684E-09	<7.8491E-09	<8.1024E-09	<9.4524E-09		<1.77E-09* Not Reported	<7.4846E-09	<9.0125E-09	<6.6822E-09	<8.3972E-09	<8.1659E-09	NA	<1.1375E-08	<8.8358E-09	
Sr-90	pCi/L												ND			

Notes:
NA = Not analyzed
ND = Not detected
DL = Detectable Level
* = Results reported from Gene
< = sample activity was below t

TABLE 5

RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-9S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S	EFT-10S
Date Sampled		September-2005	February-2006	June-2006	December-2006	December-2006	July-2007	April-2008	March-2009	September-2009	January-2010	September-2005	February-2006	June-2006	December-2006	July-2007	January-2008	January-2008	March-2009	September-2009	March-2009	September-2009	December-2009
Date Analyzed											February-10										April-09	October-09	February-10
Parameter	Units					Duplicate					GEL Results							Duplicate					GEL Results
H-3	µCi/cc	<1.25E-06	<1.13E-06	<4.82E-07* <1.12E-06	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	DRY - No sample	NA	<1.25E-06	<1.10E-06	<4.67E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.14E-06	<1.14E-06	<1.12E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA
Na-22	µCi/cc	<8.8513E-09	<1.2391E-08	<1.08E-09* <1.1618E-08	<8.4420E-09	<3.0243E-07	<9.7922E-09	<8.8687E-09	<9.5197E-09		NA	<8.4664E-09	<1.3278E-08	<2.22E-09* <1.2688 E-08	<6.9959E-09	<7.9379E-09	<9.1591E-09	<9.4187E-09	<7.4898E-09	<7.1921E-09	<7.4898E-09	<7.1921E-09	NA
Co-60	µCi/cc	<1.0071E-08	<1.3905E-08	<9.78E-10* <1.1436E-08	<8.0832e-09	<7.6620E-08	<1.0399E-08	<1.0762E-08	<9.1692E-09		NA	<1.3861E-08	<1.2286E-08	<2.39E-09* <1.2400E-08	<9.2342E-09	<1.1914E-08	<9.2914E-09	<8.4915E-09	<9.8334E-09	<1.0482E-08	<9.8334E-09	<1.0482E-08	NA
Cs-137	µCi/cc	<1.0929E-08	<8.2813E-09	<1.08E-09* <8.9681E-09	<8.5120E-09	<1.1648E-08	<9.1120E-09	<1.0501E-08	<7.9167E-09		NA	<1.0834E-08	<8.2228E-09	<2.12E-09* <9.8627E-09	<8.6467E-09	<8.7909E-09	<7.4487E-09	<7.1346E-09	<8.1403E-09	<6.8541E-09	<8.1403E-09	<6.8541E-09	NA
Sr-90	pCi/L										ND										NA	NA	ND

Notes:
NA = Not analyzed
ND = Not detected
DL = Detectable Level
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TABLE 6

COMPARISON OF ANALYTICAL RESULTS TO BACKGROUND
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Hydro-Stratigraphic Zone	*Well*		*Sample Date*	*Uranium-Alpha Activity (pCi/L) MCL = 15 (Note 1)*				*Radium Activity (pCi/L) MCL = 5*			*Gross Alpha/Beta*	
				233 234	235 236	*238*	*Total*	*226*	*228*	*Total*	*Alpha*	*Beta*
Glacial Overburden	**Background Wells**	EFT-1S	2006	1.78	<1	0.617	**2.40**	0.621	1.75	**2.37**		
			1/5/2010	1.55	<1	0.747	**2.30**	0.948	<3	**0.95**	<5	<5
		EFT-1I	1/14/2010	3.2	<1	3.82	**7.02**	<1	1.72	**1.72**	5.77	<5
		MW-393S	1/13/2010	15.5	0.989	12.2	**28.69**	<1	<3	**<4**	17.4	7.9
		MW-393S	4/1/2010	13.8	1.15	12.7		<1	<3			
		MW-393S (Dup)	4/1/2010	14.4	1.13	11.8		<1	<3			
		MW-393S (Avg)	4/1/2010	14.1	1.14	12.3	**27.49**	<1	<3	**<4**		
		MW-388S	1/13/2010	1.62	<1	0.908	**2.53**	0.908	1.69	**2.60**	15.2	35.8
		MW-388S	4/6/2010	3.76	<1	2.42	**6.18**	0.422	<3	**0.42**		
		MW-381S	4/6/2010	4.57	<1	3.24	**7.81**	0.377	<3	**0.38**		
		BKG-PAP	2006	2.82	<1	2.99	**5.81**	0.41	<3	**0.41**		
		GW-02	1/14/2010	2.42	<1	1.72	**4.14**	0.46	<3	**0.46**	<5	5.75
		UTL (Note 2):	**Using nonparametric statistics:**				**7.81**			**2.60**		
			Assume log-normal data distribution:				**16.06**			**6.97**		
			Assume normal data distribution:				**10.51**			**3.44**		
	Monitor Wells	EFT-2S	2006	1.56	<1	1.39	**2.95**	<1	<3	**<4**		
			2010	NS	NS	NS	**NS**	NS	NS	**NS**	NS	NS
		EFT-4S	2006	3.89	<1	2.81	**6.70**	<1	<3	**<4**		
		EFT-4S/D	12/29/2009	NA	NA	NA	**NA**	NA	NA	**NA**	<5	<5
		EFT-5S	2006	3.67	0.49	2.65	**6.81**	0.48	<3	**0.48**		
			12/29/2009	3.62	0.31	2.8	**6.73**	0.47	1.51	**1.98**	<5	**3.53**
		EFT-6S	2006	<1	3.87	<1	**3.87**	0.33	<3	**0.33**		
			12/29/2009	NA	NA	NA	**NA**	NA	NA	**NA**	**6.22**	<5
		EFT-7S	2006	3.33	0.34	2.65	**6.32**	0.63	<3	**0.63**		
			1/4/2010	NA	NA	NA	**NA**	NA	NA	**NA**	<5	<5
		EFT-8S	2006	4.89	0.71	4.02	**9.62**	<1	<3	**<4**		
			1/4/2010	NA	NA	NA	**NA**	NA	NA	**NA**	<5	**15.5**
		EFT-9S	2006	9.71	<1	6.33	**16.04**	0.54	<3	**0.54**		
			1/4/2010	11.2	<1	6.93	**18.13**	NA	NA	**NA**	**12**	**10.2**
		EFT-10S	2006	1.02	<1	0.811	**1.83**	1.93	<3	**1.93**		
			12/30/2009	1.26	<1	1.04	**2.30**	NA	NA	**NA**	<5	**5.59**
Deep (Bedrock)	**Background Wells**	EFT-1D	2006	1.67	<1	1.41	**3.08**	0.91	4.10	**5.01**		
			1/5/2010	2.04	<1	0.99	**3.03**	0.57	<3	**0.57**	<5	<5
		BKG-NTC	2006	1.03	<1	0.30	**1.33**	0.57	0.73	**1.30**		
		BKG-RNG	2006	1.16	<1	1.16	**2.32**	1.42	<3	**1.42**		
		GW-04	1/13/2010	0.283	<1	0.61	**0.89**	1.22	<3	**1.22**		
		GW-04	4/6/2010	0.885	<1	0.582	**1.47**	0.836	<3	**0.84**		
		MW-381D	1/13/2010	0.733	<1	0.56	**1.29**	1.51	<3	**1.51**	**4.11**	<5
		MW-393D	1/13/2010	0.673	<1	0.42	**1.09**	0.70	<3	**0.70**	<5	8.47
		MW-393D	4/6/2010	0.577	<1	<1	**0.58**	1.05	<3	**1.05**		
		UTL (Note 2):	**Using nonparametric statistics:**				**3.08**			**5.01**		
			Assume log-normal data distribution:				**5.79**			**5.65**		
			Assume normal data distribution:				**3.92**			**4.83**		
	Monitor Wells	GW-01	1/14/2010	<1	<1	<1	**0.00**	0.83	<3	**0.83**	<5	<5
		EFT-2D	2006	0.983	<1	<1	**0.98**	1.03	<3	**1.03**		
			1/4/2010	NA	NA	NA	**NA**	NA	NA	**NA**	<5	**5.53**
		EFT-4D	2006	<1	<1	<1	**<3**	1.64	1.74	**3.38**		
		EFT-4D (Dup)	2006	<1	<1	<1	**<3**	0.94	1.03	**1.97**		
		EFT-4D	12/19/2009	NA	NA	NA	**NA**	NA	NA	**NA**	<5	**5.07**
		EFT-5D	2006	<1	<1	<1	**<3**	2.30	1.26	**3.56**		
			12/29/2009	<1	<1	<1	**<3**	2.26	<3	**2.26**	<5	**6.77**
		EFT-6D	2006	1.28	<1	<1	**1.28**	0.77	<3	**0.77**		
			12/29/2009	<1	<1	0.303	**0.30**	NA	NA	**NA**	<5	**3.61**

Notes:

▨ Values that were used to calculate the UTLs for Deep background

▨ Values that were used to calculate the UTLs for Shallow background

▨ New data

▨ Shows the UTLs that are recommended for comparison. Most of the data sets fit a log-normal distribution; although the total radium values in groundwater from the Glacial overburden background wells only fit a normal distribution (the goodness of fit test rejected a log-normal distribution).

▨ Monitor well results that exceed the corresponding UTL

1. Maximum Contaminant Level set by U.S. Environmental Protection Agency. Reference: *National Primary Drinking Water Regulations; Final Rule 65 FR 236; December 7, 2000.*

2. Upper Tolerance Limit for the 90th percentile, 95 % confidence; calculations performed using " *Statistical Software ProUCL 4.0 for Environmental Applications For Data Sets with and without Nondetect Observations* "; USEPA ProUCL Version 4.00.04. Available at: http://www.epa.gov/esd/tsc/software.htm

3. Based on Shapiro-Wilk goodness of fit tests, the background Uranium and Radium activity data generally fit both normal and lognormal distributions. Monitoring data were compared to the Upper Tolerance Limits (UTLs) for lognormal data distributions (highlighted yellow) since most environmental data fits this distribution. For Radium in the glacial overburden wells, the data are not lognormal based on the Shapiro-Wilk Test. Monitoring data were compared to the UTL for normal data distributions (highlighted yellow).

4. NA = Not analyzed; NS = Not sampled.

TABLE 7
ROCs RETARDATION COEFFICIENTS AND MITRATION RATES
SITE CONCEPTUAL MODEL
DETRIOT EDISON-FERMI ENERGY CENTER
NEWPORT, MICHIGAN

	Half-Life (years)	Geometric Mean of Distribution Coefficient (ml/g)[1]	Retardation Coefficient (Rf)[2]	Estimated Migration Rate (feet/year) [4]	Descriptive Comment
^{3}H (Tritium)	12.3	N/A	0.94 [3]	178.36	extremely fast (water: Rf =1)
^{14}C	5.7	1	5	32.44	moderate
^{99}Tc	210,000	1	5	32.44	moderate
^{235}U	7.04.E+108	6	26.44	6.38	moderate
^{22}Na	2.6	20	81	2.10	slow
^{90}Sr	29	110	441	0.39	extremely slow
^{55}Fe	3	165	661	0.26	extremely slow
^{108}Ag	2.4 minutes	180	721	0.24	extremely slow
^{125}Sb	3	250	1001	0.17	extremely slow
^{60}Co	5.3	550	2201	0.08	effectively immobile
^{59}Ni	75,000	650	2601	0.07	effectively immobile
^{63}Ni	96	650	2601	0.07	effectively immobile
^{94}Nb	20,300	900	3601	0.05	effectively immobile
^{134}Cs	2.1	1,900	7601	0.02	effectively immobile
^{137}Cs	30	1,900	7601	0.02	effectively immobile
^{238}Pu	88	5,100	20401	0.01	effectively immobile
$^{239/240}$Pu	24,000 / 6,500	5,100	20401	0.01	effectively immobile
^{241}Pu	14	5,100	20401	0.01	effectively immobile
$^{242/243}$Cm	160 days/29	6,000	24001	0.01	effectively immobile
^{241}Am	430	8,400	33601	0.01	effectively immobile
^{152}Eu	13	N/A	N/A	N/A	—
^{154}Eu	8.8	N/A	N/A	N/A	—
^{155}Eu	5	N/A	N/A	N/A	—

Notes:

1 Source: Sheppard and Thibault (1990).

2 Assumes 1.2 grams/centimeter for bulk density and 30% porosity

3 Source; Leap, D. I., "Apparent Relative Retardation of Tritium and Bromide in Dolomite", Ground Water, July-August 1992.

4 Assumes a groundwater unsaturated gradient of 1 foot/feet, porosity of 30%, bulk density of 1.2, and hydraulic conductivity of 0.56 feet per day. For comparitive purposes, not site-specific.

TABLE 8
RATIONALE FOR MONITORING WELLS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

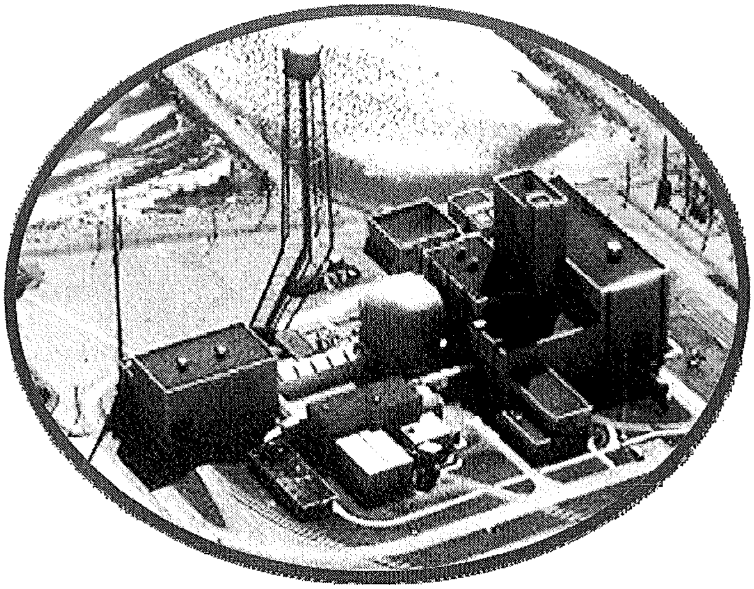
Well/SUMP	*Areas of Concern*	*Area Monitored/Rationale*
EFT-1S/I/D	Controlled Area / Former Health Physics Building	Background well; monitor potential releases from the Former Health Physics Building if flow to the southwest.
EFT-2S/D	Fuel and Repair Building (FARB) Hot Sump and Waste Tanks/ Former Waste Gas Stack	Radioactive fluids were collected in Health Physics Building drainage system and routed to FARB; Hot Sump and waste tanks inside FARB collected radioactive fluids. Monitor Former Waste Gas Stack.
EFT-4S/D	FARB, FARB Pools, Liquid Rad Waste Line	Water in FARB cut-up and decay pools was in contact with spent fuel rods; drains in Health Physics received low-level radioactive waste water. Possible leakage of primary (radioactive) sodium to tunnel and other buildings along circulatory route.
EFT-5S/D	FARB, East Sodium Gallery, Sodium Tunnel	
EFT-6S/D	East Sodium Gallery; Fission Products Detector (FPD) Building, and Reactor Building	Secondary (non-radioactive) sodium system contained tritium; radioactive condensate may have discharged to ground near northeast corner of FPD building exterior and the northeast portion of Reactor Building exterior; possible subsurface/bedrock impacts from reactor core/basement; reactor building basement contamination.
EFT-7S	Former Health Physics Building, FARB Maintenance Pit	Possible leakage from sump at east end of Former Health Physics Building; possible leakage from the FARB Maintenance Pit.
EFT-8S/8SR	FARB, Waste Gas Stack	Interior atmospheres in FARB and Inert and Sodium Service Buildings were routed to the waste gas stack, the foundation drain for which is a susceptible location for radioactive condensate accumulation.
EFT-9S	FARB, Radioactive Liquid Waste Discharge Conduit	Corrosion had been observed on this portion of the 2-inch wrought iron pipe adjacent to the northwest portion of the FARB. Pipe originated from Former Health Physics Building.
EFT-10S	West Sodium Gallery, Sodium Tunnel, and Reactor Building	Secondary (non-radioactive) sodium system contained tritium; possible subsurface impacts from Reactor Building basement.
EFT-11 I/D	Station Southwest Corner	Monitor overburden-bedrock overburden interface and bedrock regimes for possible collection of waters from Station. Assist in confirming groundwater flow direction(s).
EFT-12 I/D	Station Southeast Corner	Monitor overburden-bedrock overburden interface and bedrock regimes for possible collection of waters from Station. Assist in confirming groundwater flow direction(s).
EFT-13I	Former Health Physics Building, FARB	Possible leakage from sump at east end of Former Health Physics Building; possible leakage from FARB.
#1	Reactor Building	Services Reactor Building Annulus. Constructed below Bedrock Horizon.
#3	West Sodium Gallery	Services West Sodium Gallery. Constructed within Overburden.
#4	East Sodium Gallery	Services East Sodium Gallery. Constructed within Overburden.
#5	East of Reactor Building	Services Reactor Building Constructed within Overburden. Reactor Building ventilation duct annular area
#6	FARB Pool	Services Cut-Up Pool in FARB. Located inside building.
#7	FARB Pool	Services Decay Pool in FARB. Located inside building.
#8	West of Reactor Building	Services West Yard. Constructed in Overburden.
#9	South of Inert Gas Building	Services Gas Tunnel. Constructed in Overburden.
#10	South of Waste Gas Building	Services Waste Gas Building Basement. Constructed in Overburden.
#11	East of Reactor Building	Services East Sodium Gallery. Constructed in Overburden.
#12	FARB	Services FARB. Located inside building

Notes:

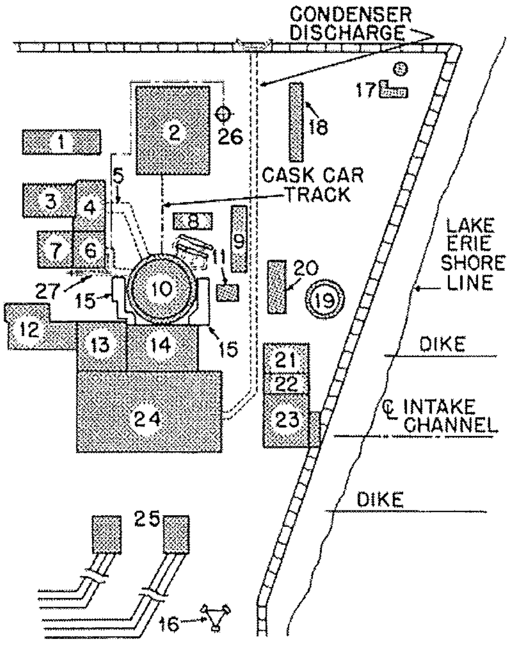
Gray shading indicates proposed monitoring well.

