**William T. O'Connor, Jr.**
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**Detroit Edison**

*A DTE Energy Company*

August 2, 2000
NRC-00-0046

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D C 20555-0001

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Detroit Edison letter to NRC "Proposed Technical Specification Changes (License Amendment) – Design Features/ Fuel Storage (Technical Specification 4.3) and Programs and Manuals/High Density Spent Fuel Racks (Technical Specification 5.5.13)", dated November 19, 1999

Subject: Response to Request for Additional Information on Technical Specifications Change Request Related to Spent Fuel Pool Expansion at Fermi 2 (TAC No. MA7233)

On April 13, 2000, Detroit Edison received a set of NRC questions pertaining to the Radiation Protection area of the proposed Technical Specifications change request to increase the capacity of the Fermi 2 Spent Fuel Pool (Reference 2). On July 13, 2000, a teleconference between Detroit Edison, NRC, and Holtec staffs was conducted to discuss these questions. Enclosed is Detroit Edison's response to the questions.

Should you have any questions or require additional information, please contact Mr. Norman K. Peterson of my staff at (734) 586-4258.

Sincerely,

William T. O'Connor Jr.

Attachment
Enclosure

cc: A. J. Kugler
M. A. Ring
NRC Resident Office
Regional Administrator, Region III
Supervisor, Electric Operators,
Michigan Public Service Commission

A001

I, WILLIAM T. O'CONNOR, JR., do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

William T. O'Connor Jr.

WILLIAM T. O'CONNOR, JR.
Vice President - Nuclear Generation

On this Second day of August, 2000 before me personally appeared William T. O'Connor, Jr., being first duly sworn and says that he executed the foregoing as his free act and deed.

Karen M Reed-Ockerman

Notary Public

KAREN M. REED-OCKERMAN
Notary Public, Monroe County, MI
My Commission Expires Sep. 2, 2003

**ENCLOSURE TO**
**NRC-00-0046**

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION ON TECHNICAL SPECIFICATIONS CHANGE REQUEST RELATED TO SPENT FUEL POOL EXPANSION AT FERMI 2

## Question 1

In your submittal, you state, "Since the new storage racks will be located in closer proximity to the SFP walls, an increase in the adjacent radiological dose is expected. Radiological analyses have shown that the dose levels adjacent to all pool areas will remain within acceptable levels." Discuss the calculation methodology used to draw the above conclusion, and provide the general (mean increase in dose rates) and the maximum dose rate increase (and locations) in, around and under the pool in accessible areas. You should describe how the dose rates will differ for both during storage and movement of spent fuel. You should pay particular attention to the spent fuel cask loading area, directly adjacent to the new racks. What would the dose rates be inside this area, and in accessible, adjacent areas (during fuel rack loading and unloading) if it were possible to have this pit area dry? Do these dose increases change the radiation zoning of the facility as described in the FSAR? If so provide revised radiation zoning maps for the effected areas.

## Response to Question 1

The calculation methodology for all gamma dose rate calculations associated with storage and transit of spent fuel assemblies utilized the following computer programs, all from the Radiation Shielding Information Center (RSIC) in Oak Ridge, Tennessee.

SAS2H-ORIGEN-S/ARP, in "Scale 4.3 – Modular Code System for Performing Standardized Computer Analyses for Licensing Evaluation", NUREG-CR-0200, Rev. 5, September 1995. This program was used to determine 18-group gamma source strengths for spent Fermi-2 fuel assemblies. The fuel assembly characteristics used for the ORIGEN calculations were as follows:

| | |
|---|---|
| Initial enrichment | 5.0%; |
| Fuel exposure | 50,000 Mwd/mtU; and |
| Cooling time | 60 hours. |

QAD-CGGP, A Combinatorial Geometry Point Kernel Code, Report CCC-493, RSIC, July 16, 1980. This program used the 18-group gamma source strengths determined with the ORIGEN program and the combinatorial geometry of the specific volumetric source/dose-rate-point arrangement to determine the gamma dose rate at the specified point. Gamma flux-to-dose conversion factors input in QAD-CGGP were taken from American National Standard ANS/ANSI-6.2.2-1991, neutron and gamma-ray fluence-to-dose factors, ANS, 1992.

PICTURE, in Report CCC-545, Scale 4, Vol. 3, RSIC, August 1984 (date of PICTURE draft). This program was used when preparing the combinatorial geometry input for QAD-CGGP. It checks the proposed geometry for the correct locations and relationships of the solid bodies that will describe the specific source/dose-rate-point situation. For some geometries, it was not necessary to use the PICTURE program.

Dose rates from spent fuel assemblies were calculated using conservative values in every case. Most notably, the fuel cooling time was taken as only 60 hours (the specified minimum) for all assemblies in cases where multiple fuel assemblies form the gamma source. In all fuel-in-transit dose rate calculations, the 60 hour minimum was also used.

For calculations of dose rates from radionuclides in the Spent Fuel Pool water, 18-group gamma source strengths were determined for two sets of measured isotope concentrations: one for normal plant operations, and one for operations during refueling. For radiation zone designations, the higher, refueling-operations concentrations were used.

General dose rate increases will be minimal, with dose rates from stored fuel remaining less than 1 mrem/hr through the east and west pool walls (0.6 mrem/hr maximum compared to a previous maximum of 0.5 mrem/hr). This small increase occurs at the elevation corresponding to the mid-height of the active fuel region of the stored assemblies and at the horizontal mid-point of the array of stored assemblies, and does not require changes in radiation zone designations in accessible areas to the east and west of the pool. There are changes in some radiation zone designations, and these are discussed in detail later in this response. The dose rate beneath the pool will be less than 0.6 mrem/hr, due to the increased shielding between the source (fuel assemblies) and the closest dose rate point. As stated above, the calculated dose rates from the array of stored assemblies are very conservative, because all assemblies in the array are assumed to have been cooled only 60 hours.

The dose rate through the north wall of the Spent Fuel Pool will be relatively high, and it represents the maximum increase from fuel stored in the new racks compared to the old configuration. This is because stored fuel assemblies will occupy spaces along a portion of the north wall that previously did not contain racks and was not used for fuel storage. In the past, the closest approach of most stored fuel to the north wall was about ten feet. This ten feet of pool water provided shielding which, combined with the four-foot-thick concrete north wall and less-conservative fuel parameter specifications, limited dose rates in the region to the north of the wall. Dose rates in the region were shown to have maximums of 1 and 8 mrem/hr (depending on elevation) with the old rack arrangement; the new dose rate maximum will be nearly 400 mrem/hr. This area is an equipment storage room that can be locked and is not part of the general access area for the Reactor Building third floor.

The dose rate in the Spent Fuel Pool will depend on the arrangement of the stored fuel and the location of the dose rate point. It is not anticipated the dose rate will change significantly due to the different rack arrangement, because the characteristics of the stored fuel (initial enrichment, exposure, cooling time) are the principal factors in determining the dose rates within the pool. The pool is already designated radiation zone X, indicating exposure levels that are the maximum under the zone ratings.

The dose rate in the region immediately above the pool is the sum of the dose rates from radionuclides in the pool water and from fuel in transit. The contribution of the stored assemblies to the dose rate at or above the surface of the pool is negligible because of the thickness of water (and fuel assembly structure) above the active fuel. The dose rate from radionuclides in the pool is different for times of normal plant operation and times of refueling, as stated above. The normal dose rate is extremely small, only 0.1 mrem/hr, while the value during refueling is 0.43 mrem/hr. When the contribution from fuel in transit is added to these values, the dose rates at the surface of the pool water are 5.6 mrem/hr and 5.9 mrem/hr for normal operation and refueling, respectively. Note that the dominant contributor to the dose rate is the fuel in transit, and that the conservative dose rate values shown here result from an assembly cooled only 60 hours. The radiation zone designation in the past has indicated a maximum of 2 mrem/hr. The need for a change in zone designation is not necessitated by the new racks, because the fuel stored there does not contribute materially to the dose rate above the pool. The need to change the designation results from the characteristics specified for the fuel assembly that is being moved.