ATTACHMENT A
HISTORICAL PHOTOGRAPHS OF FERMI 1

Fermi 1 Pictures



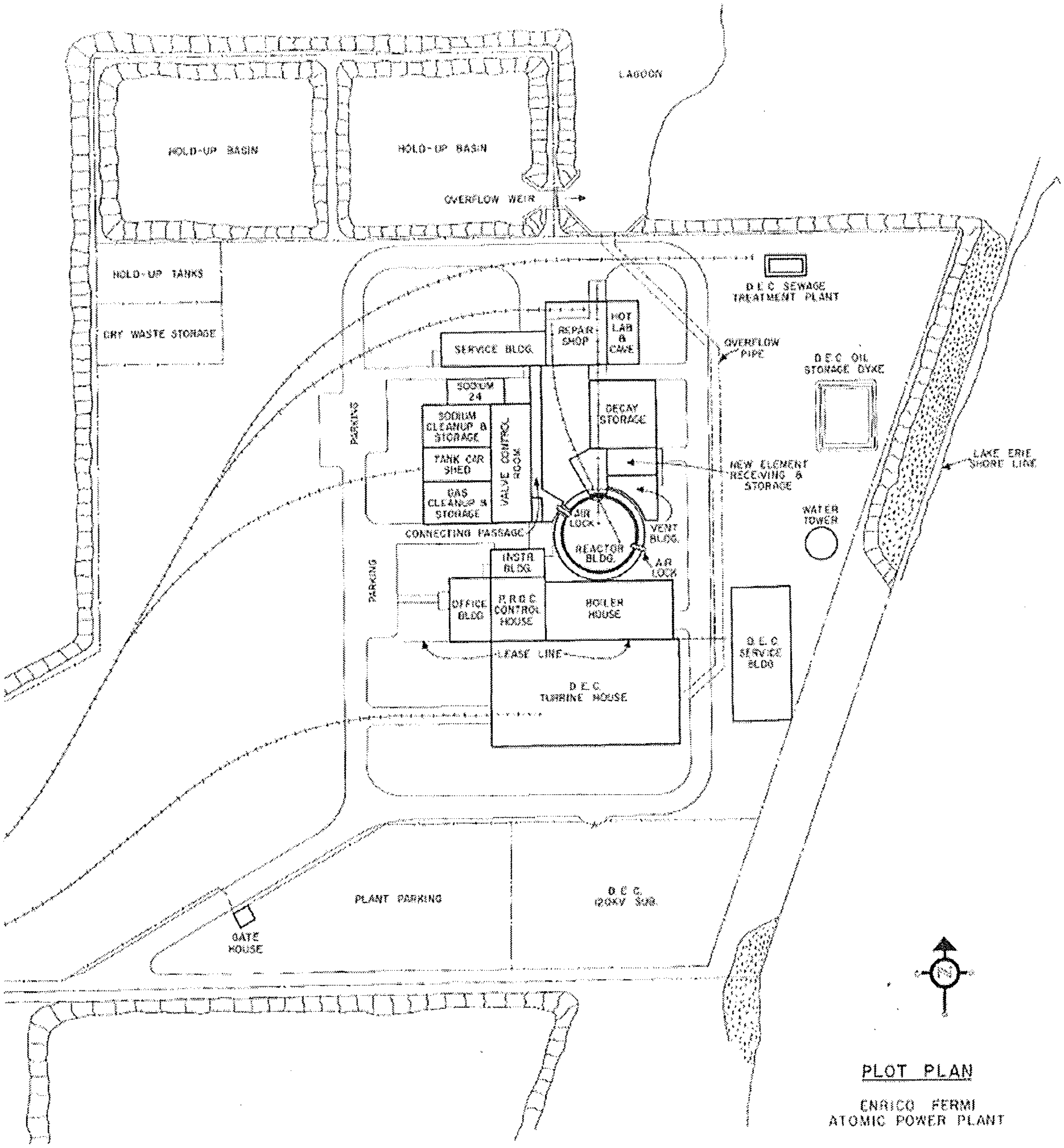
1 HEALTH PHYSICS BUILDING
2 FUEL & REPAIR BUILDING
3 SODIUM PURIFICATION & STORAGE
4 SODIUM CONTROLS
5 SODIUM TUNNEL
6 INERT GAS BUILDING
7 WASTE GAS DISPOSAL BUILDING
8 VENTILATION BUILDING
9 APDA CONTROL BUILDING (TEMP)
10 REACTOR BUILDING
11 NA K HEATER—COOLER (TEMP)
12 OFFICE BUILDING
13 CONTROL BUILDING
14 STEAM GENERATOR BUILDING
15 { EAST SODIUM GALLERY
WEST SODIUM GALLERY
16 WEATHER TOWER
17 SEWAGE PLANT
18 ELECTRICAL SUBSTATION (TEMP)
19 POTABLE WATER TOWER
20 FUEL OIL TANK
21 POTABLE WATER TREATMENT
22 HEATING PLANT
23 SERVICE WATER PUMPS & TREATMENT
24 TURBINE HOUSE
25 120-KV MAT
26 WASTE GAS DISPOSAL STACK
27 GAS TUNNEL



3-1-60

PLOT PLAN
ENRICO FERMI ATOMIC POWER PLANT

Fermi 1 Pictures



PLOT PLAN

ENRICO FERMI
ATOMIC POWER PLANT

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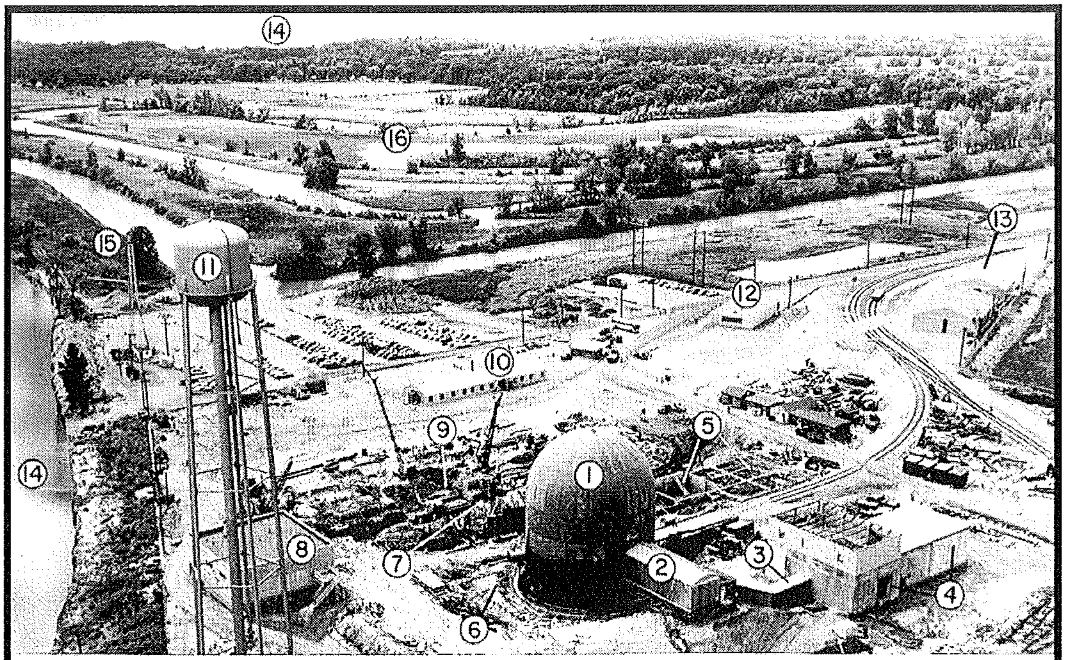
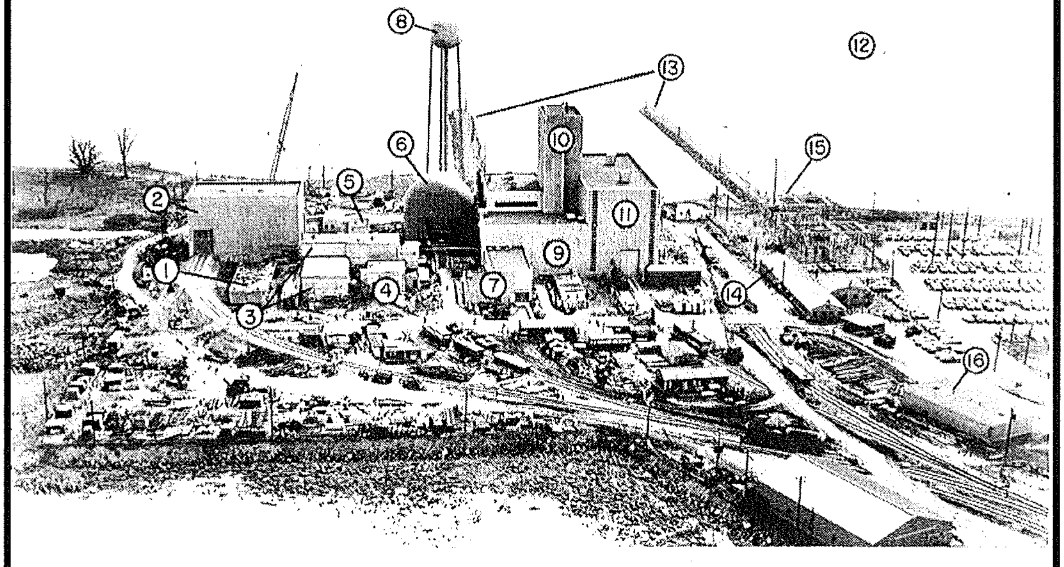


ENRICO FERMI ATOMIC POWER PLANT SITE

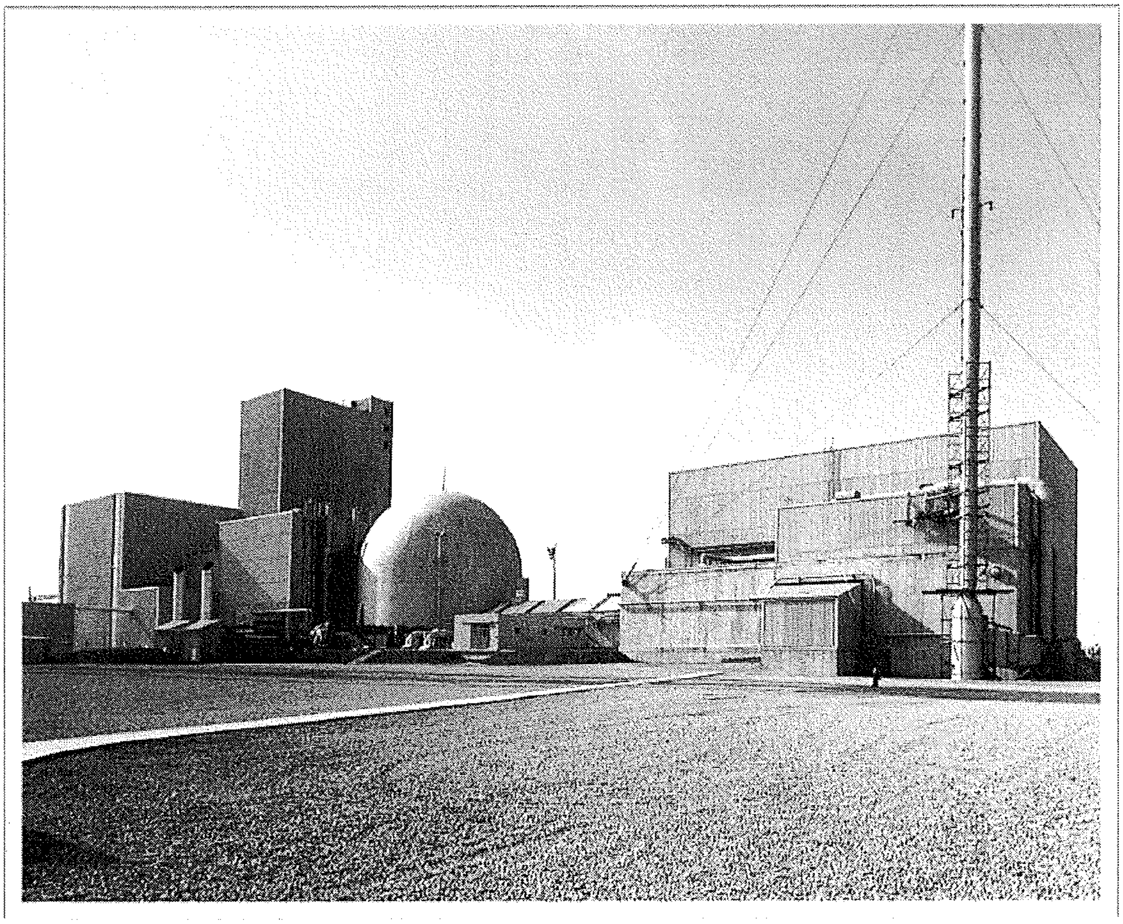
1. Reactor Containment Building
2. Equipment Entry Chamber (temporary)
3. Sodium Tunnel
4. Sodium Storage and Purification Building
5. Plant Offices and Control Center
6. Sodium Gallery Foundation
7. Steam Generator Construction
8. Water Treatment and Heating Plant
9. Turbine House Location
10. Construction Offices
11. Water Storage Tank
12. Atomic Information Center
13. Storage and Shops
14. Lake Erie
15. Meteorological Tower
16. Lagoons and Marshlands



ENRICO FERMI ATOMIC POWER PLANT SITE

1. Health Physics Building
2. Fuel Element & Repair Building
3. Sodium Purification & Storage
4. Inert Gas Building
5. Ventilation Building
6. Reactor Containment Building
7. Plant Offices
8. Water Storage Tank
9. Control Center
10. Boiler House
11. Turbine-Generator Building
12. Lake Erie
13. Jetties for Condenser Water Intake
14. Construction Offices
15. Electrical Switching Station
16. Atomic Information Center

Fermi 1 Pictures



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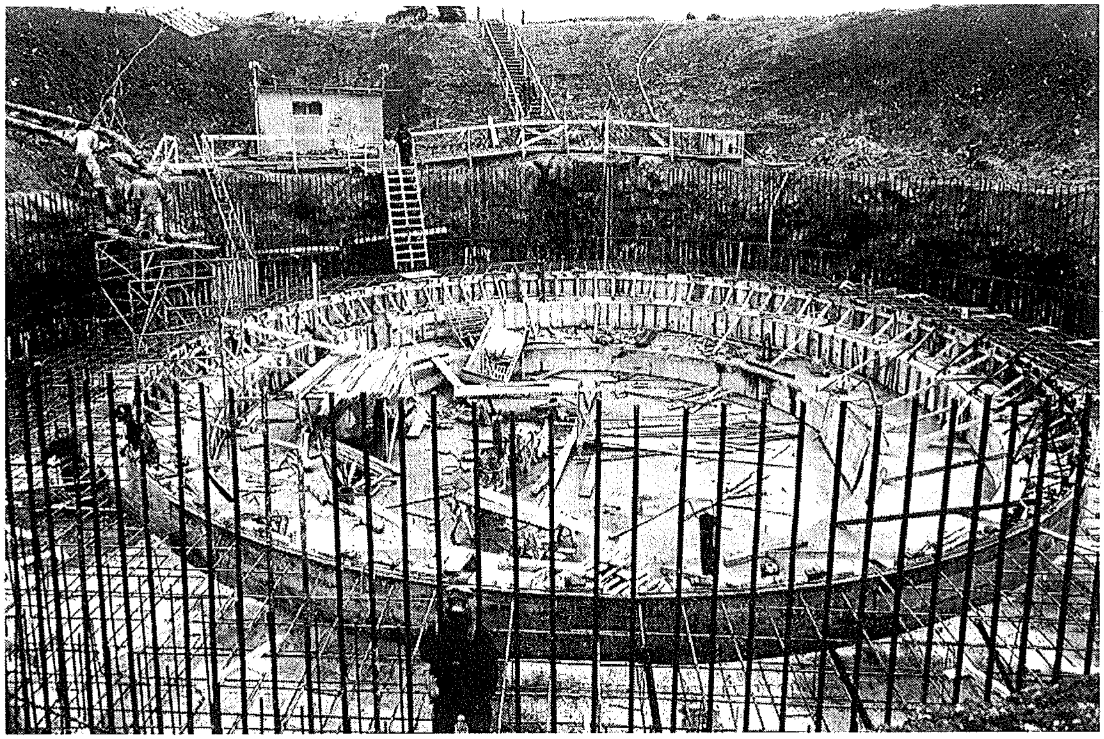

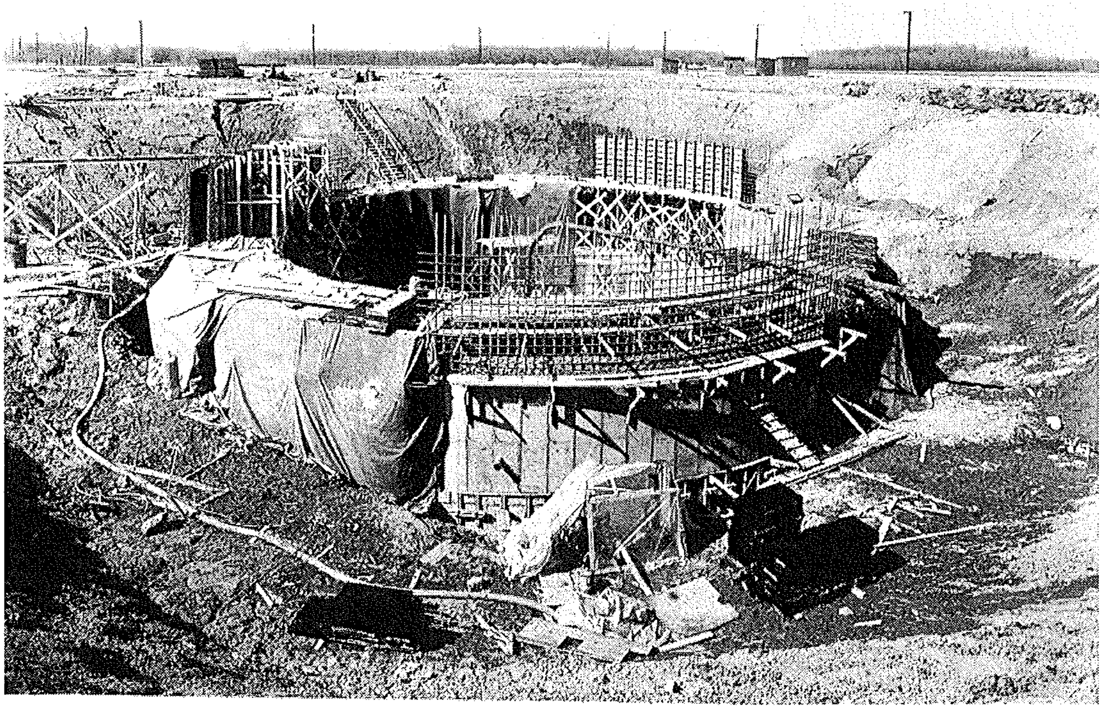

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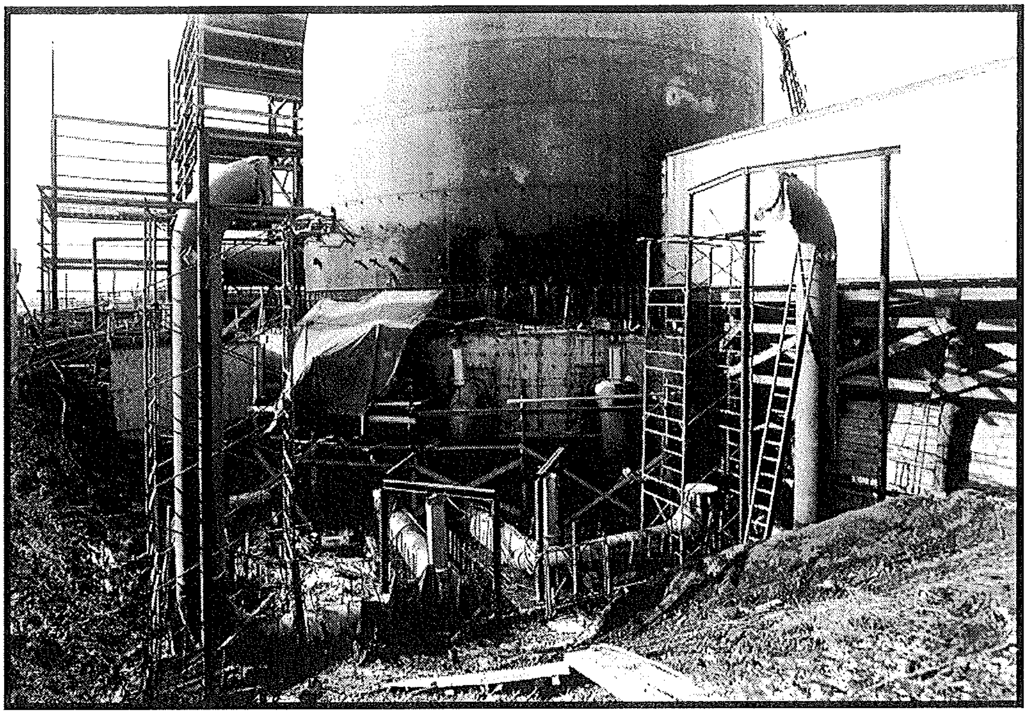

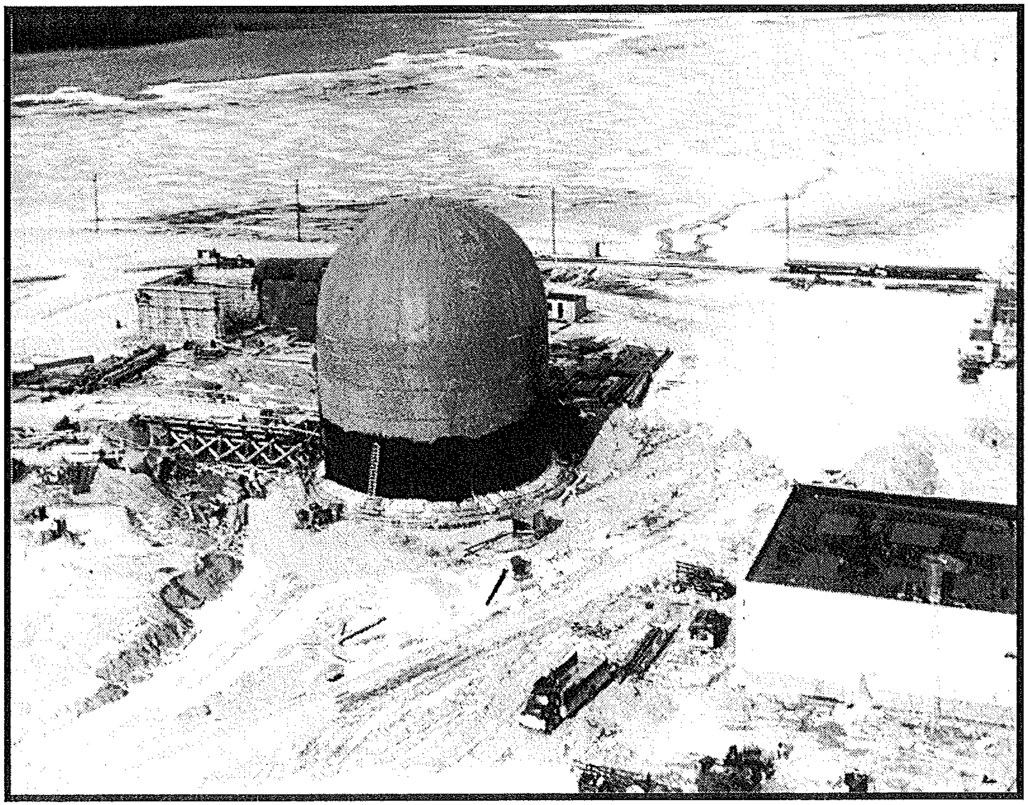

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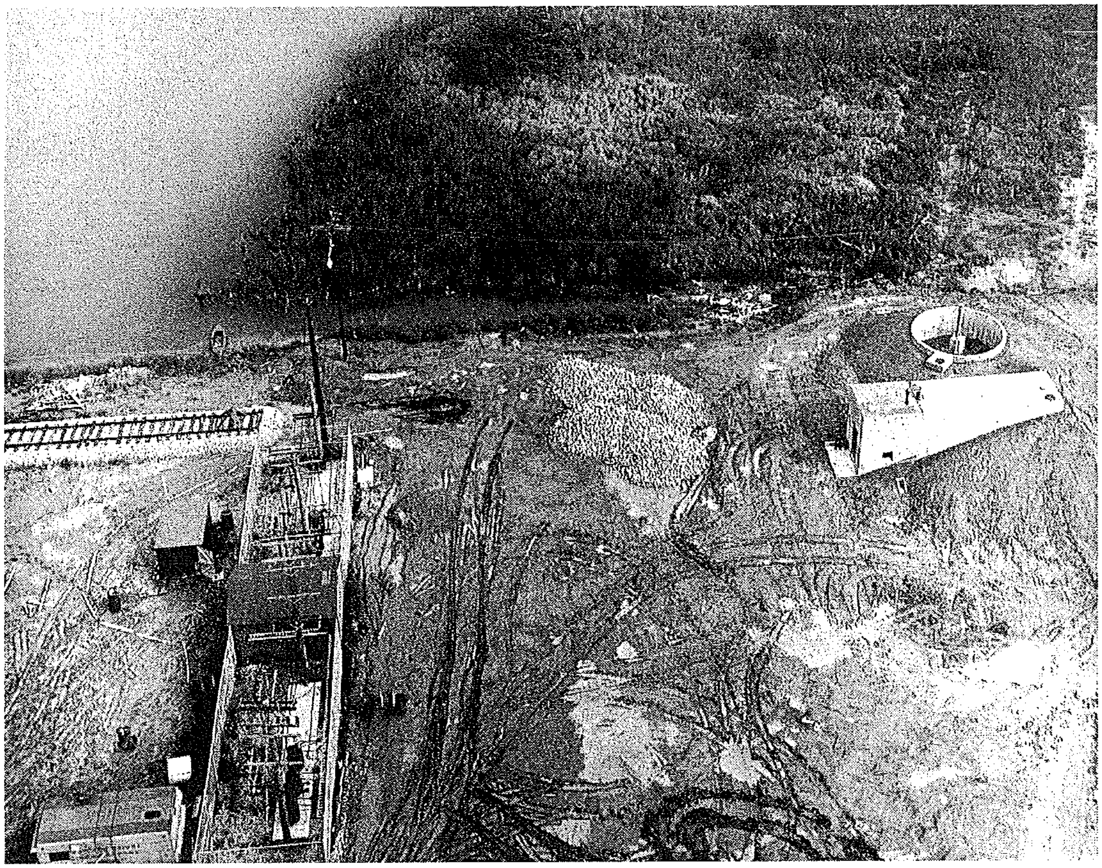

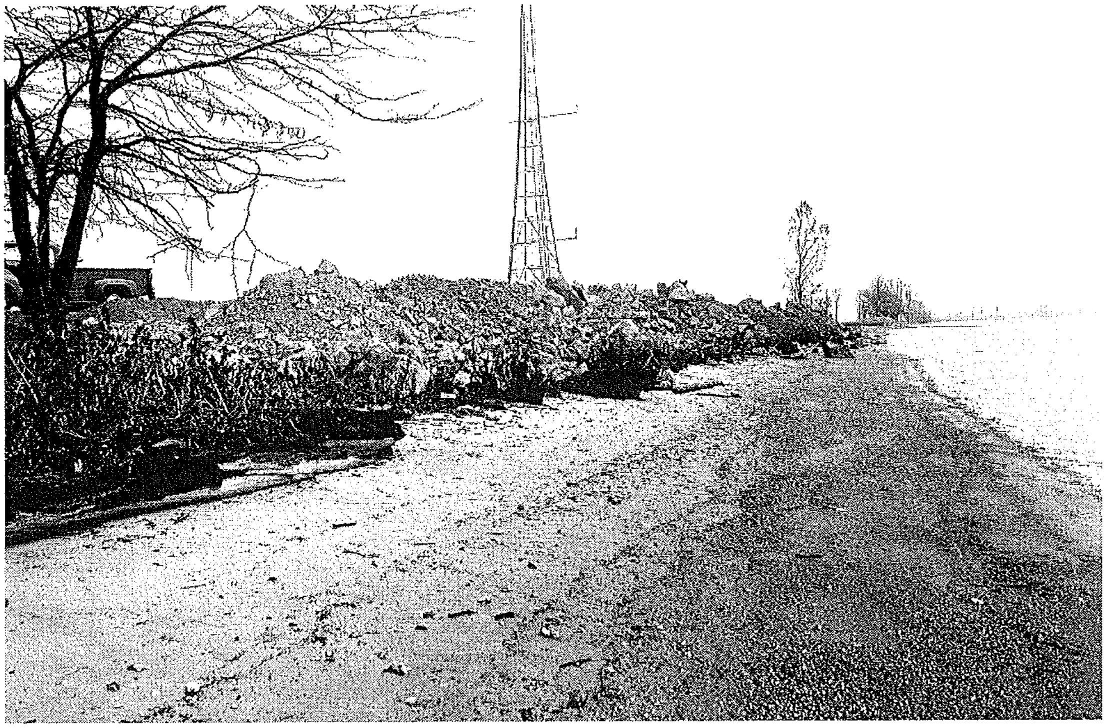

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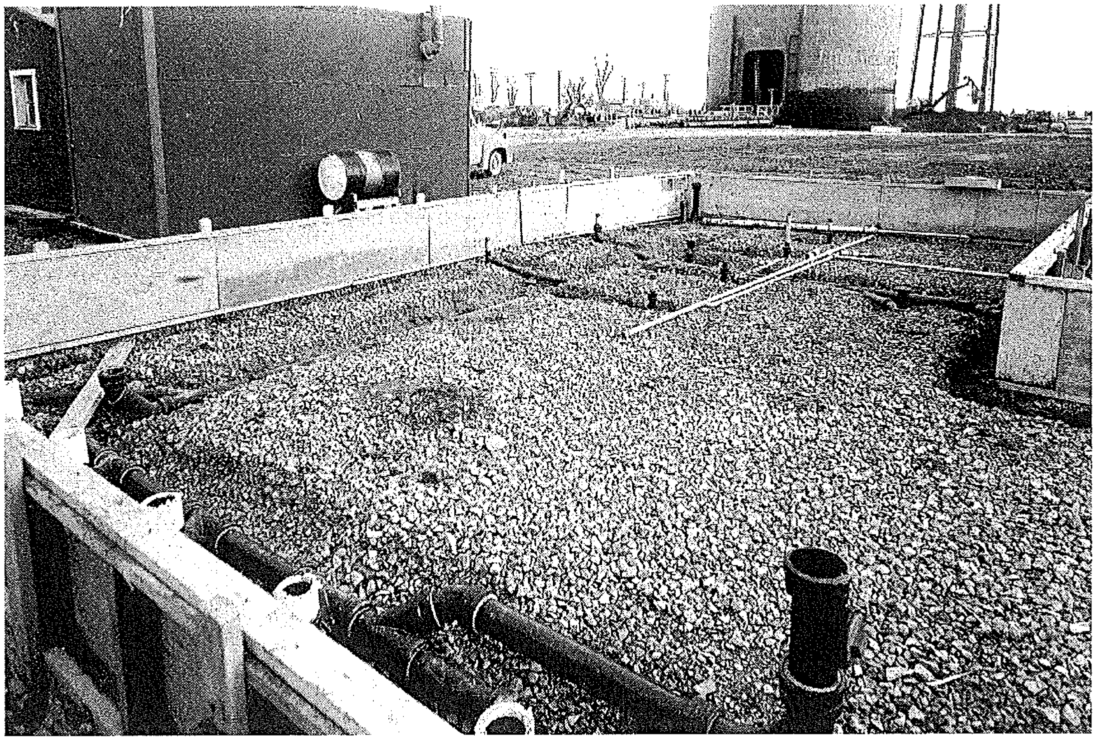

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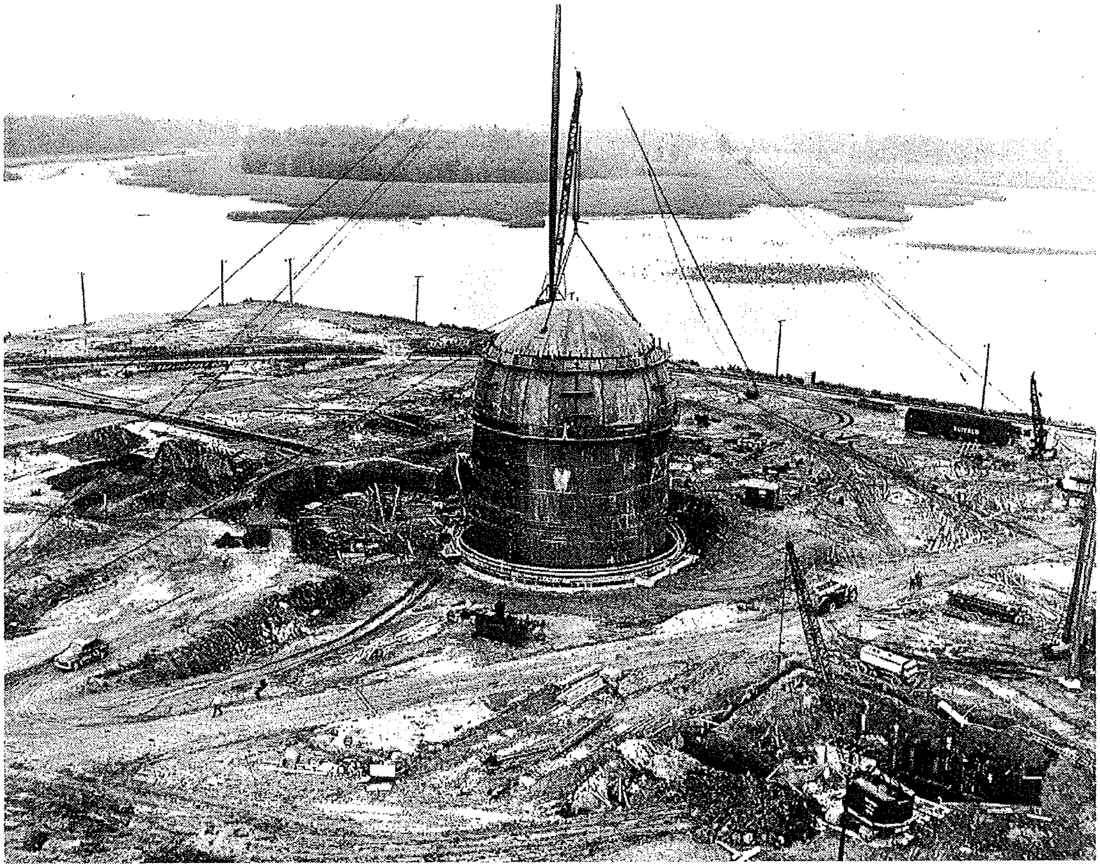

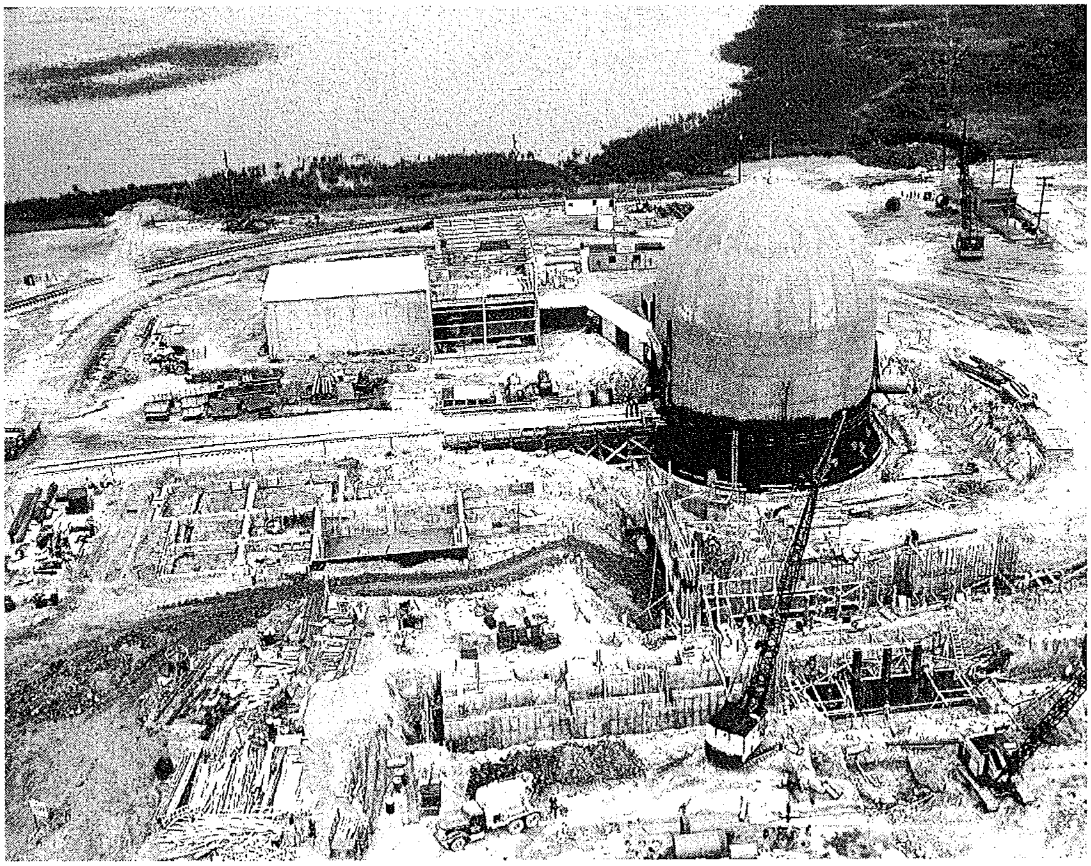

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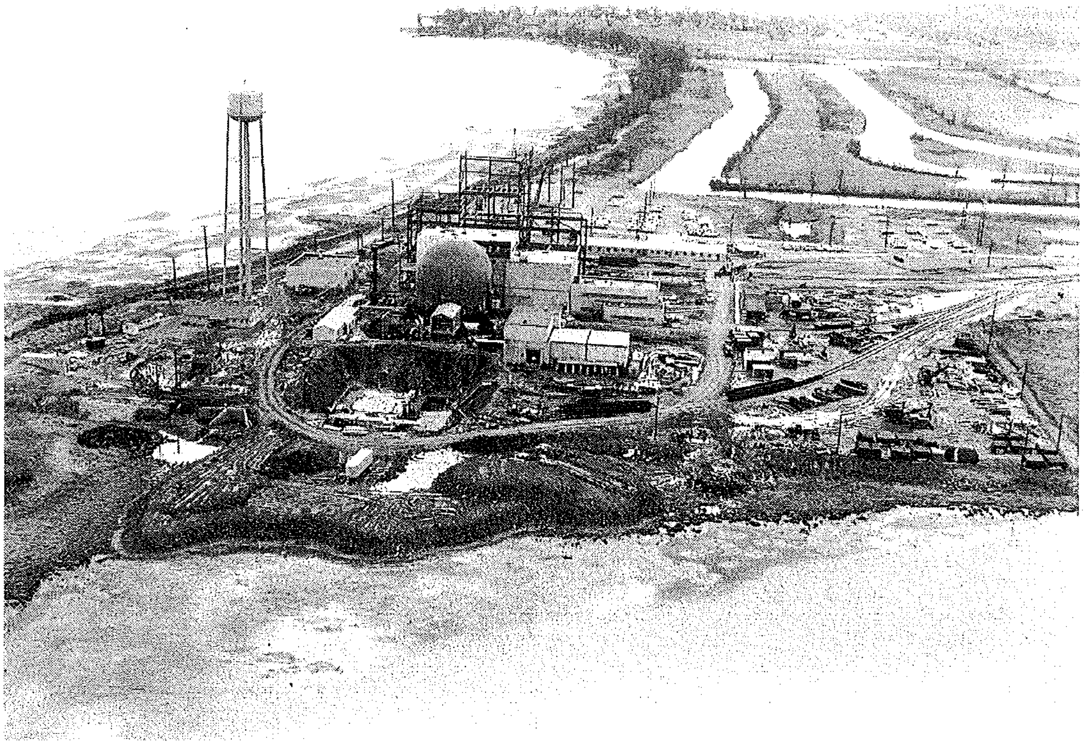

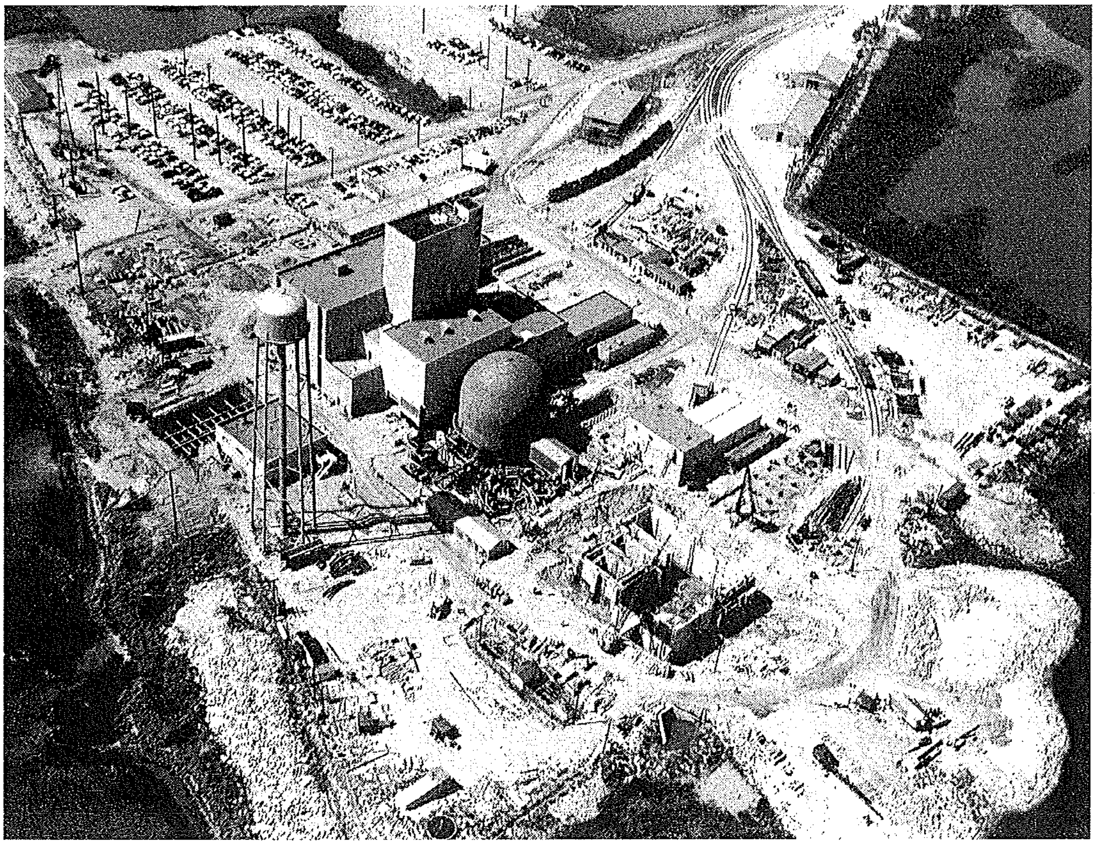

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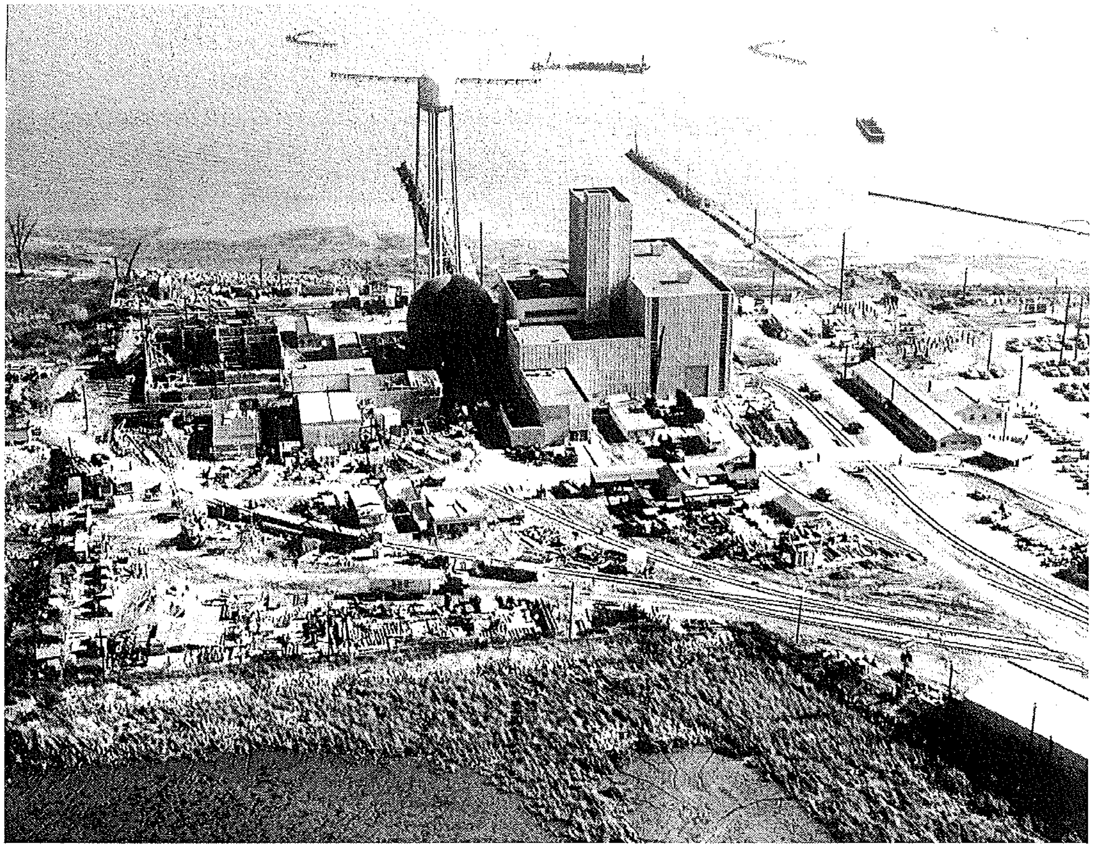