The dose rate on the operating floor, or pool deck, has been 0.5 mrem/hr or less, according to the past zone designation. The new racks will not result in a measurable increase in the dose rate on the pool deck, but the specification of high-exposure, short-cooling-time fuel will. The dose rate three feet above the pool deck, at the edge of the pool, will be 4 mrem/hr during refueling -- when a 60-hour-cooled fuel assembly is located immediately adjacent to the pool wall directly below the dose rate point. More than 90% of this dose rate comes from the single fuel assembly being moved, with the remainder due to the radionuclides in the pool water.

As pointed out in the response to the preceding portion of the request, the new racks will have no affect on the dose rates that result from fuel movement. Those dose rates are determined by the exposure history and cooling time of the assembly being moved. The requirement for a minimum thickness of pool water above the active portion of an assembly in transit does not change.

The differences in dose rates from fuel stored in the old racks versus the new racks have been described above.

The spent fuel cask loading area is simply a region within the Spent Fuel Pool, and it is impossible to have this pit area dry as long as fuel is stored in the pool and requires cooling. The fuel-in-transit dose rate calculations would apply if there were concerns that fuel assemblies may be moved into, or through, this area in the absence of the cask. If it were possible to submerge a cask containing only air, a void would be introduced into the pool. However, the dose rates from the stored fuel are calculated for an array of assemblies located only inches from the pool walls, so introducing a void at some distance removed from any wall would have no effect on the dose rates in surrounding, accessible areas.

Dose rate increases due to the installation of the new racks and due to the specification of high-burnup, short-cooling-time fuels cause changes in the radiation zoning of the facility as described in the UFSAR. These changes are itemized below.

In UFSAR Fig. 12.1-6 ("Third Floor"), for the area north of the Spent Fuel Pool north wall:

Change Zone from III to X.

In UFSAR Fig. 12.1-7, Sheet 1 ("Fourth Floor"), for the area north of the Spent Fuel Pool north wall:

Change Zone from VI to X.

In UFSAR Fig. 12.1-8 ("Fifth Floor"), for the area above the Spent Fuel Pool:

Change Zone from IV to VI.

In UFSAR Fig. 12.1-8 ("Fifth Floor"), for the Spent Fuel Pool deck:

Change Zone from II to V.

These changes are reflected in Attachment A containing UFSAR Figures 12.1-6, 12.1.7-Sheet 1 and 12.1-8.

**Question 2**

You note that there may be an emergent need to use divers during the rack installation project. Provide a description of any sources of high radiation that may be in the SFP during potential diving operations at any time during the installation process. Discuss what precautions (such as use of TV monitoring, tethers, etc.) will be used to ensure that the divers will maintain a safe distance from any high radiation sources in the SFP. Describe how you plan to monitor the doses received by the divers during the re-racking operation (e.g., use of dosimetry, alarming dosimeters, remote readout radiation detectors). The NRC staff finds the information, methods and guidelines (pertinent to diving) in Regulatory Guide 8.38, "Control of Access of High and

Very High Radiation Areas in Nuclear Power Plants, "June 1993, acceptable for controlling diving operations.

**Response to Question 2**

During the Fermi 2 fuel rack installation project there is a contingency plan to use divers in the event a pool liner repair is necessary. This is typical for all rerack projects. When the project at Fermi 2 commences, there will be several sources of high radiation in the Spent Fuel Pool including spent fuel, 1 bucket of fuel bundle parts, 2 tubes filled with stelite bearings and 8 LPRM's. If diving is necessary, these sources shall be configured in the Spent Fuel Pool to provide the maximum distance and shielding, consistent with ALARA practices at Fermi 2. Administrative control includes a project dive procedure, compliant with Reg. Guide 8.38 (June 1993) Appendix A, which provides instruction on diver restraint, radiological monitoring, physical monitoring, and standard spent fuel diving operations and documentation. A 6' 3-Dimensional TLD tree, which simulates a human body being lowered into the dive work area contains enough TLD's (sealed in plastic) on it to verify exposure rates and dose gradients. It is typically left in the dive area for 2 to 4 hours and then read using an onsite TLD reader. This ensures proper use of multiple dosimetry, accurate dose assessment and exposure controls.