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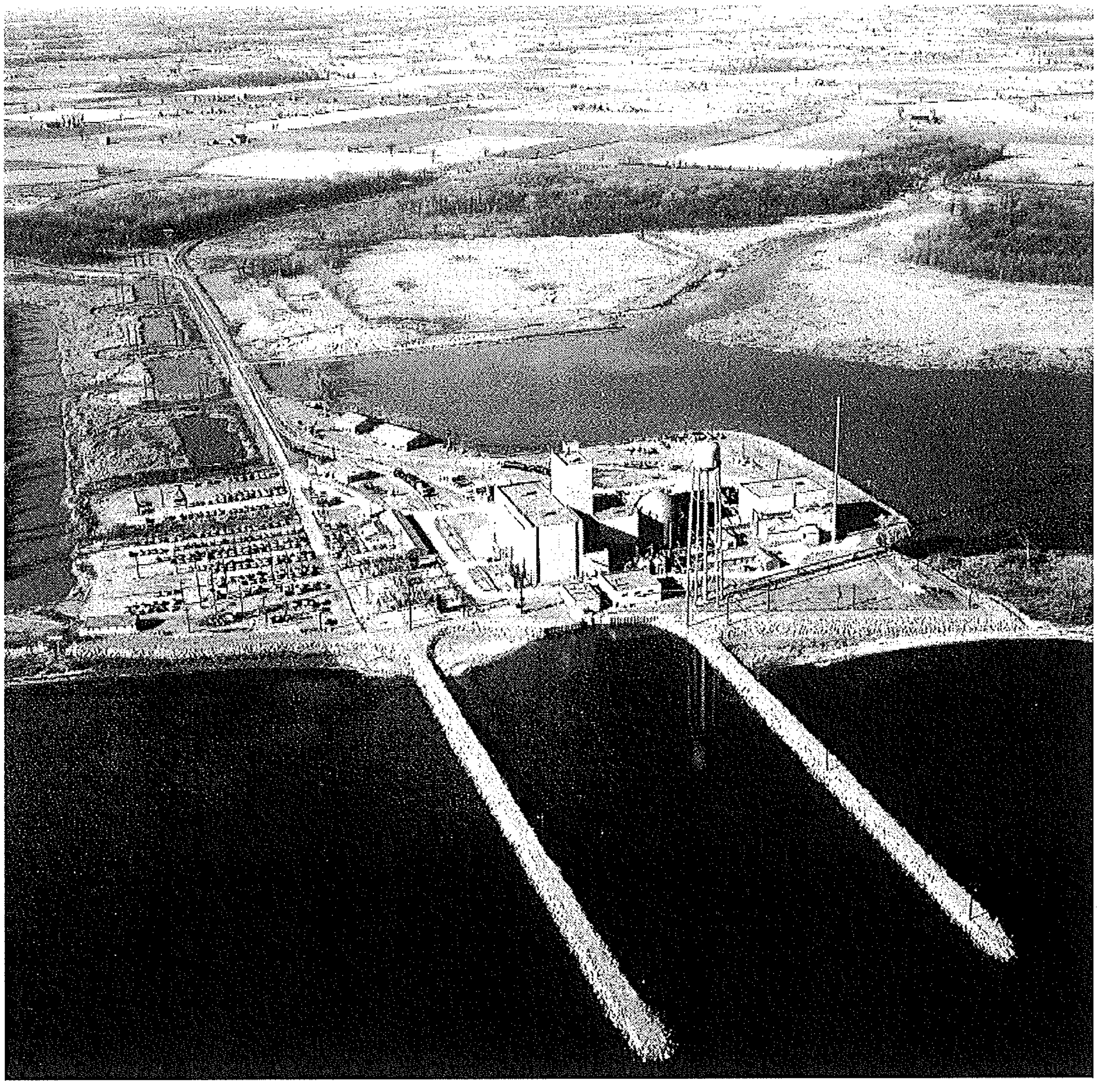

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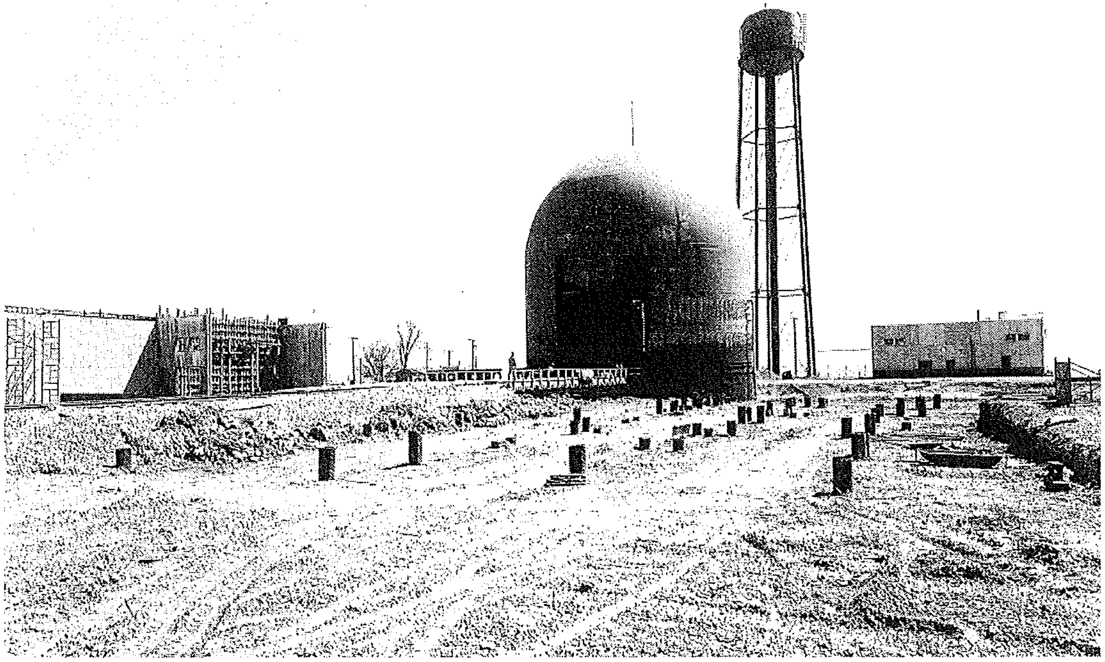

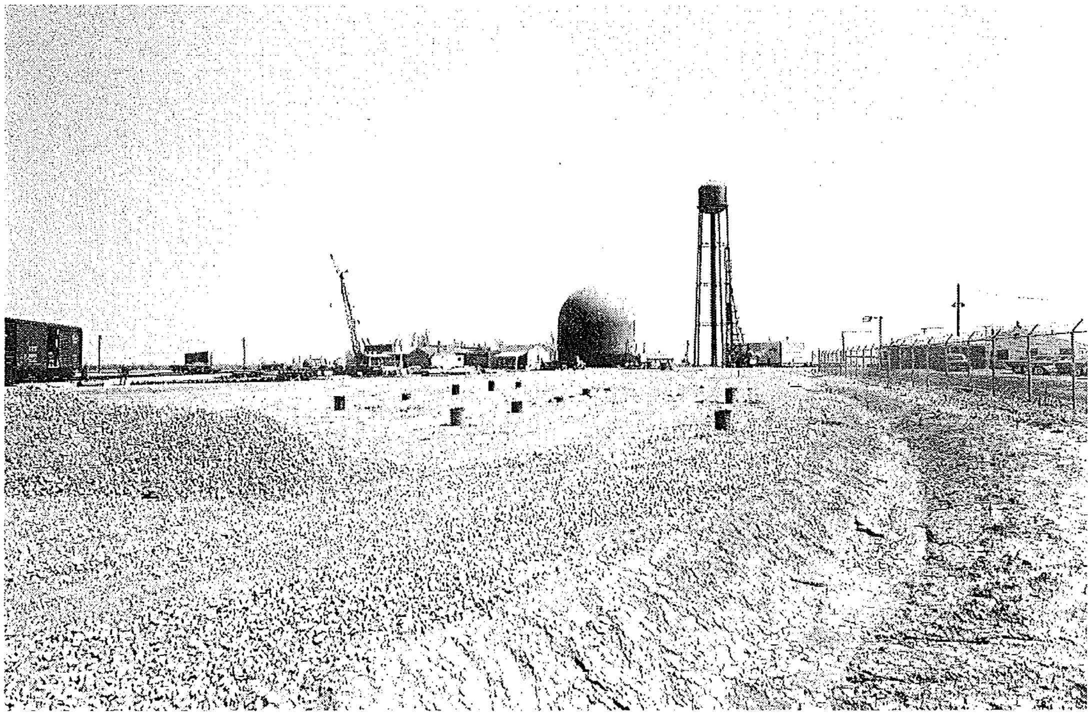

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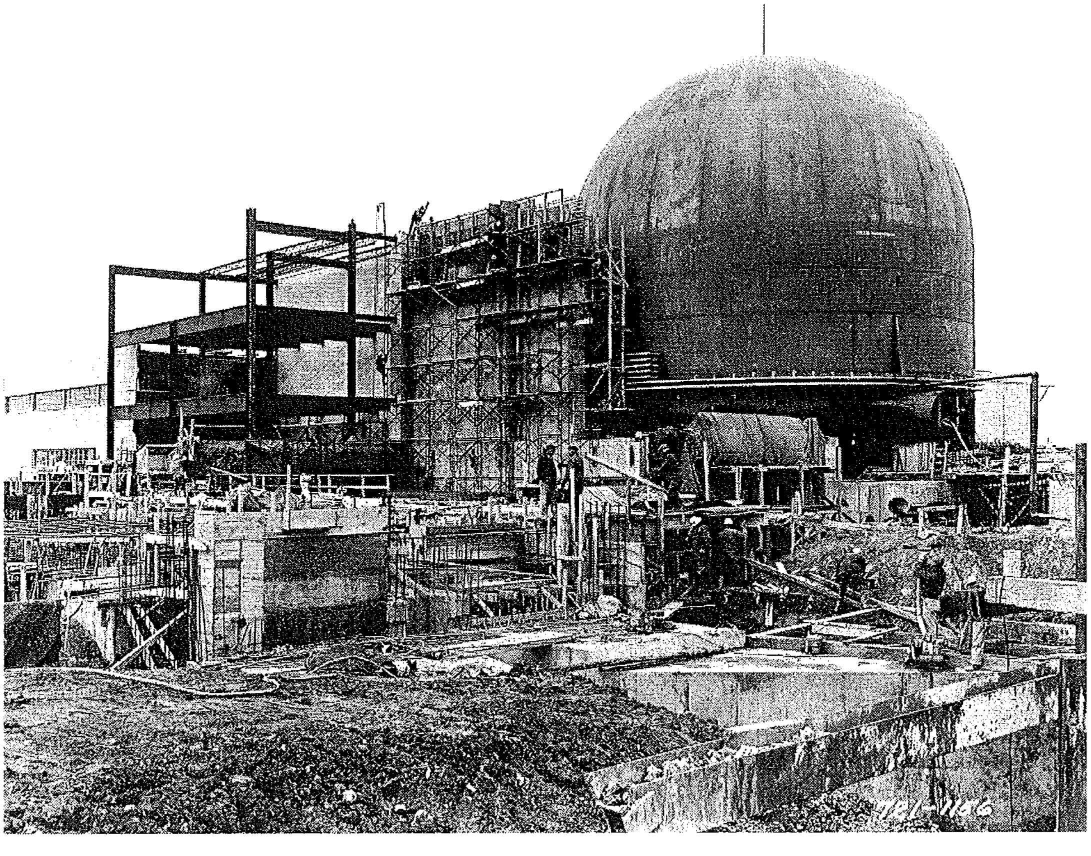

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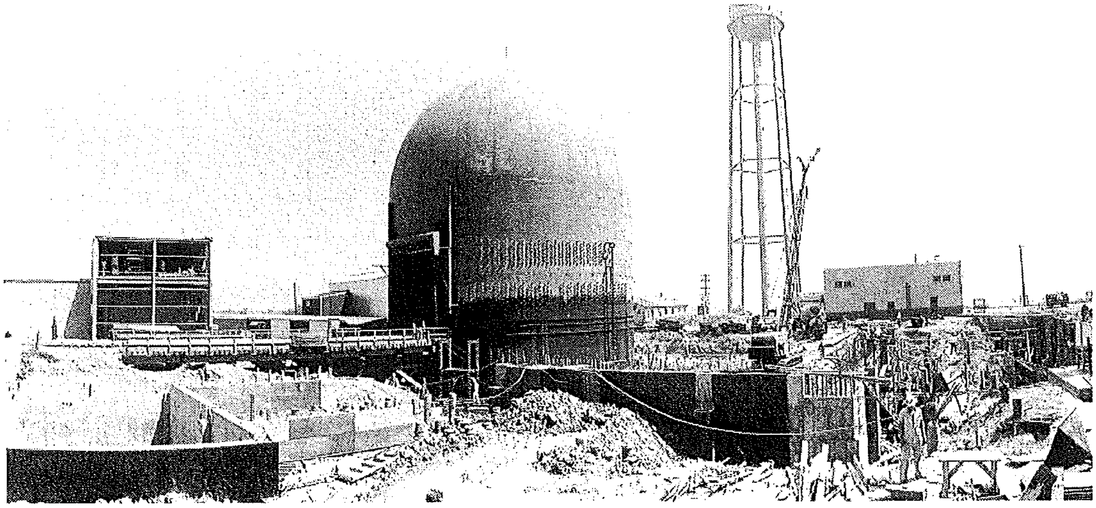
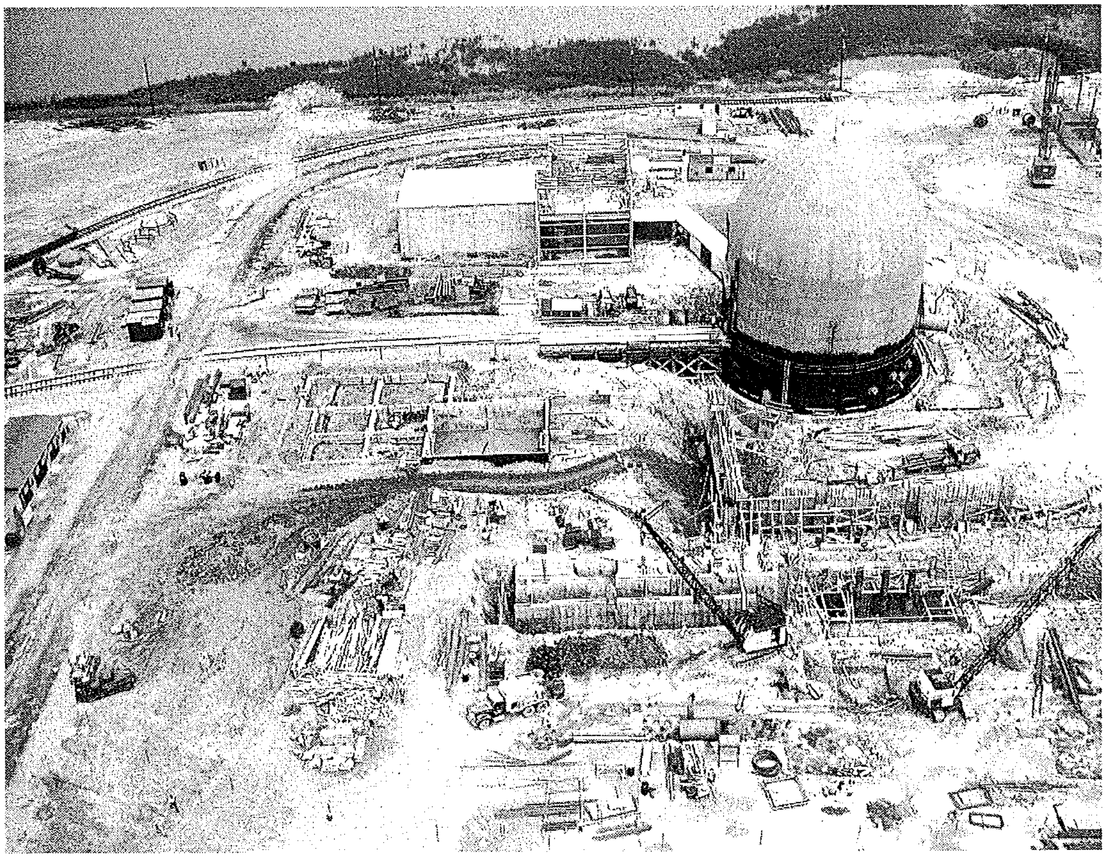




Addendum to Site Conceptual Model Report

Updated Table of Analytical Results and Clarifications

This addendum provides an updated version of Table 5, "Radionuclide Analytical Results" from the "Site Conceptual Model, Revision 1" report. This table includes more recent data and includes the onsite laboratory analysis of the five new wells, sump analytical results, Tc-99 and Sr-90 results.

This attachment also provides the following two clarifications to the "Site Conceptual Model, Revision 1".

1. Section 3.7.4 addresses the onsite quarry and its use to supply fill material for the construction of Fermi 2. The first paragraph addresses its original planned size per drawing of ~22 acres and 25 feet deep. The size of ~40 acres and 20 to 70 feet deep listed for June 30, 1972 is the final size when quarry operations ceased.

2. Section 2.1 summarizes the station operating history. It mentions that Fermi 1 experienced a partial fuel meltdown, although no radioactive material was released. Terminology should be that radioactive material was not released in excess of plant limits. Activity levels were elevated in the reactor and reactor building, but the containment automatically isolated and the release of fission products to the environment was within the plant Technical Specification limits.

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*	*Background #1 (Located near NTC) (GW-3)*
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*June-2007*	*December-2007*	*March-2008*	*March-2009*
Date Analyzed												
Parameter	Units											
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.82E-07* <1.12E-06	<3.80E-07	<4.30E-07	<4.30E-07	<4.40E-07	<4.20E-07
Na-22	µCi/cc	<8.3260E-09	<1.1768E-08	<1.1929E-08	<1.0235E-08	<9.3854E-09	<3.99E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported
Co-60	µCi/cc	<1.2821E-08	<1.1915E-08	<1.0760E-08	<1.1448E-08	<1.3298E-08	<4.60E-09* <6.10E-09	<5.80E-09	<2.80E-09	<5.20E-09	<7.90E-09	<7.90E-09
Cs-137	µCi/cc	<8.9032E-09	<9.7535E-09	<8.9682E-09	<9.6380E-09	<1.0172E-08	<3.67E-09* <4.90E-09	<5.70E-09	<2.70E-09	<5.10E-09	<6.30E-09	<7.40E-09
Sr-90	pCi/L						<2.35E-09*					
Tc-99	pCi/L						<3.35E-08*					

Well ID		*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*	*Background #2 (Located off Pointe Aux Peaux Road) (GW-2)*
Sample ID												
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*June-2007*	*December-2007*	*March-2008*	*March-2009*
Date Analyzed												
Parameter	Units											
Parameter	Units											
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<3.80E-07	<4.30E-07	<4.30E-07	<4.40E-07	<4.30E-07
Na-22	µCi/cc	<1.1094E-08	<1.1222E-08	<1.2313E-08	<1.2188E-08	<1.2171E-08	<3.71E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported
Co-60	µCi/cc	<1.2236E-08	<1.3355E-08	<1.3897E-08	<1.2301E-08	<1.1514E-08	<3.36E-09* <5.20E-09	<4.60E-09	<4.40E-09	<6.40E-09	<7.10E-09	<8.60E-09
Cs-137	µCi/cc	<9.4135E-09	<8.8800E-09	<7.9696E-09	<9.4438E-09	<8.9271E-09	<3.58E-09* <5.20E-09	<4.30E-09	<4.10E-09	<4.70E-09	<6.80E-09	<6.60E-09
Sr-90	pCi/L						<2.34E-09*					
Tc-99	pCi/L						<3.23E-08*					

Well ID		*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*	*Background #3 (Located by Firing Range) (GW-4)*
Sample ID												
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*June-2007*	*December-2007*	*March-2008*	*March-2009*
Date Analyzed												
Parameter	Units											
Parameter	Units											
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<3.80E-07	<4.20E-07	<4.30E-07	<4.40E-07	<4.30E-07
Na-22	µCi/cc	<9.8033E-09	<1.0131E-08	<1.0784E-08	<1.0392E-08	<1.0508E-08	<3.79E-09* Not Reported	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported
Co-60	µCi/cc	<1.1228E-08	<1.2311E-08	<1.2352E-08	<1.2468E-08	<1.4441E-08	<3.48E-09* <4.50E-09	<4.50E-09	<2.70E-09	<4.70E-09	<7.70E-09	<8.10E-09
Cs-137	µCi/cc	<1.0670E-08	<8.7213E-09	<7.5394E-09	<8.1238E-09	<1.1569E-08	<3.45E-09* <5.80E-09	<4.80E-09	<2.70E-09	<3.80E-09	<7.10E-09	<7.40E-09
Sr-90	pCi/L						<2.11E-09*					
Tc-99	pCi/L						<2.97E-08*					

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*	*EFT-1S*
Sample ID														*EFT-1/S010510*		
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*January-2010*	*May-2010*	*October-2010*
Date Analyzed														*February-10*		
Parameter	Units													**GEL Results**		
Parameter	Units															
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<4.85E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06
Na-22	µCi/cc	<1.0086E-08	<8.4390E-09	<9.9837E-09	<1.0751E-08	<7.8844E-09	<9.1733E-09	<2.51E-09* <1.1822E-08	<9.5580E-09	<5.5124E-09	<5.3526E-09	<7.9078E-09	<6.4882E-09	NA	<8.11E-09	<7.6214E-09
Co-60	µCi/cc	<1.1063E-08	<1.2497E-08	<1.1037E-08	<1.2852E-08	<1.0587E-08	<1.0667E-08	<2.21E-09* <1.3478E-08	<6.6331E-09	<9.3011E-09	<9.2103E-09	<8.5598E-09	<9.2523E-09	NA	<9.05E-09	<7.2055E-09
Cs-137	µCi/cc	<9.7608E-09	<9.1448E-09	<8.4271E-09	<1.1096E-08	<1.0902E-08	<9.6622E-09	<2.32E-09* <9.7049E-09	<7.9235E-09	<8.1314E-09	<8.5046E-09	<7.9151E-09	<7.3685E-09	NA	<6.17E-09	<6.5733E-09
Sr-90	pCi/L							<1.84E-09*						NA	NA	NA
Tc-99	pCi/L							<2.95E-08*								

Well ID		*EFT-1I*	*EFT-1I*	*EFT-1I*
Sample ID		*EFT-1/I011410*		
Date Sampled		*January-2010*	*May-2010*	*October-2010*
Date Analyzed		*February-10*		
Parameter	Units	**GEL Results**		
Parameter	Units			
H-3	µCi/cc	NA	<1.11E-06	<1.18E-06
Na-22	µCi/cc	NA	<8.35E-09	<5.7501E-09
Co-60	µCi/cc	NA	<7.55E-09	<8.2428E-09
Cs-137	µCi/cc	NA	<6.74E-09	<7.3531E-09
Sr-90	pCi/L	<1.96E-09*	NA	NA
Tc-99	pCi/L			

Well ID		*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*	*EFT-1D*
Sample ID														*EFT-1/D010510*		
Date Sampled		*April-2004*	*July-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*January-2010*	*May-2010*	*October-2010*
Date Analyzed														*February-10*		
Parameter	Units									Duplicate				**GEL Results**		
Parameter	Units															
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.08E-06	<1.25E-06	<1.18E-06	<4.87E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.16E-06	<1.18E-06
Na-22	µCi/cc	<1.0320E-08	<7.8619E-09	<9.0777E-09	<1.1321E-08	<1.2143E-08	<2.80E-09* <1.4078E-08	<9.3654E-09	<1.0331E-08	<8.2444E-09	<6.7178E-09	<7.2134E-09	<1.0735E-08	NA	<6.15E-09	<5.3068E-09
Co-60	µCi/cc	<1.3046E-08	<1.2810E-08	<1.2278E-08	<1.3402E-08	<1.4276E-08	<2.93E-09* <8.2906E-09	<1.2187E-08	<9.3008E-09	<9.9910E-09	<9.6580E-09	<1.0387E-08	<8.5320E-09	NA	<8.39E-09	<6.9431E-09
Cs-137	µCi/cc	<9.5493E-09	<9.4406E-09	<9.9089E-09	<1.0879E-08	<1.0171E-08	<2.80E-09* <8.9010E-09	<9.3495E-09	<8.2578E-09	<8.4241E-09	<7.8385E-09	<8.1651E-09	<9.3764E-09	NA	<6.79E-09	<6.1747E-09
Sr-90	pCi/L						<1.60E-09*							NA	NA	NA
Tc-99	pCi/L						<3.03E-08*									

Well ID		*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*	*EFT-2S*
Sample ID															
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*June-2010*	*November-2010*
Date Analyzed													*October-09*	*September-10*	
Parameter	Units														
Parameter	Units														
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	DRY	<1.25E-06	DRY	<4.87E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	<1.16E-06	DRY
Na-22	µCi/cc	<1.0497E-08	<1.0178E-08	<9.1869E-09		<9.6864E-09		<2.05E-09* <1.1379E-08	<4.7855E-09	<7.4184E-09	<1.0288E-08	<6.4658E-09	<7.4678E-09	<7.89E-09	
Co-60	µCi/cc	<1.3569E-08	<1.1138E-08	<8.6360E-09		<1.1308E-08		<2.12E-09* <1.1956E-08	<9.5573E-09	<1.0316E-08	<1.0201E-08	<8.6624E-09	<9.4332E-09	<7.34E-09	
Cs-137	µCi/cc	<8.6460E-09	<8.1003E-09	<9.2891E-09		<6.1138E-09		<1.93E-09* <5.2764E-09	<9.5321E-09	<6.7670E-09	<6.9924E-09	<7.3340E-09	<9.0637E-09	<7.45E-09	
Sr-90	pCi/L							<1.83E-09*						NA	
Tc-99	pCi/L							<3.03E-08*							

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*	*EFT-2D*
Sample ID																	*EFT-2/D010410*		
Date Sampled		*April-2004*	*April-2004*	*July-2004*	*October-2004*	*November-2004*	*February-2005*	*September-2005*	*February-2006*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*January-2010*	*June-2010*	*November-2010*
Date Analyzed																			
Parameter	Units		*Duplicate*							*Duplicate*							**GEL Results**		
Parameter	Units																		
H-3	µCi/cc	<1.20E-06	<1.20E-06	<1.41E-06	<1.22E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<1.13E-06	<4.85E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06
Na-22	µCi/cc	<9.6289E-09	<1.0458E-08	<9.4942E-09	<1.1906E-08	<9.4260E-09	<9.7954E-09	<1.0476E-08	<1.0568E-08	<1.0342E-08	<2.09E-09* <1.5904E-08	<1.0902E-08	<1.1650E-08	<7.8808E-09	<9.9496E-09	<9.6978E-09	NA	<7.997E-09	<7.9453E-09
Co-60	µCi/cc	<1.1704E-08	<1.0397E-08	<1.4079E-08	<1.5042E-08	<1.1037E-08	<1.0389E-08	<1.3085E-08	<1.0851E-08	<1.4306E-08	<1.88E-09* <1.1447E-08	<1.2098E-08	<1.0316E-08	<9.7815E-09	<1.1696E-08	<8.9898E-09	NA	<8.62E-09	<6.3489E-09
Cs-137	µCi/cc	<9.3513E-09	<6.7600E-09	<1.0681E-08	<8.8931E-09	<9.6981E-09	<9.6680E-09	<8.0124E-09	<9.9376E-09	<1.0540E-08	<1.72E-09* <7.3761E-09	<8.5369E-09	<9.0380E-09	<8.3196E-09	<7.3076E-09	<7.9751E-09	NA	<7.09E-09	<7.1904E-09
Sr-90	pCi/L										<1.79E-09*						NA	NA	NA
Tc-99	pCi/L										<3.00E-08*								

Well ID		*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*	*EFT-4S*
Sample ID																	
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*January-2010*	*May-2010*	*October-2010*
Date Analyzed															*Sample not received by GEL*		
Parameter	Units																
Parameter	Units																
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.13E-06	<4.85E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	NA	<1.26E-09	<1.18E-06
Na-22	µCi/cc	<1.0841E-08	<7.8101E-09	<1.0145E-08	<9.7689E-09	<1.2322E-08	<1.0315E-08	<3.98E-09* <1.0011E-08	<7.4412E-09	<8.4466E-09	<1.0389E-08	<9.6679E-09	<7.6616 E-09	NA		<6.04E-09	<7.7934E-09
Co-60	µCi/cc	<1.2678E-08	<1.3461E-08	<1.0208E-08	<1.0391E-08	<1.5519E-08	<1.1380E-08	<4.29E-09* <1.2594E-08	<1.0900E-08	<8.9259E-09	<8.2588E-09	<1.0954E-08	<9.2386E-09	NA		<7.60E-09	<8.0303E-09
Cs-137	µCi/cc	<9.8021E-09	<8.1678E-09	<9.1254E-09	<9.6594E-09	<1.0487E-08	<1.2591E-08	<3.67E-09* <8.9335E-09	<8.4829E-09	<8.8195E-09	<8.2304E-09	<8.6006E-09	<9.0753E-09	NA		<5.67E-09	<6.6482E-09
Sr-90	pCi/L							<1.63E-09*						NA		NA	NA
Tc-99	pCi/L							<2.98E-08*									

Well ID		*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*	*EFT-4D*
Sample ID															*EFT-4/D122909*		
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*May-2010*	*October-2010*
Date Analyzed															*February-10*		
Parameter	Units								*Duplicate*						**GEL Results**		
Parameter	Units																
H-3	µCi/cc	<1.20E-06	<1.37E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.85E-07* <1.12E-06	<4.84E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.17E-06
Na-22	µCi/cc	<1.0169E-08	<8.3089E-09	<1.1935E-08	<9.3931E-09	<9.8371E-09	<1.1508E-08	<3.50E-09* <1.3470E-08	<3.56E-09* <1.0393E-08	<8.9950E-09	<8.9316E-09	<9.1459E-09	<6.9588E-09	<8.7548E-09	NA	<6.54E-09	<5.8939E-09
Co-60	µCi/cc	<1.1981E-08	<1.1611E-08	<1.0259E-08	<1.2979E-08	<1.2998E-08	<1.2268E-08	<3.68E-09* <1.2313E-08	<3.72E-09* <1.0128E-08	<8.3117E-09	<8.8466E-09	<1.0023E-08	<9.6977E-09	<9.8457E-09	NA	<7.62E-09	<6.9027E-09
Cs-137	µCi/cc	<8.6459E-09	<7.3827E-09	<6.9107E-09	<1.0868E-08	<1.0589E-08	<1.0005E-08	<3.35E-09* <9.4605E-09	<3.55E-09* <6.1486E-09	<9.2439E-09	<8.4863E-09	<8.7263E-09	<8.8013E-09	<7.0717E-09	NA	<6.70E-09	<6.07E-09
Sr-90	pCi/L							<1.60E-09*	<1.49E-09*						NA	NA	NA
Tc-99	pCi/L							<3.00E-08*	<3.06E-08*								

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*	*EFT-5S*
Sample ID														*EFT-5/S122909*		
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*May-2010*	*October-2010*
Date Analyzed														*February-10*		
Parameter	Units													**GEL Results**		
Parameter	Units															
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.92E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06
Na-22	µCi/cc	<1.2267E-08	<1.0527E-08	<1.0156E-08	<1.0087E-08	<1.1347E-08	<1.3134E-08	<1.84E-09* <1.1425E-08	<1.1072E-08	<9.7962E-09	<8.8609E-09	<7.9452E-09	<9.2133E-09	NA	<6.02E-09	<7.2582E-09
Co-60	µCi/cc	<1.0968E-08	<1.1448E-08	<1.0691E-08	<1.4063E-08	<9.2084E-09	<1.2518E-08	<1.98E-09* <1.1150E-08	<1.0052E-08	<9.1024E-09	<9.0657E-09	<9.5254E-09	<6.1753E-09	NA	<1.00E-08	<6.7473E-09
Cs-137	µCi/cc	<9.9056E-09	<7.0427E-09	<9.5432E-09	<8.8377E-09	<8.4928E-09	<1.0614E-08	<1.87E-09* <7.0719E-09	<7.2689E-09	<8.3949E-09	<8.5134E-09	<1.0150E-08	<7.8685E-09	NA	<7.41E-09	<6.6547E-09
Sr-90	pCi/L							<1.65E-09*						<1.96E0-9*	NA	NA
Tc-99	pCi/L							<3.01E-08*								

Well ID		*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*	*EFT-5D*
Sample ID															*EFT-5/D122909*		
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*December-2009*	*May-2010*	*October-2010*
Date Analyzed															*February-10*		
Parameter	Units					*Duplicate*									**GEL Results**		
Parameter	Units																
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.93E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.16E-06	<1.32E-06
Na-22	µCi/cc	<7.9238E-09	<1.0875E-08	<1.2568E-08	<1.0362E-08	<7.7359E-09	<1.1353E-08	<1.0687E-08	<2.40E-09* <1.1295E-08	<1.0634E-08	<9.6624E-09	<1.0031E-08	<7.5168E-09	<9.1260E-09	NA	<8.79E-09	<6.4167E-09
Co-60	µCi/cc	<1.1440E-08	<1.0748E-08	<1.2334E-08	<1.2107E-08	<1.1624E-08	<1.2502E-08	<1.2956E-08	<2.34E-09* <1.1046E-08	<9.7632E-09	<1.2708E-08	<9.6523E-09	<9.6361E-09	<7.2827E-09	NA	<8.45E-09	<7.4735E-09
Cs-137	µCi/cc	<9.9193E-09	<8.4313E-09	<9.5826E-09	<1.1570E-08	<9.9670E-09	<1.0344E-08	<1.0007E-08	<2.14E-09* <9.5759E-09	<8.3723E-09	<8.2371E-09	<8.0682E-09	<8.6436E-09	<7.9105E-09	NA	<6.145E-09	<7.042E-09
Sr-90	pCi/L								<1.78E-09*						<1.96E-09*	NA	NA
Tc-99	pCi/L								<3.01E-08*								

Well ID		*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*	*EFT-6S*
Sample ID													*EFT-6/S122909*		
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*August-2009*	*December-2009*	*May-2010*	*October-2010*
Date Analyzed													*February-10*		
Parameter	Units												**GEL Results**		
Parameter	Units														
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<4.84E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.10E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	<1.18E-06
Na-22	µCi/cc	<1.2405E-08	<9.2077E-09	<1.1005E-08	<1.2600E-08	<1.2452E-08	<4.37E-09* <1.2169E-08	<1.1646E-08	<7.7428E-09	<8.0792E-09	<8.8864E-09	<8.3924E-09	NA	<8.82E-09	<7.1409E-09
Co-60	µCi/cc	<1.3624E-08	<1.1987E-08	<1.2262E-08	<9.7660E-09	<1.3875E-08	<3.78E-09* <1.1451E-08	<1.2410E-08	<7.1885E-09	<9.6521E-09	<9.9537E-09	<8.1703E-09	NA	<9.00E-09	<6.9941E-09
Cs-137	µCi/cc	<9.5382E-09	<9.3034E-09	<9.6692E-09	<9.9529E-09	<8.5905E-09	<3.46E-09* <7.5852E-09	<8.1559E-09	<6.5449E-09	<7.9383E-09	<9.0845E-09	<7.0120E-09	NA	<7.61E-09	<6.7494E-09
Sr-90	pCi/L						<1.74E-09*						NA	NA	NA
Tc-99	pCi/L						<3.03E-08*								

Well ID		*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*	*EFT-6D*
Sample ID																	*EFT-6/D122909*		
Date Sampled		*July-2004*	*July-2004*	*October-2004*	*October-2004*	*February-2005*	*September-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*March-2009*	*August-2009*	*December-2009*	*May-2010*	*October-2010*
Date Analyzed																	*February-10*		
Parameter	Units		Duplicate			Duplicate		Duplicate							*Duplicate*		**GEL Results**		
Parameter	Units																		
H-3	µCi/cc	<1.41E-06	<1.41E-06	<1.22E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.25E-06	<1.13E-06	<4.85E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.12E-06	<1.20E-06	NA	<1.10E-06	<1.18E-06
Na-22	µCi/cc	<1.0323E-08	<8.3389E-09	<7.3284E-09	<1.0716E-08	<8.9670E-09	<9.0835E-09	<1.0728E-08	<1.2956E-08	<1.97E-09* <1.0050E-08	<1.0978E-08	<6.9531E-09	<7.3800E-09	<9.2786E-09	<8.8553E-09	<8.1058E-09	NA	<7.24E-09	<7.4746E-09
Co-60	µCi/cc	<1.4667E-08	<1.3759E-08	<1.1373E-08	<1.4557E-08	<1.1331E-08	<1.4880E-08	<1.1991E-08	<1.3876E-08	<2.13E-09* <1.1469E-08	<9.1155E-09	<9.1083E-09	<1.1316E-08	<8.1625E-09	<7.5742E-09	<8.9149E-09	NA	<7.50E-09	<7.5143E-09
Cs-137	µCi/cc	<7.7276E-09	<9.3965E-09	<8.4927E-09	<1.0527E-08	<8.9498E-09	<9.9425E-09	<9.2431E-09	<1.1844E-08	<1.83E-09* <7.2416E-09	<1.0272E-08	<9.5955E-09	<7.0228E-09	<7.8757E-09	<8.6477E-09	<7.8617E-09	NA	<7.43E-09	<6.2297E-09
Sr-90	pCi/L									<1.75E-09*							NA	NA	NA
Tc-99	pCi/L									<3.03E-08*									

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*	*EFT-7S*
Sample ID														*EFT-7/S010410*		
Date Sampled		*April-2004*	*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*January-2008*	*March-2009*	*September-2009*	*January-2010*	*June-2010*	*November-2010*
Date Analyzed														*February-10*		
Parameter	Units													**GEL Results**		
Parameter	Units															
H-3	µCi/cc	<1.20E-06	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	<1.10E-06	<6.88E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.14E-06	Not Sampled due to radioactive waste shipment.	<1.20E-06	NA	<1.11E-06	<1.18E-06
Na-22	µCi/cc	<1.0688E-08	<6.3803E-09	<1.0185E-08	<9.6176E-09	<1.0723E-08	<1.1291E-08	<1.97E-09* <9.7765E-09	<9.1456E-09	<7.4899E-09	<8.6995E-09		<7.5472E-09	NA	<9.46E-09	<5.9172E-09
Co-60	µCi/cc	<1.3601E-08	<1.2139E-08	<1.1196E-08	<1.3703E-08	<1.1250E-08	<1.3566E-08	<2.01E-09* <1.1678E-08	<8.6767E-09	<9.1024E-09	<7.7048E-09		<1.1047E-08	NA	<7.02E-09	<6.5052E-09
Cs-137	µCi/cc	<7.7272E-09	<9.8698E-09	<1.0263E-08	<8.3787E-09	<1.1287E-08	<9.8752E-09	<1.87E-09* <8.8174E-09	<7.7653E-09	<9.1347E-09	<8.9034E-09		<6.6524E-09	NA	<7.74E-09	<7.2305E-09
Sr-90	pCi/L							<1.76E-09*						NA	NA	NA
Tc-99	pCi/L							<3.10E-08*								

Well ID		*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*	*EFT-8S*		*EFT-8SNew*	*EFT-8SNew*
Sample ID															*EFT-8/S010110*	
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009 (Old Well)*	*June-2010 (Old Well)*	*October-2010 (Old Well)*	*January-2010*	*October-2010*
Date Analyzed															*February-10*	
Parameter	Units														**GEL Results**	
Parameter	Units															
H-3	µCi/cc	<1.41E-06	<1.22E-06	<1.08E-06	<1.25E-06	DRY - No sample	<4.83E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	<1.20E-06	1.11E-06	DRY - No sample	NA	<1.17E-06
Na-22	µCi/cc	<7.6018E-09	<8.4427E-09	<1.1498E-08	<1.0235E-08		<1.68E-09* Not Reported	<1.1224E-08	<1.0725E-08	<7.5504E-09	<8.4483E-09	<8.1074E-09	<8.717E-09		NA	<5.0109E-09
Co-60	µCi/cc	<9.3478E-09	<1.4382E-08	<1.1870E-08	<9.9156E-09		<1.66E-09* Not Reported	<1.1204E-08	<9.3730E-09	<9.5269E-09	<9.6307E-09	<9.6939E-09	<4.47E-09		NA	<6.4163E-09
Cs-137	µCi/cc	<7.1684E-09	<7.8491E-09	<8.1024E-09	<9.4524E-09		<1.77E-09* Not Reported	<7.4546E-09	<9.0125E-09	<6.6822E-09	<8.3972E-09	<8.1659E-09	<7.58E-09		NA	<6.4783E-09
Sr-90	pCi/L						<3.97E-09*						NA		NA	NA
Tc-99	pCi/L						<3.05E-08*									

Well ID		*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*	*EFT-9S*
Sample ID														*EFT-9/S010410*		
Date Sampled		*July-2004*	*October-2004*	*February-2005*	*September-2005*	*February-2006*	*June-2006*	*December-2006*	*December-2006*	*July-2007*	*April-2008*	*March-2009*	*September-2009*	*January-2010*	*June-2010*	*October-2010*
Date Analyzed														*February-10*		
Parameter	Units								Duplicate					**GEL Results**		
Parameter	Units															
H-3	µCi/cc	<1.22E-06	<1.22E-06	DRY - No sample	<1.25E-06	<1.13E-06	<4.82E-07* <1.12E-06	<1.12E-06	<1.12E-06	<1.19E-06	<1.20E-06	<1.12E-06	DRY - No sample	NA	<1.16E-06	<1.18E-06
Na-22	µCi/cc	<9.1340E-09	<9.7325E-09		<8.8513E-09	<1.3391E-08	<1.08E-09* <1.1618E-08	<8.4420E-09	<3.0243E-07	<9.7922E-09	<8.8687E-09	<9.5197E-09		NA	<7.60E-09	<6.2251E-09
Co-60	µCi/cc	<1.3087E-08	<1.1806E-08		<1.0071E-08	<1.3905E-08	<9.78E-10* <1.1436E-08	<8.0832e-09	<7.6620E-08	<1.0399E-08	<1.0762E-08	<9.1692E-09		NA	<1.00E-08	<8.817E-09
Cs-137	µCi/cc	<1.1375E-08	<8.8358E-09		<1.0929E-08	<8.2813E-09	<1.05E-09* <8.9681E-09	<8.5120E-09	<1.1698E-08	<9.1120E-09	<1.0501E-08	<7.9167E-09		NA	<7.31E-09	<6.0579E-09
Sr-90	pCi/L						<1.90E-09*							NA	NA	NA
Tc-99	pCi/L						<3.01E-08*									