Communication is a very important aspect of Spent Fuel Pool diving. Pre-dive briefs shall be performed before each dive to discuss dive goals, authorized dive areas, sources of high radiation in the dive area and dose rates, procedural requirements, and team responsibilities. Throughout the dive the diver shall be in constant communication with the dive supervisor by way of a dive radio. The dive procedure requires the dive to be terminated if communication is lost with the diver. An underwater camera shall be used to monitor the diver's location. The diver shall be physically restrained by a dive tender with a tether contained within the dive umbilical. These precautions, in addition to procedural and RWP requirements, will ensure that the diver remains in the designated dive area and away from any high radiation sources in the Spent Fuel Pool. Remote readout dosimetry is also used to monitor the diver's exposure throughout the diving evolution. Alarming dosimeters shall be used to confirm the exposure and dose rates, while TLD's shall be used to officially document final exposure.

**Question 3**

Describe any radiation surveys that will be performed (from the pool rim or by divers in the pool) to map dose rates in the SFP, or to check for contamination of material, equipment or divers upon removal from the pool.

**Response to Question 3**

A detailed pool survey shall be performed, from the rim of the pool, using remote underwater probes to map dose rates in and around the dive area to verify all intended high radiation sources have been removed from the area. It is standard procedure to equip the diver with a probe for surveying the dive area. Any item removed from the Spent Fuel Pool, including the diver, shall be surveyed for radiation, and smeared for contamination levels. The diver and all equipment removed from the Spent Fuel Pool are monitored for potential "hot particles". This is accomplished by setting up bull pen areas where the diver and all equipment are monitored for hot particles. This also isolates the bull pen from the rest of the refuel floor to prevent the spread of higher levels of contamination to general access areas. Fermi 2 has experienced minor fuel defects in the past. These bundles have been suppressed in the core until removed. In 1998 Fermi experienced fuel defects that resulted in suppressing the affected 2 bundles and eventual

change-out during a mid-cycle outage. These fuel bundles are currently stored in the Spent Fuel Pool and have not been disassembled. At no time in the history of the plant have "fuel fleas" or alpha particles been detected from fuel leaks.

**Question 4**

The design change requested includes storage racks to be installed above the new fuel storage racks that "may support up to five tons each (dry weight) of miscellaneous components." If these racks are intended for storing radioactive components, describe the "additional measures" that will be provided such that an individual is not able to gain access to a Very High Radiation Area (VHRA), as required by 10 CFR 20.1602. You should address, at a minimum, the measures that will prevent someone from creating a VHRA by raising activated components, stored on these racks, out of the pool during this pool re-racking as well as future plant operations.