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*	*EFT-10S*
Sample ID											*EFT-10S031609*	*EFT-10S91509*	*EFT-10/S123009*		*EFT-10/S123009*
Date Sampled		*September-2005*	*February-2006*	*June-2006*	*December-2006*	*July-2007*	*January-2008*	*January-2008*	*March-2009*	*September-2009*	*March-2009*	*September-2009*	*December-2009*	*June-2010*	*October-2010*
Date Analyzed											*April-09*	*October-09*	*February-10*		
Parameter	Units							Duplicate					GEL Results		
Parameter	Units														
H-3	µCi/cc	<1.25E-06	<1.10E-06	<4.87E-07* <1.12E-06	<1.12E-06	<1.19E-06	<1.14E-06	<1.14E-06	<1.12E-06	<1.20E-06	<1.12E-06	<1.20E-06	NA	<1.11E-06	DRY - No sample
Na-22	µCi/cc	<8.4664E-09	<1.3278E-08	<2.22E-09* <1.2688 E-08	<6.9959E-09	<7.9379E-09	<9.1591E-09	<9.4187E-09	<7.4898E-09	<7.1921E-09	<7.4898E-09	<7.1921E-09	NA	<9.27E-09	
Co-60	µCi/cc	<1.3861E-08	<1.2286E-08	<2.39E-09* <1.2400E-08	<9.2342E-09	<1.1914E-08	<9.2914E-09	<8.4915E-09	<9.8334E-09	<1.0482E-08	<9.8334E-09	<1.0482E-08	NA	<7.29E-09	
Cs-137	µCi/cc	<1.0834E-08	<8.2228E-09	<2.12E-09* <9.8627E-09	<8.6467E-09	<8.7939E-09	<7.4487E-09	<7.1346E-09	<8.1403E-09	<6.8591E-09	<8.1403E-09	<6.8591E-09	NA	<7.81E-09	
Sr-90	pCi/L			<1.47E-09*									NA	NA	
Tc-99	pCi/L			<3.07E-08*											

Well ID		*11-I*
Sample ID		
Date Sampled		*May-2011*
Date Analyzed		*May-11*
Parameter	Units	
Parameter	Units	
H-3	µCi/cc	<1.21E-06
Na-22	µCi/cc	<1.14E-08
Co-60	µCi/cc	<6.88E-09
Cs-137	µCi/cc	<7.41E-09
Sr-90	pCi/L	
Tc-99	pCi/L	

Well ID		*11-D*
Sample ID		
Date Sampled		*April-2011*
Date Analyzed		*April-11*
Parameter	Units	
Parameter	Units	
H-3	µCi/cc	<1.29E-06
Na-22	µCi/cc	<6.15E-09
Co-60	µCi/cc	<8.72E-09
Cs-137	µCi/cc	<8.17E-09
Sr-90	pCi/L	
Tc-99	pCi/L	

Well ID		*12-I*
Sample ID		
Date Sampled		*April-2011*
Date Analyzed		*April-11*
Parameter	Units	
Parameter	Units	
H-3	µCi/cc	<1.29E-06
Na-22	µCi/cc	<5.19E-09
Co-60	µCi/cc	<1.01E-08
Cs-137	µCi/cc	<6.27E-09
Sr-90	pCi/L	
Tc-99	pCi/L	

Well ID		*12-D*
Sample ID		
Date Sampled		*April-2011*
Date Analyzed		*April-11*
Parameter	Units	
Parameter	Units	
H-3	µCi/cc	<1.29E-06
Na-22	µCi/cc	<7.94E-09
Co-60	µCi/cc	<9.12E-09
Cs-137	µCi/cc	<7.13E-08
Sr-90	pCi/L	
Tc-99	pCi/L	

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

TABLE 5

UPDATED RADIONUCLIDE ANALYTICAL RESULTS
SITE CONCEPTUAL MODEL
DETROIT EDISON - FERMI ENERGY CENTER
NEWPORT, MICHIGAN

Well ID		*13-I*	*13-I*
Sample ID			
Date Sampled		*April-2011*	*May-2011*
Date Analyzed		*April-11*	*May-11*
Parameter	Units		
Parameter	Units		
H-3	µCi/cc	<1.29E-06	<1.14E-06
Na-22	µCi/cc	<9.40E-09	<6.82E-09
Co-60	µCi/cc	<1.04E-08	<1.05E-08
Cs-137	µCi/cc	<7.69E-09	<9.85E-09
Sr-90	pCi/L		
Tc-99	pCi/L		

Sump ID		*Sump 1*	*Sump 1*	*Sump 1*	*Sump 1*	*Sump 1*	*Sump 1*	*Sump 3*	*Sump 3*	*Sump 3*	*Sump 3*	*Sump 3*	*Sump 4*	*Sump 4*	*Sump 4*	*Sump 4*	*Sump 4*	*Sump 4*
Sample ID																		
Date Sampled		*April-2008*	*March-2009*	*December-2009*	*May-2010*	*December-2010*	*May-2011*	*April-2008*	*March-2009*	*December-2009*	*December-2010*	*May-2011*	*April-2008*	*March-2009*	*December-2009*	*May-2010*	*December-2010*	*May-2011*
Date Analyzed		*May & June-2008*	*March & May-2009*	*December-09*	*May-2010*	*January-2011*	*May-2011*	*May & June-2008*	*March & May-2009*	*December-09*	*January-2011*	*May-2011*	*May & June-2008*	*March & May-2009*	*December-09*	*May-2010*	*January-2011*	*May-2011*
Parameter	Units																	
Parameter	Units																	
H-3	µCi/cc	<1.22E-06	<1.16E-06	<1.15E-06	<1.20E-06	<1.40E-06	<1.14E-06	<1.22E-06	<1.16E-06	<1.08E-06	<1.40E-06	<1.18E-06	<1.31E-06	<1.16E-06	<1.15E-06	<1.21E-06	<1.40E-06	<1.18E-06
Na-22	µCi/cc	<9.0631E-09	<8.87E-09	<1.06E-08	<5.78E-09	<5.1084E-09	<5.71E-09	<1.03E-08	<8.66E-09	<1.18E-08	<6.8372E-09	<7.08E-09	<9.06E-09	<8.40E-09	<8.80E-09	<6.35E-09	<1.0444E-08	<6.93E-09
Co-60	µCi/cc	<8.8998E-09	<1.05E-08	<8.33E-09	<7.63E-09	<7.2319E-09	<7.64E-09	<6.94E-09	<1.35E-08	<1.061E-08	<6.0617E-09	<8.64E-09	<7.11E-09	<9.14E-09	<7.65E-09	<7.78E-09	<9.5972E-09	<9.41E-09
Cs-137	µCi/cc	<9.5851E-09	<9.20E-09	<8.69E-09	<7.55E-09	<7.4335E-09	<7.08E-09	<9.24E-09	<1.05E-08	<9.30E-09	<8.2164E-09	<6.74E-09	<8.38E-09	<9.40E-09	<8.90E09	<6.17E-09	1.86-2.47E-08	<6.67E-09
Sr-90	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tc-99	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Sump ID		*Sump 5*	*Sump 5*	*Sump 5*	*Sump 5*	*Sump 5*	*Sump 5*	*Sump 8*	*Sump 9*	*Sump 9*	*Sump 9*	*Sump 9*	*Sump 9*	*Sump 9*
Sample ID														
Date Sampled		*April-2008*	*March-2009*	*December-2009*	*May-2010*	*December-2010*	*May-2011*	*May-2011*	*April-2008*	*Nov.-2008*	*December-2009*	*May-2010*	*December-2010*	*May-2011*
Date Analyzed		*May & June-2008*	*March & May-2009*	*December-09*	*May-2010*	*January-2011*	*May-2011*	*May-2011*	*May & June-2008*	*March & May-2009*	*December-09*	*May-2010*	*January-2011*	*May-2011*
Parameter	Units													
Parameter	Units													
H-3	µCi/cc	<1.22E-06	<1.16E-06	<1.08E-06	<1.21E-06	<1.40E-06	<1.18E-06	<1.18E-06	<1.22E-06	<1.16E-06	<1.15E-06	<1.21E-06	<1.40E-06	<1.18E-06
Na-22	µCi/cc	<8.65E-09	<1.12E-08	<1.29E-08	<6.37E-09	<9.3255E-09	<6.47E-09	<6.79E-09	<1.04E-08	<1.26E-08	<9.38E-09	<6.81E-09	<4.4551E-09	<6.38E-09
Co-60	µCi/cc	<8.29E-09	<9.07E-09	<1.44E-08	<8.21E-09	<9.4401E-09	<7.75E-09	<8.83E-09	<1.00E-08	<1.23E-08	<8.84E-09	<6.96E-09	<8.808E-09	<6.01E-09
Cs-137	µCi/cc	<7.23E-09	<8.89E-09	<8.20E-09	<5.57E-09	<7.3488E-09	<7.25E-09	<6.58E-09	<9.81E-09	<8.69E-09	<8.11E-09	<7.79E-09	<6.5062E-09	<7.16E-09
Sr-90	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tc-99	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Sump ID		*Sump 10*	*Sump 10*	*Sump 10*	*Sump 10*	*Sump 10*	*Sump 10*	*Sump 11*	*Sump 11*	*Sump 11*	*Sump 11*	*Sump 11*	*Sump 11*
Sample ID													
Date Sampled		*April-2008*	*Nov.-2008*	*December-2009*	*May-2010*	*December-2010*	*May-2011*	*April-2008*	*March-2009*	*December-2009*	*May-2010*	*December-2010*	*May-2011*
Date Analyzed		*May & June-2008*	*March & May-2009*	*December-09*	*May-2010*	*January-2011*	*May-2011*	*May & June-2008*	*March & May-2009*	*December-09*	*May-2010*	*January-2011*	*May-2011*
Parameter	Units												
Parameter	Units												
H-3	µCi/cc	<1.22E-06	<1.16E-06	<1.15E-06	<1.21E-06	<1.40E-06	<1.18E-06	<1.22E-06	<1.16E-06	<1.15E-06	<1.20E-06	<1.40E-06	<1.18E-06
Na-22	µCi/cc	<6.78E-09	<1.22E-08	<7.44E-09	<6.47E-09	<7.6968E-09	<6.17E-09	<9.58E-09	<9.54E-09	<9.52E-09	<6.77E-09	<6.092E-09	<6.63E-09
Co-60	µCi/cc	<9.74E-09	<1.19E-08	<6.90E-09	<7.16E-09	<9.3461E-09	<7.45E-09	<9.54E-09	<8.47E-09	<9.90E-09	<6.16E-09	<7.8248E-09	<8.27E-09
Cs-137	µCi/cc	<8.36E-09	<8.84E-09	<8.38E-09	<6.42E-09	<6.8833E-09	<5.84E-09	<8.67E-09	<9.46E-09	<9.00E-09	<6.51E-09	<7.1327E-09	<5.77E-09
Sr-90	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tc-99	pCi/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
NA = Not analyzed

* = Results reported from General Engineering Laboratories, LLC (GEL)
< = Sample activity was below the minimum detectable activity (MDA) for the analysis

Attachment 2

Responses to NRC Groundwater Questions

Question 1: The descriptions provided do not present the geologic understanding and framework needed to support analyses and conclusions presented elsewhere in the report. In addition, sections 1.3 and 3.0 of Reference 3 should be combined to create a fluid transition between the regional and local geologic settings. Please provide the following:

- A well-defined description of the physiographic setting, which should include physical characteristics of the site. The physical characteristics should detail the topography, climatic conditions, map identifiers, such as latitude and longitude, township and range, section, landmarks, boundaries, geomorphologic attributes, water body features and drainage patterns and conditions of the site and surrounding area.
- A description of the regional geology should be obtained from public resources, if available, which identifies regional geologic units as well as descriptions of their lithology, mineralogy, porosity, permeability, known thickness, age, source, depositional environment and geomorphic setting. The descriptions should be supported by geologic maps of the surficial and bedrock units, if available.
- A description of the local geology for the project site should include geologic conditions that may affect the project site, a lithology description of the unsaturated and saturated zones, mineralogy, porosity, permeability, known thickness, age, source, depositional environment and geomorphic setting to substantiate and the defend the data and conclusions within the report. The descriptions should be supported by geologic maps of the surficial and bedrock units, if available.

Response to Question 1: The updated site conceptual model is contained in "Site Conceptual Model, Revision 1" in Attachment 1. Section 3.0 is entitled, "Setting, Geology and Hydrogeology". Subsections addressing this question include " Location and Physiographic Setting", "Topography and Surface Water Drainage", "Climate", "Soil", "Geology", including "Regional Geology" and "Station Geology", and "Hydrogeology", including "Regional Hydrogeology" and "Station Hydrogeology".

Question 2: Resolve statement on page ii that June 2006 data is incomplete, but conclusions were reached using June 2006 data.
Response to Question 2: Attachment 1, "Site Conceptual Model, Revision 1" to this letter includes data through the late 2009/early 2010 sample analyses. At the time the Reference 3 report was written, some of the results for the June 2006 samples were available, including the offsite laboratory results and onsite tritium analysis results. The available data was evaluated and included in Reference 3. The other onsite analysis was not complete.

Question 3: The work plan states that the groundwater report will be completed following a minimum of four quarterly sets of sample analyses. The groundwater characterization should include an assessment of groundwater samples from June and December of 2006 since monitoring well construction was not completed until September of 2005.
Response to Question 3: Table 5 of Attachment 1, "Site Conceptual Model, Revision 1", shows at least 4 samples were analyzed from each of the monitoring wells. Note that well 1I was

installed initially as a background well and was not sampled routinely since no other intermediate monitoring wells were installed. Reference 3 addresses that well 1I is not sampled. Sampling of well 1I commenced in early 2010 during the review of the groundwater monitoring information. Well 1I failed this winter (after the October 2010 sample was taken) and the available sample results obtained are contained in Attachments 1 and 3.

Question 4: The report states that Golder installed 16 monitoring wells at 11 locations, but figure 2 shows 15 monitoring wells at 10 locations. Please include monitoring well EFT-1I onto figure 2.
Response to Question 4: Figure 3 of Attachment 1, "Site Conceptual Model, Revision 1", shows the location of EFT1S, 1I and 1D, which are located adjacent to each other.

Question 5: The characterization should include groundwater elevations and radiological samples from monitoring well EFT-1I. Additional wells screened in the intermediate zone may be appropriate to determine if any vertical migration has occurred. Provide justification for not installing/sampling monitoring wells in the intermediate zone, which takes into account the potential for contaminants to migrate downward from the fill material.
Response to Question 5: Three new wells were installed in the intermediate zone. Note that as discussed in Attachment 1, "Site Conceptual Model, Revision 1", Section 3.8, the water in the shallow zone is perched, and the preferred pathways are through the more permeable fill around major structures. Monitoring wells were not originally installed in the intermediate zone since little water was produced in the clay, which acts as an aquitard. Well EFT-1I was sampled, as addressed in response to Question 3. However, it has since failed. Samples were collected in January, May and October for specific analyses.

Question 6: Many of the shallow and deep monitoring wells do not appear to be located down gradient of the areas of concern. In addition, monitoring wells that are located as close as possible or adjacent to the areas of concern may not be appropriate since releases would have occurred over 30 years ago. Provide justification for monitoring well locations that coincides with shallow and deep groundwater flow observations/calculations as well as geochemical conditions that enhance or retard contaminant transport.
Response to Question 6: Refer to Section 6 of Attachment 1, "Site Conceptual Model, Revision 1", for an evaluation of well network in comparison to potential sources. Five additional wells have been installed in 3 locations to improve the monitoring coverage.

Question 7: Clarify if the surveying performed was by a licensed surveyor as stated in the 2005 Golder Work Plan. Also, please include the following:

1) Discussion on the qualification of the surveyor and equipment used,
2) Ground elevations at each monitoring well in reference to a U.S. Geologic Survey vertical benchmark as stated in the Work Plan, and
3) Discussion of benchmarks used for survey.

Response to Question 7: The Fermi 1 well surveys and recent assessment were performed under the supervision of Gregory D. Stephens, a Licensed Professional Land Surveyor in the State of Michigan, (license number 29252). The equipment used was a Leica NA 2 Auto Level.

The elevation benchmark for Fermi 1 is a brass disk set by U.S. Lake Survey in 1961. It differs from the Fermi 2 elevation datum by 0.04 feet and the Fermi 3 datum (NAVD88) by 1.17 feet. To convert data from the Fermi 3 elevation datum to Fermi 1 datum, 1.17 feet needs to be added to the Fermi 3 value.

Attachment 1, "Site Conceptual Model, Revision 1", Table 2 contains the ground elevations at each monitoring well in Fermi 1 datum, excluding the newly installed wells. For the new wells, the ground elevations in Fermi 1 datum are:

Well 11D – 582.84 ft
Well 11I – 582.80 ft
Well 12D – 582.40 ft
Well 12I – 582.47 ft
Well 13I – 582.51 ft

Question 8: The calculations for the horizontal groundwater flow velocity should use the hydraulic conductivity for the fill and not for the glacial lake clay since the water is flowing in the fill.
Response to Question 8: As discussed in Section 3.8 of Attachment 1, "Site Conceptual Model, Revision 1", there is little to no continuous lateral flow in the clay backfill (shallow) and glacial lake clay and glacial till (intermediate). Flow in the fill is primarily limited to the permeable fill surrounding major structures. See Section 3.8 for a discussion of groundwater flow. Also, see Section 3.6.2.1 for the shallow zone clay fill and 3.6.2.4 for the permeable fill.

Question 9: Clarify, preferably using a table, that analysis done at each laboratory. Please specify which radionuclides EF2 is unable to identify.
Response to Question 9: Table 5 of Attachment 1, "Site Conceptual Model, Revision 1", provides a summary of the results of radionuclide analysis for the isotopes of H-3, Na-22, Co-60, and Cs-137 and some Sr-90 analyses. Table 6 provides a summary of the results for radium and uranium isotopes and for gross alpha and gross beta analyzed at General Engineering Laboratory, LLC (GEL). The EF2 laboratory cannot analyze for strontium, or the radium and uranium isotopes and was not used for the gross alpha and gross beta analyses. The results marked with an asterisk on Table 5 for the June 2006 sampling were also analyzed at GEL. There are also results shown as not detected or below the detectable level for Sr-90 for the late 2009/early 2010 sampling period that are noted as being performed at GEL.

An updated Table 5 is included in Attachment 1, "Addendum to Site Conceptual Model, Revision 1" showing the results for the strontium and Tc-99 analysis in June 2006. The Tc-99 results are from GEL since they are not analyzed at EF2. Table 5 is also updated in Attachment 1, " Addendum to Site Conceptual Model, Revision 1" to show the Sr-90 results as below the specific detection level for that analysis, rather than just below detection level and which samples analyzed at GEL in early 2010 were and were not analyzed for strontium.

Question 10: The report states that it does not include June and December 2006 results for gross emissions from licensed radionuclides using gamma spectroscopy and for tritium using liquid scintillation and then goes on to state the June and December 2006 results for liquid scintillation are complete. Please address this discrepancy in the groundwater characterization repot. A table for each sample set would help clarify which analyses were used for the report. The number of groundwater analyses appears to be insufficient to demonstrate that contamination of the site does not exist. Please provide the following:

1) Justification for analyzing one set of samples for alpha and radium activity.
2) Justification for excluding gross beta particle activity from the analytical procedures.

Response to Question 10: Table 5 of Attachment 1, "Site Conceptual Model, Revision 1", contains the analytical results through 2009 for each of the EFT-series wells for four of the key isotopes of tritium, Na-22, Co-60 and Cs-137. The addendum to Attachment 1, "Site Conceptual Model, Revision 1", also shows the Sr-90 and Tc-99 results. At the time the Reference 3 report was being written, EF2 isotopic results were not available for June and December, 2006. The tritium is analyzed using a different instrument, and so those results were available. The sentence structure in Section 2.7 of the Reference 3 report is awkward. The liquid scintillation tritium results were provided to the authors while the report was being written and so they were available for evaluation before report completion and added into the report.

A limited number of samples were sent to the external laboratory for alpha and radium analyses because these radionuclides would not be expected to be present due to plant release without other isotopes that were being analyzed onsite also present and the higher cost of offsite analysis. Gross beta analyses are not contained in the "Work Plan for Groundwater Analysis" (Appendix A of the "Report on Groundwater Characterization"). However, a set of samples was taken in late 2009/early 2010 and analyzed for gross alpha and gross beta. The results are included in Table 6 of Attachment 1, "Site Conceptual Model, Revision 1". Some additional samples from the late 2009/early 2010 sampling period were also analyzed for uranium and radium isotopes. The results were similar to the 2006 analyses, as shown in Table 6.

An additional set of samples taken in October-November 2010 was analyzed for gross alpha and gross beta. Results are shown in Attachment 3.

Question 11: Provide justification for determination that bedding plane fractures are not zones of notable dissolution.

Response to Question 11: This was based on observations during drilling, as addressed in Section 3.5.2 of Attachment 1, "Site Conceptual Model, Revision 1" . During drilling the hydrogeologist noted no clear evidence of dissolution along bedding fractures, such as secondary mineralization in the recovered bedrock cores, drilling fluid loss, a sudden decrease in core barrel penetration resistance, or an unexpected drop in the core barrel. This observation is supported by Section 2.5.1.2.2.2 of the Fermi 2 Updated Final Safety Analysis (UFSAR), which states in part: "Fractures are present to a variable degree in the Bass Islands Group; joints are relatively tight and discontinuous and usually display only very minor solution activity."

Question 12: The description of the fill material is currently insufficient to obtain an understanding of the geologic profile of the fill material. Please provide information on the origin of the fill material and descriptions of the fill material from construction reports and/or geotechnical evaluations.
Response to Question 12: Sections 3.5.2 and 3.6 of Attachment 1, "Site Conceptual Model, Revision 1", address the fill material. Also, refer to the boring logs contained in Appendix B of the Golder report submitted in Reference 3.

Question 13: The assessment of the groundwater flow in the shallow zone is insufficient to determine the controlling factors of groundwater flow in the fill material. Please provide the following:

1) A map that depicts the surface of the glacial lake clay (perching clay) in mean sea level to understand the potential of groundwater flow in the shallow zone.
2) A discussion on groundwater flow through permeable fill materials surrounding subsurface features such as building basements and tunnels with great attention to the flow near the reactor basement since all native clay material was removed down to the bedrock.
3) A discussion of the effectiveness of MW-6D which is set at a depth approximately 12 feet above the reactor basement.
4) A discussion how the sheet piling that retains the fill material along Lake Erie influences the groundwater flow in the shallow zone as well as specifications about the sheet piling illustrated in figure 2 of the work plan included in Reference 3.
5) Contoured groundwater elevation maps for the shallow zone for all dates after 8/5/04 that are shown of figure 1 of the report in Reference 3.

Response to Question 13: Section 3.7 of Attachment 1, "Site Conceptual Model, Revision 1", covers information on station groundwater flow influences, including Sections 3.7.2 on permeable fill and 3.7.3 on the sheet pilings and other dikes. Section 3.8 covers groundwater flow. As discussed in Section 3.8, continuous lateral flow does not occur in the shallow zone at Fermi 1. Therefore, no groundwater contour map can be prepared for the shallow zone.

Section 6.1 addresses the wells monitoring the Reactor Building. It addresses that well EFT-6D monitors the vertical zone at the concrete Reactor Building floor level. Note that the bottom of the Reactor Building is filled with concrete. The section also recommends installation of two additional deep wells, EFT-11D and 12D at 530' to 540', to monitor below the invert of the Reactor Building at 539'. These have been installed. Figures 6 and 11 show the site conceptual groundwater flow model. Figure 7 shows the location of the dikes and sheet piling/beach barrier.

Question 14: Please change the use of native clay, clay and perching clay surface to glacial lake clay throughout the report to be consistent with the cross-sections when referring to the strata that is creating the perched water table.
Response to Question 14: Attachment 1, "Site Conceptual Model, Revision 1", uses specific terms for the clay layers, and describes the Glacial Lake Clay and Glacial Till characteristics.

Question 15: It is stated that, in other areas, the tendency will be for the perched water to slowly penetrate downward through the clay (glacial lake clay and glacial till) into the underlying bedrock, which is the basis for the installation of the bedrock wells. Please provide the following:

1) A map that shows the "other areas" which have a tendency for perched groundwater to penetrate downward.
2) A discussion why these "other areas" have a tendency to allow perched water to penetrate downward.
3) A discussion on seepage through the glacial lake clay and glacial till to the underlying bedrock.

Response to Question 15: Section 3.8 of Attachment 1, "Site Conceptual Model, Revision 1", addresses groundwater flow and Section 5 addresses potential migration. Figures 6 and 11 show the site conceptual model for groundwater flow.

Question 16: During the NRC site visit, it was noted that the piezometric elevation could be seen in a cutout within the FARB building basement floor. Since the site is located so close to Lake Erie it would be probable for a piezometric surface that is hydraulically connected to Lake Erie to exist. Evaluate the observation.

Response to Question 16: Section 2.3.6 and 6.5 of Attachment 1, "Site Conceptual Model, Revision 1", address the Fuel and Repair Building (FARB), including the maintenance pit sump and pit within it, which is constructed down to 545.5', which is into the bedrock. As part of decommissioning, the sump is being dewatered and cleaned. In the past, water had seeped into the maintenance pit sump, and so it is expected that level may rise again during the storage period.

Question 17: Groundwater flow within the intermediate zone should be discussed in detail to provide adequate understanding of the potential for contaminants to be transported through this zone.

Response to Question 17: Section 3.6.2.2 of Attachment 1, "Site Conceptual Model, Revision 1", addresses the intermediate zone and Section 3.8 addresses groundwater flow. Three additional wells have been installed in the intermediate zone to collect additional data.

Question 18: The Upper Tolerance Limit (UTL) should be calculated with an adequate number of samples for the UTL to be representative of site background levels. The use of three sample sets is inadequate for the determination of background UTLs. Provide a UTL for each zone with a suggested minimum of 8 sample sets.

Response to Question 18: Additional background samples were taken to provide additional data for UTL calculations. UTL calculations are only performed for uranium and radium isotopes, since other isotopes were not measured above detectable levels. Section 4.2 and Table 6 of Attachment 1, "Site Conceptual Model, Revision 1", provide the results.

Question 19: The UTL should be calculated for each hydraulic unit of concern. Provide an UTL for the shallow zone and compare the sample results to the UTL in table form.

Response to Question 19: UTL results are provided for the shallow zone and deep (bedrock) zone in Table 6 of Attachment 1, “Site Conceptual Model, Revision 1”,.

Question 20: During Fermi 1 operations, unlined lagoons, pits, canals and surface-drainage ways received radioactively contaminated liquid effluent. These pathways are considered to have a potential for contributing to ground water contamination. What steps have been taken to ensure that high potential pathways created by Fermi 1 operations will be considered during Fermi 2 decommissioning?
Response to Question 20: A special decommissioning list document is maintained onsite showing areas of use of radioactive materials outside the radiologically restricted areas to identify areas of potential contamination. The lists are updated biennially for Fermi 1 and for Fermi 2. The Fermi 2 site includes Fermi 1 per the Fermi 2 UFSAR. The Fermi 2 Historical Site Assessment to be performed during decommissioning is required to address site historical use.

Question 21: Provide groundwater elevation for monitoring wells just after installation and boring logs for EF1 and EF2 REMP wells.
Response to Question 21: The boring logs for Fermi 1 wells were included in Appendix B of the report submitted in Reference 3. Initial groundwater levels are noted on the boring logs. Please note the need to add 0.18 feet to each measurement as addressed in this letter. Attachment 4 to this letter includes the boring logs for the Fermi 2 REMP wells installed in 2003.

Question 22: Is the glacial till considered to be a separate hydrogeologic unit from the dolostone bedrock, or in the same hydrogeologic unit as the bedrock? In either case, the technical basis will need to be supported by data and analysis, e.g. hydraulic conductivity and gradient of the glacial till in comparison to that of the bedrock.
Response to Question 22: Refer to Section 3.6 of Attachment 1, “Site Conceptual Model, Revision 1”, on regional and station hydrogeology for the discussion of these separate zones.

Question 23: Figure 2 in the Reference 3 work plan (“Work Plan for Groundwater Analysis”, Appendix A of the “Report on Groundwater Characterization”) shows a sand unit near Lake Erie. Is this an accurate representation? If so, this sand unit would need to be characterized.
Response to Question 23: The sand unit appeared on a boring log outside the Fermi 1 license termination boundary near the lake. It was not observed during the Fermi 1 well drilling. Refer to Section 3.7 of Attachment 1, “Site Conceptual Model, Revision 1”, regarding areas of influence for Fermi 1.

Question 24: Information on direction and quantity of surface runoff from the site could be useful in estimating groundwater recharge to the fill.
Response to Question 24: Section 3.7.1 and Figure 6 of Attachment 1, “Site Conceptual Model, Revision 1”, address groundwater recharge.

Question 25: In order to concentrate the hydrogeologic review on the most significant areas, it would be useful to know if any known release of contaminates had ever occurred below the glacial lake clay, i.e. directly into the deeper groundwater system.
Response to Question 25: No known releases of contaminates occurred below the glacial lake clay into the bedrock. During plant operation, the Reactor Building systems were filled with heated sodium or gas. There were no water containing systems in the Reactor Building basement. While liquids have been used during decommissioning in the Reactor Building, there are no known releases of contaminates out of the building basement. The Historical Site Assessment discusses the history of known plant releases.

Question 26: Address differences between the Fermi 3 COLA groundwater statements and Fermi 1 report, including that COLA states that data from wells EFT-1D and EFT-2D were omitted since they were not adequately isolated from the influence of groundwater in the overburden.
Response to Question 26: The scope and details of the Fermi 1 decommissioning field investigation and the Fermi 3 COLA field investigation were developed for different purposes. The Fermi 1 decommissioning work was designed to address the possibility of site-specific contaminant transport local to the area of Fermi 1. The Fermi 3 COLA investigation was designed to address both geotechnical questions regarding construction of a new reactor and to characterize the groundwater flow system across the entire property occupied by the Fermi complex. This difference in the physical scale and the purpose of the two investigations has resulted in discrepancies with respect to some interpretations and details of the reported results.

Regarding Fermi 1 monitoring wells EFT-1D and EFT-2D, the Fermi 3 hydrogeologist (Black & Veatch) recognizes that the boring logs and construction details of these two wells indicate the tops of the effective monitoring intervals at approximately one half foot below the top of the Bass Islands dolomite. For groundwater sampling, if the wells are purged immediately prior to sampling, they agreed the groundwater samples should likely be representative of the groundwater near the top of the Bass Islands dolomite.

The Fermi 1 report divided the ground into three zones: shallow, intermediate and bedrock. The Fermi 3 COLA divided the ground into overburden and bedrock, though in some cases the overburden area was further differentiated. The Fermi 3 COLA Final Safety Analysis Report, Section 2.4.12.2.3.2.1, "Overburden", mentions the clay fill installed during construction of Fermi 1 that is monitored by the shallow wells and that the deep wells monitor the upper part of the Bass Islands Group. In the sections on results for September 2007 through March 2008, the report addresses local perched groundwater being apparent near Fermi 1. This corroborates with the site conceptual model for Fermi 1 which addresses perched water in the shallow zone.

One additional impact is due to the construction dike that separates Fermi 1 from the rest of the site. The dike discussed in Section 3.7.3 of Attachment 1, "Site Conceptual Model, Revision 1", provides a barrier for flow through the overburden on the north and west sides of Fermi 1. Typically, the dike also is the boundary at which the type of fill changes between Fermi 1 and the Fermi 2 site.

In conclusion, the differences are due to the scale of the evaluation - the one report is specific to the relatively small area at Fermi 1, the other to the larger site area; the difference of the fill at Fermi 1 vs. the rest of the site; the construction dike; and the purpose of the investigation. Some data from the Fermi 3 COLA is addressed in Sections 3.6 and 3.7 of Attachment 1, "Site Conceptual Model, Revision 1".

Question 27: Long-term monitoring should be removed from the listed objectives of the site conceptual model report. Long-term monitoring is typically used for sites that are using restricted release criteria and are required to continue monitoring for an extended period of time.
Response to Question 27: Detroit Edison agrees this report did not need to include "long-term monitoring" in the objective to "provide recommendations for additional investigations and long-monitoring". It is conceivable that the results of the evaluation could have led to a recommendation of longer term monitoring vs. short term investigations, but it did not. The evaluation did result in recommendations for additional monitoring, but not long-term monitoring. Having "provide recommendations for additional investigations and long-term monitoring" as an objective, is not inappropriate, though long-term monitoring could have been excluded as an objective since the Fermi 1 license termination goal is to meet the criteria. Sampling of the new wells will occur prior to the facility being placed back into a more passive monitoring SAFSTOR status.

Question 28: Provide a short discussion for the ground surface survey results for the Reactor Building air conditioning condensate drainage pipe during decommissioning.
Response to Question 28: The pipe system was partially excavated (out to a distance of approximately 35 feet) forming a trench along its length. This was done until an embankment and frozen ground inhibited further progress. Since the exact location of the discharge is not known, the discharge point has not been surveyed. Surveys of the pipe did not indicate that contamination was present. A gamma spectroscopy analysis of a soil sample from the excavation identified 0.57 pCi/g of Cs-137. This level is within the range of Cs-137 expected from fallout in this area of the country (per the National Council on Radiation Protection & Measurements (NCRP) Report No. 154).

Question 29: Provide a specific date that the contaminated liquid was pumped out of the FARB sump.
Response to Question 29: Per the work request that pumped out and evaporated the liquid, the pumping out of the FARB sump was completed August 31, 2009. Note that additional water may and has collected there, since the building drains are currently still piped to the sump.

Question 30: Provide the LLD of Ra-226.
Response to Question 30: Radium-226 analyses are performed at the GEL laboratory. The detection level varies for each analysis. The range for the 2006 and 2010 analyses was from 0.205 to 1.38 pCi/L, with the majority of detection levels between 0.25 and 0.45 pCi/L.

Question 31: Address the difference between the shallow zone and bedrock groundwater elevations, considering that the shallow zone contains perched water in the fill material, which is perched on top of an unsaturated zone.
Response to Question 31: Refer to Section 3.8 of Attachment 1, "Site Conceptual Model, Revision 1", which is the revision being submitted in this letter.

Question 32: Address the difference is groundwater elevations in the bedrock compared to Lake Erie, including identifying the datum the Lake Erie elevation is provided in and comparing it to the NOAA website showing that the mean elevation of the lake was 571.96 (IGLD 1985 datum) on 8/31/09.
Response to Question 32: Refer to Section 3.8 of Attachment 1,"Site Conceptual Model, Revision 1". Also, a conversion factor of approximately 1.17 feet needs to be added to the IGLD 1985 datum reported on the NOAA website to convert to the Fermi 1 datum for comparison. The converted value is shown in Table 4 of Attachment 1, "Site Conceptual Model, Revision 1".
Question 33: Provide sample results for Tc-99.
Response to Question 33: Results for Tc-99 are included in the modified Table 5 in Attachment 1, Addendum to "Site Conceptual Model, Revision 1".

Question 34: Address the basis of why there would be no continuous flow in the intermediate zone, including reference to any supporting information in the Fermi 3 COLA.
Response to Question 34: Refer to Sections 3.6.2.2 and 3.8 of Attachment 1, "Site Conceptual Model, Revision 1". The new intermediate wells will provide additional information.

Question 35: Provide results of water samples taken from the sumps for groundwater quality characterization and analysis in Table 5.
Response to Question 35: The results are included in the Addendum to "Site Conceptual Model, Revision 1". Note that in January 2011, sample analysis of a sample from Sump No. 4 identified Cs-137 at ~2E-08 uCi/ml. A backup sample was taken and no plant related radioactive material was found in that sample. No Cs-137 was identified in the other sump samples. The 10CFR20 App. B Table 2 for Cs-137 water is 1E-06 uCi/ml and Table 3 value for release to sewers is 1E-05 uCi/ml. The first sample contained a large amount of sediment which is not normally discharged as the sump pump sits above the sediment. The second sample had very little sediment in the sample. The normal sample method of dropping a sample tube into the sump was used on both occasions. Further investigation determined that the sediment contained the Cs-137, while the water in the sump and discharge did not. The sump was subsequently cleaned. No Cs-137 was detected in the post-cleanup sample or in the subsequent periodic sample. As part of the corrective action document follow-up, the sediment at the bottom of the other sumps being sampled was checked for potential plant related activity. Slight amounts of Cs-137 were detected in the sediment at the bottom of Sumps 1 and 10. Testing showed no detectable Cs-137 in the discharge of these sumps. The sump pump suctions were above the level of the sediment. The sumps were cleaned. No Cs-137 was detected in the subsequent periodic sump samples. This response updates the information contained in Attachment 1, "Site Conceptual Model, Revision 1", regarding sump sample results.

Attachment 3

Well Samples Analyzed for Gross Alpha and Gross Beta

Well Samples Analyzed for Gross Alpha and Gross Beta

Well Background Wells	Sample Date	Gross Alpha pCi/L	Gross Beta pCi/L
EFT-1S	1/05/10	<5	<5
	10/25/10	<5	<5
EFT-1I	1/14/10	5.77	<5
	10/28/10	5.19	7.44
MW-393S	1/13/10	17.4	7.9
MW-388S	1/13/10	15.2	35.8
GW-02	1/14/10	<5	5.75
	10/14/10	4.07	2.83
EFT-1D	1/5/10	<5	<5
	10/27/10	10.1	9.78
MW-381D	1/13/10	4.11	<5
MW-393D	1/13/10	<5	8.47
GW-04	10/28/10	3.96	5.76
GW-03	10/13/10	<5	3.57

Well Monitor Wells	Sample Date	Gross Alpha pCi/L	Gross Beta pCi/L
EFT-2S	Dry 1/10 & 10/10	-	-
EFT-4S	12/29/09	<5	<5
	10/20/10	<5	7.44
EFT-5S	12/29/09	<5	3.53
	10/27/10	<5	<5
EFT-6S	12/29/09	6.22	<5
	10/20/10	4.08	4.81
EFT-7S	1/4/10	<5	<5
	11/1/10	2.82	4.84
EFT-8S	1/4/10	<5	15.5
	10/25/10	3.96	9.77
EFT-9S	1/4/10	12	10.2
	10/14/10	<5	<5
EFT-10S	12/30/09	<5	5.59
	Dry 11/10	-	-
GW-01	1/14/10	<5	<5
EFT-2D	1/4/10	<5	5.53
	10/25/10	5.01	6.85
EFT-4D	12/19/09	<5	5.07
	10/20/10	6.35	7.69
EFT-5D	12/29/09	<5	6.77
	10/20/10	3.53	9.40
EFT-6D	12/29/09	<5	3.61
	10/14/10	7.86	9.54

Attachment 4

Annulus Sketch and Boring Logs

PROJECT: Detroit Edison/Fermi 1
LOCATION: Monroe, MI
PROJECT NUMBER: 033-8883

RECORD OF BOREHOLE GW-1

BORING DATE: 7/31/03
DRILLING CONTRACTOR: Toltest

SHEET 1 OF 1
DATUM: LOCAL

BORING METHOD: Split Spoon; 4 1/4" Hollow Stem Auger

SOIL PROFILE

DEPTH SCALE FEET	DESCRIPTION	ELEV. DEPTH (ft)
	SANDY SOIL	
0	9" Dry, brown, sand (F.L.).	0.0
	2" Red brick	3.0
	Moist, black and grey, silty clay (FILL).	
	Moist, black, sand and silt, trace of clay (FILL).	3.0
	Wet, dark grey, SANDY SILT.	8.0
10	Wet, dark grey, fine SAND.	10.6
	Wet, dark brown, PEAT.	11.0
15	Moist, soft, bluish grey, SILTY CLAY, trace of humus.	14.0
	Moist, greenish grey, medium to fine SAND	18.1
	Moist, greenish grey to reddish brown, SILTY CLAY, laminated.	
20	Moist, reddish brown, SILTY CLAY trace of silt and fine gravel.	20.0
	Brown, medium SAND	23.1
25	Moist, grey, SILTY CLAY with trace fine gravel, hard (1" rock fragment at 20').	
30	LIMESTONE.	28.0
	End of Boring.	33.0
35		

SAMPLES

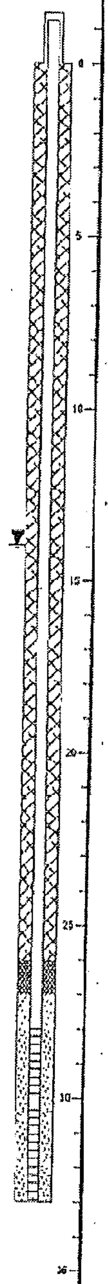
NUMBER	TYPE	RECOVERY (in)
1	2" D.O.	8
2	2" D.O.	18
3	2" D.O.	24
4	2" D.O.	23
5	2" D.O.	14
6	2" D.O.	20
7	2" D.O.	24
8	2" D.O.	12
9	2" D.O.	20
10	2" D.O.	20
11	2" D.O.	16
12	2" D.O.	10
13	2" D.O.	20
14	2" D.O.	23

ELEVATION

ADDITIONAL LAB. TESTING

WELL CONSTRUCTION DETAILS AND GROUNDWATER OBSERVATIONS

GW-1



Aluminum Protective Cover

Well Casing:
2" Sch. 40 PVC with non welded flush joints and O-rings

Well Development:
Date: 8/5/03
Method: Split Spoon/Hollow Stem Auger
Equipment: 2" D.O.
Duration: 2' minutes

Stabilization Parameters:
Odor: None
pH (s.u): 6.58
SC (mS): 2.57
Turb (NTU): 0
Temp (°C): 12.3

Annular Grout:
Slurry Bentonite Grout

Static Water Level at 13.90' bgs. - 7/31/03

Annular Seal:
Bentonite Chip at 26-27'

Filter Pack:
Filter sand 27-33'

Well Screen:
Set screen at 28-33'
2"x30" PVC with machined 0.010" slot and PVC bottom cap

DEPTH SCALE
1 inch to 4.7 feet

Golder Associates

LOGGED: DY
CHECKED: DR

LAN-BOREHOLE LOG-1 ENV DATA BORING LOGS.GPJ GLDR_LDN.GDT 8/27/03 DATA INPUT: EAD

PROJECT: Detroit Edison/Fermi 1
LOCATION: Monroe, MI
PROJECT NUMBER: 033-8803

RECORD OF BOREHOLE GW-2

BORING DATE: 8/1/03
DRILLING CONTRACTOR: Toltest

SHEET 1 OF 1
DATUM: LOCAL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (%)	ELEVATION	ADDITIONAL LAB. TESTING
		GRASS/WEED							
0	Split Spoon 4 1/4" Hollow Stem Auger	0-2" Topsoil.		0.2					
		Moist, mottled, greenish grey/dark grey, silty clay (FILL).			1	2" D.O.	10		
		Moist, mottled, brown/reddish brown, silty clay (FILL).		2.0	2	2" D.O.	10		
5		No recovery.		4.0	3	2" D.O.	0		
					4	2" D.O.	0		
		Moist, brown and grey, SILTY CLAY, trace of silt/fine sand partings, trace of coal.		8.0	5	2" D.O.	24		
10		Moist, brown and grey, SILTY CLAY, occasional sand pockets, trace of fine gravel.		10.0	6	2" D.O.	24		
					7	2" D.O.	24		
		Moist, grey, SILTY CLAY, trace of fine gravel.		13.0					
		Moist, grey, SILTY CLAY, trace coarse to fine gravel.		14.0	8	2" D.O.	24		
15		Moist, grey, SILTY CLAY with silt partings.		15.0					
		Moist, grey, SILTY CLAY, little fine gravel and fine sand.		16.0	9	2" D.O.	24		
		Wet, grey, SANDY SILT/SILTY SAND.		18.0	10	2" D.O.	24		
20					11	2" D.O.	24		
					12	2" D.O.	24		
		End of Boring.		24.0					
25									
30									
35									