**Response to Question 4**

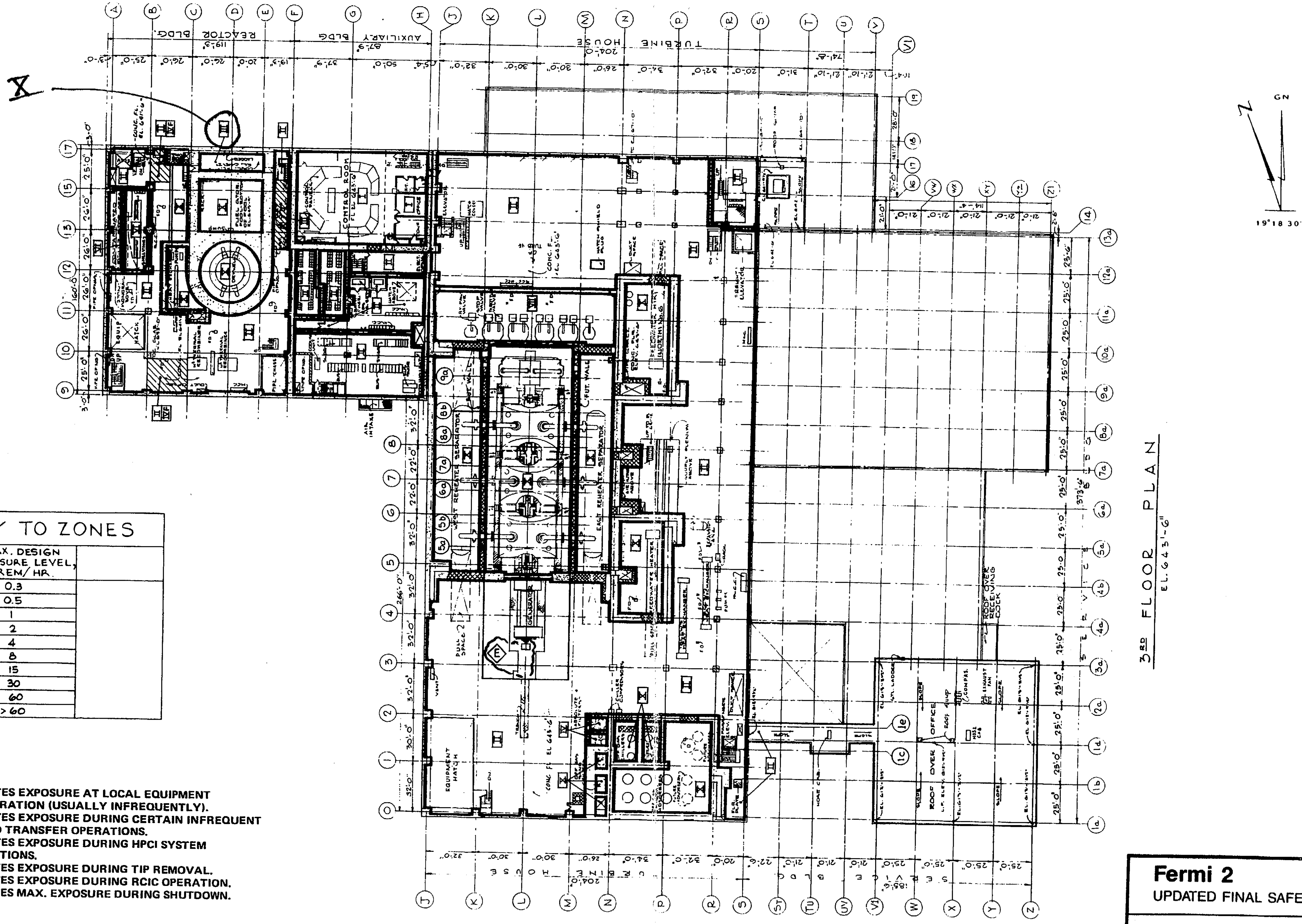
The overhead platform is installed on top of the new fuel storage racks in the Fermi 2 Spent Fuel Pool. The overhead platform extends 30 inches above the rack and maintains sufficient water coverage (shielding) to the surface of the pool. Radioactive components may be stored on the overhead platform, some of which may be highly radioactive. Lifting slings and tag lines will be properly secured to the sides of the Spent Fuel Pool. The slings and lines will be tagged with a "Radioactive Materials Tag". The "Radioactive Materials Tag" will contain identified radiological hazards and conditions for the material, accurate dose rate assessment, and sufficient information to meet the requirements in 10 CFR 19.12 for "Instructions to Workers". Because the components are considered "inaccessible to personnel" performing above pool surface duties the requirements of 10 CFR 20.1601(a) and 20.1602, do not apply. This guidance is described in NUREG/CR-5569 Revision 1 "Health Physics Positions Data Base", positions HPPOS-016 and HPPOS-245 for access controls for Spent Fuel Storage Pools. Administrative procedures and controls shall govern movement, surveying, and storage of all components on the overhead platform.