WELL CONSTRUCTION DETAILS AND GROUNDWATER OBSERVATIONS

GW-2

Aluminum Protective Cover

Well Casing:
2" Sch. 40 PVC with non welded flush joints and O-rings

Well Development:
Date: 8/1/03
Method: Split Spoon/Hollow Stem Auger
Equipment: 2" D.O.
Duration: 50 minutes

Stabilization Parameters:
Odor: None
pH (s.u): 6.74
SC (mS): 2.36
Turb (NTU): 0
Temp (°C): 13

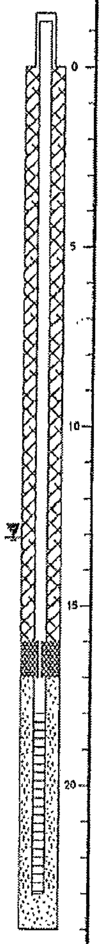
Annular Grout:
Slurry Bentonite Grout

Static Water Level at 13.10' - 8/1/03

Annular Seal:
Bentonite Chip at 16-17'

Filter Pack:
Filter sand 18-24'

Well Screen :
Set screen at 18-23'
2"x60" PVC with machined 0.010" slot and PVC bottom cap



LAN-BOREHOLE LOG-1 ENV DATA BORING LOGS.GPJ GLDR_LDN.GDT 8/27/03 DATA INPUT: EAD

DEPTH SCALE
1 inch to 4.7 feet

Golder Associates

LOGGED: DY
CHECKED: DR

RECORD OF BOREHOLE GW-3

PROJECT: Detroit Edison/Fermi 1
LOCATION: Monroe, MI
PROJECT NUMBER: 033-9863

BORING DATE: 7/20/03
DRILLING CONTRACTOR: Tolest

SHEET 1 OF 1
DATUM: LOCAL

BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	RECOVERY (%)
	GRASS				
Split Spoon 4 1/4" Hollow Stem Auger	Moist, dark grey to mottled brown, silty clay (FILL).	0.0	1	2" D.O.	10
	Moist, mottled reddish brown, greenish grey/grey, silty clay (FILL).	2.0	2	2" D.O.	12
			3	2" D.O.	14
	Moist, reddish brown, grey, SILTY CLAY, occasional in sand layer, trace of fine gravel and coal.	6.0	4	2" D.O.	24
	Moist, brown, SILTY CLAY, little fine gravel, little coal, occasional grey silt/sand pocket.	8.0	5	2" D.O.	24
	Moist, half dark grey and deep brown, SILTY CLAY.	10.0	6	2" D.O.	24
	Damp, grey, hard, SILTY CLAY, trace of fine gravel.	12.0	7	2" D.O.	8
	LIMESTONE.	13.0			
	End of Boring.	22.5			

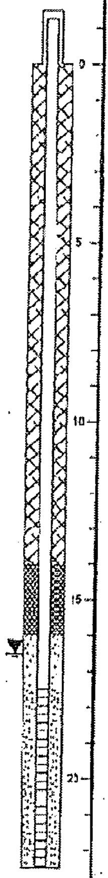
DEPTH SCALE FEET: 0, 5, 10, 15, 20, 25, 30, 35

ELEVATION

ADDITIONAL LAB. TESTING

WELL CONSTRUCTION DETAILS AND GROUNDWATER OBSERVATIONS

GW-3



Aluminum Protective Cover

Well Casing:
2" Sch. 40 PVC with non welded flush joints and O-rings

Well Development:
Date: 7/31/03
Method: Split Spoon/Hollow Stem Auger
Equipment: 2" D.O.
Duration: 1 hour and 12 minutes

Stabilization Parameters:
Odor: None
pH (s.u): 7.34
SC (mS): 1.66
Turb (NTU): 0
Temp (°C): 12.3

Annular Grout:
Slurry Bentonite Grout

Annular Seal:
Bentonite Chip at 14-16'

Static Water Level at 16.51' - 7/31/03

Filter Pack:
Filter sand 16-22.5'

Well Screen:
Set screen at 17.5-22.5
2"x60" PVC with machined 0.010" slot and PVC bottom cap

DEPTH SCALE
1 inch to 4.7 feet

Golder Associates

LOGGED: CY
CHECKED: DR

LAV-BOREHOLE 1 DG-1 ENV DATA BORING LOGS.GPJ GLDR_LDN.GDT 8/27/03 DATA INPUT: EAD

PROJECT: Detroit Edison/Fermi 1
LOCATION: Monroe, MI
PROJECT NUMBER: 031-8883

RECORD OF BOREHOLE GW-4

BORING DATE: 7/30/03
DRILLING CONTRACTOR: Tollest

SHEET 1 OF 1
DATUM: LOCAL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft).	SAMPLES NUMBER	TYPE	RECOVERY (%)	ELEVATION		ADDITIONAL LAB. TESTING
		TOP SOIL								
0	Split Spoon 4 1/4" Hollow Stem Auger	TOPSOIL		0.0						
		Moist, mottled, greenish grey/reddish brown, silty clay (FILL).		0.5	1	2" D.O.	6			
					2	2" D.O.	12			
5		Moist, mottled, grey/brown, SILTY CLAY, trace of silt.		4.0	3	2" D.O.	24			
		Moist, brown/reddish brown, SILTY CLAY, occasional greenish grey/grey silt pocket, trace of fine gravel.		6.0	4	2" D.O.	24			
10		Weathered LIMESTONE.		8.5	5	2" D.O.	8			
15		LIMESTONE.		12.0						
20		End of Boring.		18.0						
25										
30										
35										

WELL CONSTRUCTION DETAILS AND GROUNDWATER OBSERVATIONS

GW-4

Aluminum Protective Cover

Wall Casing:
2" Sch. 40 PVC with non welded flush joints and O-rings

Well Development:
Date: 8/1/03
Method: Split Spoon/Hollow Stem Auger
Equipment: 2" D.O.
Duration: 1 hour and 14 minutes

Annular Grout:
Slurry Bentonite Grout

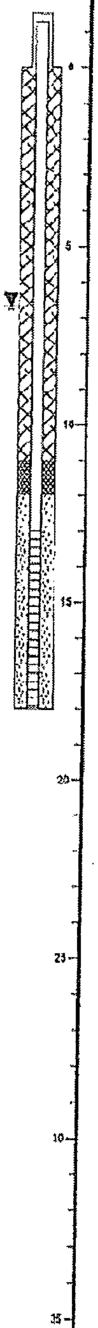
Static Water Level at 6.70' - 8/1/03

Stabilization Parameters:
Odor: None
pH (s.u): NA
SC (mS): NA
Turb (NTU): NA
Temp (°C): NA

Annular Seal:
Bentonite Chip at 11-12'

Filter Pack:
Filter sand 12-18'

Well Screen :
Set screen at 13-18'
2"x60" PVC with machined 0.010" slot and PVC bottom cap



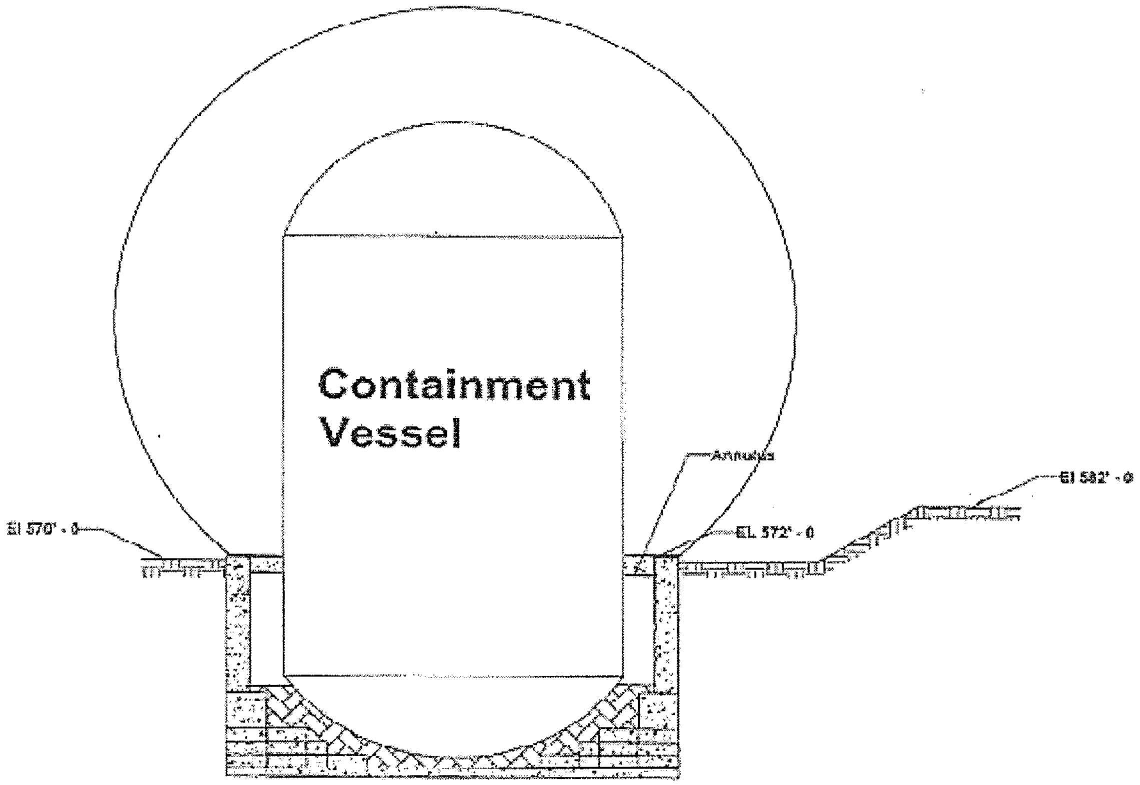
LAN BORHOLE LOG-1 ENV DATA BORING LOGS.GPJ GLDR_LDN.GDT 9/2/03 DATA INPUT: EAD

DEPTH SCALE
1 inch to 4.7 feet

Golder Associates

LOGGED: DY
CHECKED: DR

Reactor Building showing annulus surrounding building below grade.



USNRC
Attachment 4
NRC-11-0018
Page 7

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax 419-241-1808

BORING NUMBER 11-D

PAGE 1 OF 1

CLIENT DTE Energy Company

PROJECT NAME FERMI 1 - Monitoring Wells

PROJECT NUMBER 6851.01

PROJECT LOCATION Monroe, MI

DRILLING CONTRACTOR TTL Associates CW GJ

RIG NO. 111

GROUND ELEVATION 582.84 ft

DRILLING METHOD 6-1/4 in. HSA/Air Rotary

GROUND WATER LEVELS:

DATE STARTED 4/7/11

COMPLETED 4/11/11

∇ **AT TIME OF DRILLING** 28.8 ft / Elev 554.0 ft

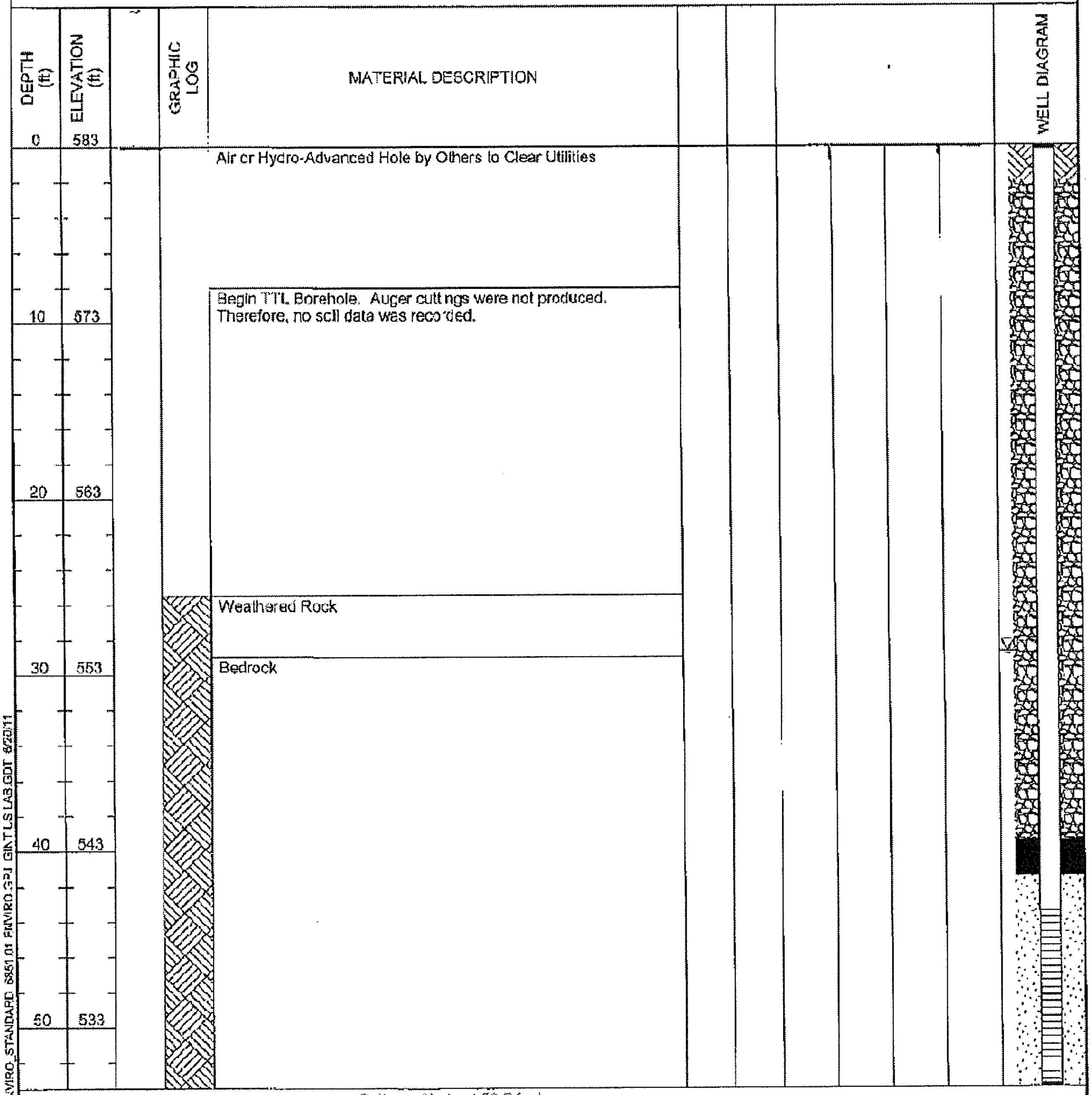
LOGGED BY GJ

CHECKED BY CPI

AT END OF DRILLING ---

NOTES Becomes wet with water under pressure at 28.8 feet bgs

AFTER DRILLING ---



Air or Hydro-Advanced Hole by Others to Clear Utilities

Begin TTL Borehole. Auger cuttings were not produced. Therefore, no soil data was recorded.

Weathered Rock

Bedrock

Bottom of hole at 53.5 feet.

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

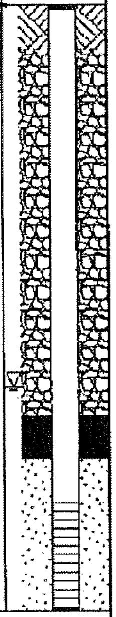
BORING NUMBER 11-I

PAGE 1 OF 1

CLIENT DTE Energy Company
PROJECT NAME FERMI 1 - Monitoring Wells
PROJECT NUMBER 6851.01
PROJECT LOCATION Monroe, MI
DRILLING CONTRACTOR TTL Associates CW GJ
RIG NO. 111
GROUND ELEVATION 582.80 ft
DRILLING METHOD 4-1/4 In. HSA
GROUND WATER LEVELS:
DATE STARTED 3/31/11 **COMPLETED** 3/31/11
∇ **AT TIME OF DRILLING** 17.5 ft / Elev 565.3 ft
LOGGED BY GJ **CHECKED BY** CPI
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION
0	583		Air or Hydro-Advanced Hole by Others to Clear Utilities
10	573	▨	Sandy Silty Clay gray with trace gravel, moist
20	563	░	Silty Sand brown, wet
		▨	Sandy Silty Clay gray with trace gravel, moist
		⊠	Weathered Rock

WELL DIAGRAM



Bottom of hole at 27.8 feet.

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

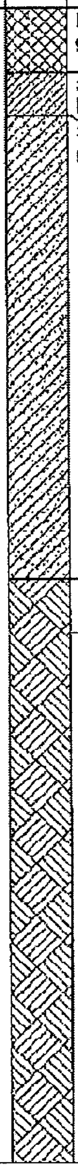
BORING NUMBER 12-D

PAGE 1 OF 1

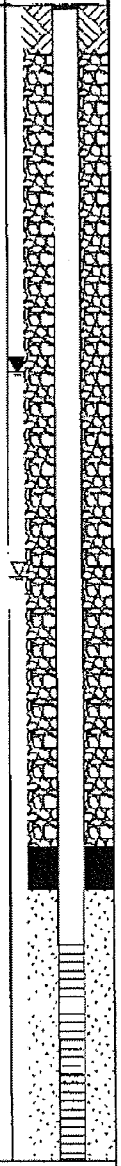
CLIENT DTE Energy Company
PROJECT NAME FERMI 1 - Monitoring Wells
PROJECT NUMBER 685'.01
PROJECT LOCATION Monroe, MI
DRILLING CONTRACTOR TTL Associates CW GJ
RIG NO. 111
GROUND ELEVATION 582.40 ft
DRILLING METHOD 6-1/4 in. HSA/Air Rotary
GROUND WATER LEVELS:
DATE STARTED 4/4/11
COMPLETED 4/5/11
∇ **AT TIME OF DRILLING** 26.5 ft / Elev 555.9 ft
LOGGED BY GJ
CHECKED BY CPI
▼ **AT END OF DRILLING** 17.0 ft / Elev 565.4 ft
NOTES
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION
0	582	Fill gray, crushed stone
		Sandy Clay brown with silt and trace gravel, moist
		Sandy Silty Clay gray with trace gravel, moist
10	572	
20	562	
		Weatherd Rock
		Bedrock
30	552	
40	542	
50	532	

GRAPHIC LOG



WELL DIAGRAM



Bottom of hole at 53.0 feet.

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

BORING NUMBER 12-I

PAGE 1 OF 1

CLIENT DTE Energy Company

PROJECT NAME FERMI 1 - Monitoring Wells

PROJECT NUMBER 6851.01

PROJECT LOCATION Monroe, MI

DRILLING CONTRACTOR TTL Associates CW GJ

RIG NO. 111

GROUND ELEVATION 582.47 ft

DRILLING METHOD 4-1/4 in. HSA

GROUND WATER LEVELS:

DATE STARTED 4/4/11

COMPLETED 4/4/11

▽ **AT TIME OF DRILLING** 26.0 ft / Elev 556.5 ft

LOGGED BY GJ

CHECKED BY CPI

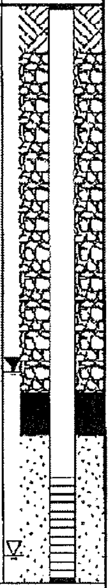
▼ **AT END OF DRILLING** 17.3 ft / Elev 565.2 ft

NOTES

AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION
0	582	▨	Fill gray, crushed stone
		▨	Sandy Clay brown with silt and trace grave, moist
		▨	Sandy Silty Clay gray with trace gravel, moist
10	572		-becomes brown at 11 feet bgs
			-becomes gray and wet at 17.5 feet bgs
20	562		
		▨	Weathered Rock

WELL DIAGRAM



Bottom of hole at 27.3 feet.

TTL Associates, Inc.
1915 N 12th Street
Toledo, Ohio 43624
Telephone: 419-324-2222
Fax: 419-241-1808

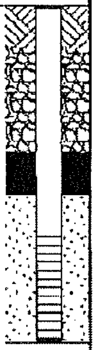
BORING NUMBER 13-I

PAGE 1 OF 1

CLIENT DTE Energy Company
PROJECT NAME FERMI 1 - Monitoring Wells
PROJECT NUMBER 6851.01
PROJECT LOCATION Monroe, MI
DRILLING CONTRACTOR TTL Associates CW GJ
RIG NO. 111
GROUND ELEVATION 582.51 ft
DRILLING METHOD Geoprobe
GROUND WATER LEVELS:
DATE STARTED 4/13/11
COMPLETED 4/13/11
AT TIME OF DRILLING ---
LOGGED BY GJ
CHECKED BY CPI
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)		GRAPHIC LOG	MATERIAL DESCRIPTION
0	583			
				Concrete
				Fill brown sand, moist
				Sandy Silty Clay brown with trace gravel, moist
10	573			
				-becomes gray at 14 feet bgs
				[Advanced to 21.6 feet bgs with 2-inch diameter rod. In order to install well, pushed a 3-inch diameter rod for larger hole. The 3-inch diameter rod could not be advanced beyond 16 feet bgs.]
20	563			

WELL DIAGRAM



Bottom of hole at 21.6 feet.