**ATTACHMENT TO**
**NRC-00-0046**

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION ON TECHNICAL SPECIFICATIONS CHANGE REQUEST RELATED TO SPENT FUEL POOL EXPANSION AT FERMI 2**

**ATTACHMENT A**

**(Marked up UFSAR Figures 12.1-6, 12.1.7-Sheet 1 and 12.1-8)**




## KEY TO ZONES

| ZONE NO. | MAX. DESIGN EXPOSURE LEVEL, MREM/HR. |
|---|---|
| I | 0.3 |
| II | 0.5 |
| III | 1 |
| IV | 2 |
| V | 4 |
| VI | 8 |
| VII | 15 |
| VIII | 30 |
| IX | 60 |
| X | > 60 |

A. DENOTES EXPOSURE AT LOCAL EQUIPMENT IN OPERATION (USUALLY INFREQUENTLY).
B. DENOTES EXPOSURE DURING CERTAIN INFREQUENT LIQUID TRANSFER OPERATIONS.
C. DENOTES EXPOSURE DURING HPCI SYSTEM OPERATIONS.
D. DENOTES EXPOSURE DURING TIP REMOVAL.
E. DENOTES EXPOSURE DURING RCIC OPERATION.
F. DENOTES MAX. EXPOSURE DURING SHUTDOWN.

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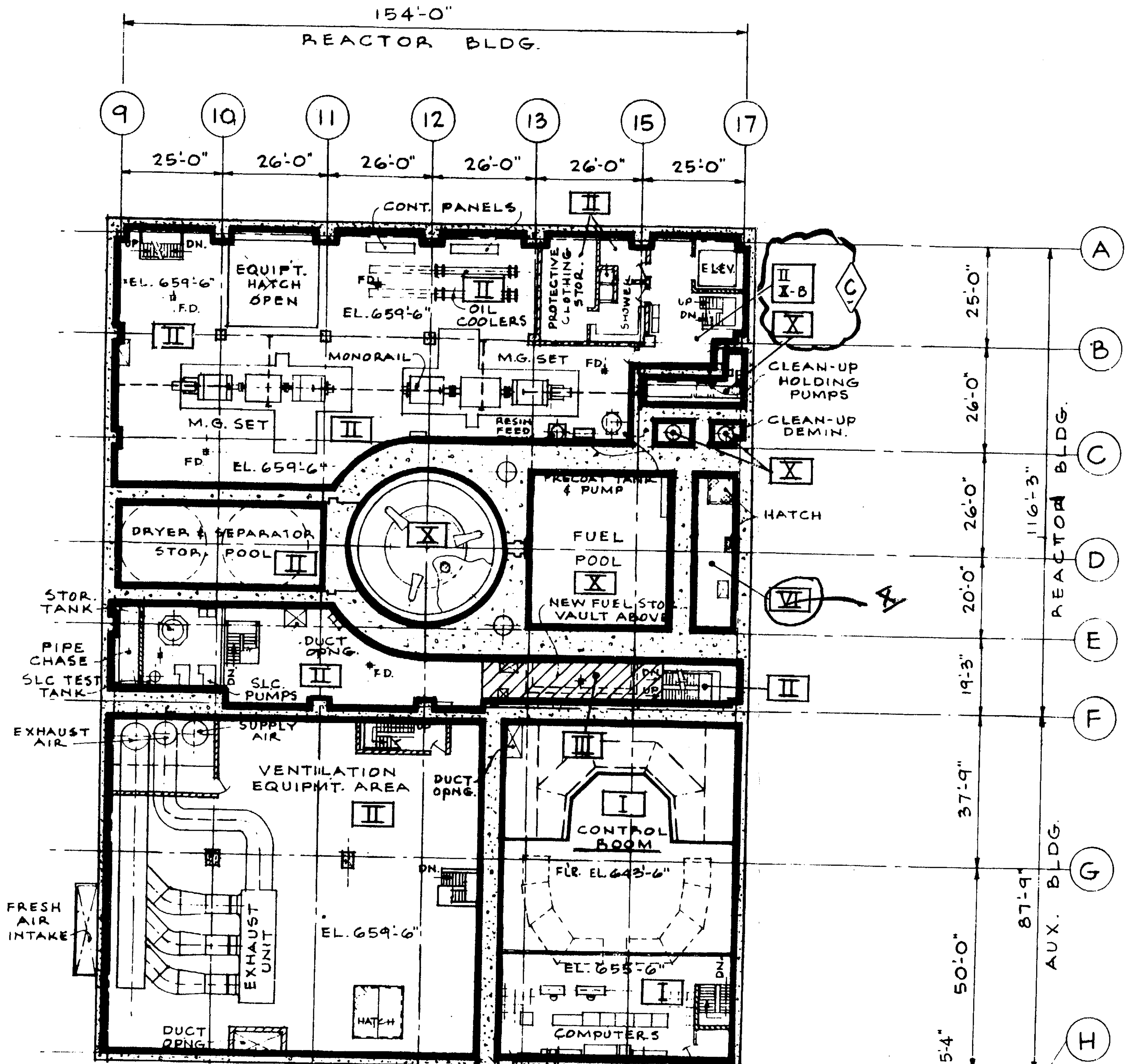
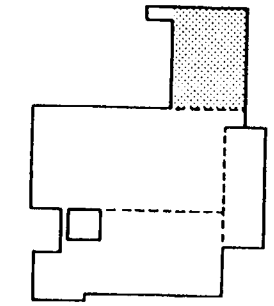
**Fermi 2**
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 12.1-6

FERMI 2 RADIATION ZONES–THIRD FLOOR PLAN



## Key To Zones

| ZONE NO. | MAX. DESIGN EXPOSURE LEVEL, MREM/HR. |
|---|---|
| I | 0.3 |
| II | 0.5 |
| III | 1 |
| IV | 2 |
| V | 4 |
| VI | 8 |
| VII | 15 |
| VIII | 30 |
| IX | 60 |
| X | >60 |

A. DENOTES EXPOSURE AT LOCAL EQUIPMENT IN OPERATION (USUALLY INFREQUENTLY).
B. DENOTES EXPOSURE DURING CERTAIN INFREQUENT LIQUID TRANSFER OPERATIONS.
C. DENOTES EXPOSURE DURING HPCI SYSTEM OPERATIONS.
D. DENOTES EXPOSURE DURING TIP REMOVAL.
E. DENOTES EXPOSURE DURING RCIC OPERATION.
F. DENOTES MAX. EXPOSURE DURING SHUTDOWN.

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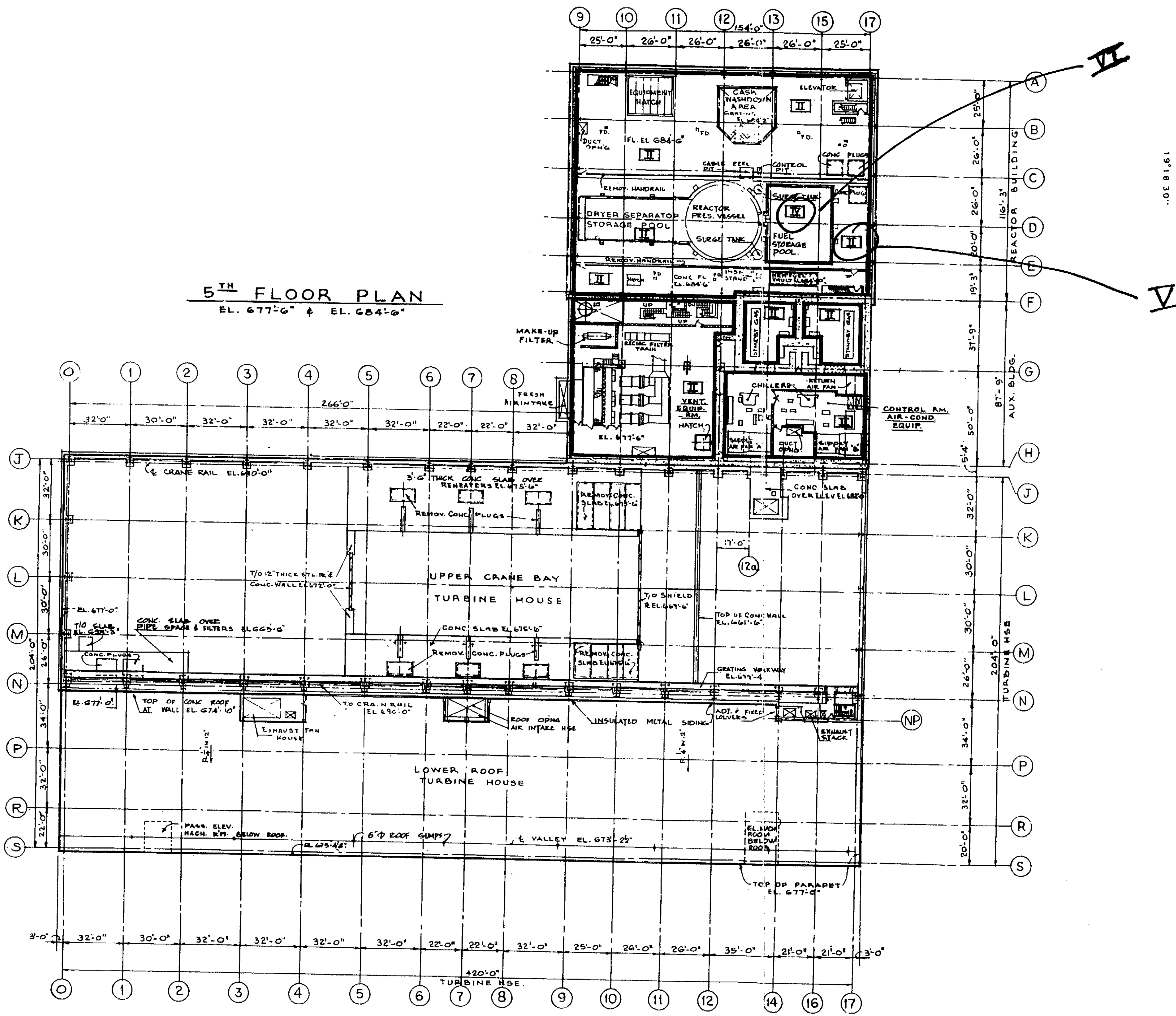
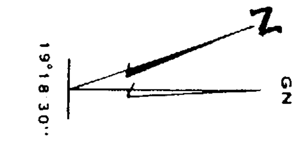
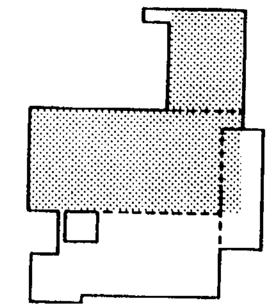
**Fermi 2**
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 12.1-7, SHEET 1

FERMI 2 RADIATION ZONES
FOURTH FLOOR PLAN



## Key To Zones

| ZONE NO. | MAX. DESIGN EXPOSURE LEVEL, MREM/HR. |
|---|---|
| II | 0.5 |
| III | 1 |
| IV | 2 |
| V | 4 |
| VI | 8 |
| VII | 15 |
| VIII | 30 |
| IX | 60 |
| X | > 60 |

A. DENOTES EXPOSURE AT LOCAL EQUIPMENT IN OPERATION (USUALLY INFREQUENTLY).
B. DENOTES EXPOSURE DURING CERTAIN INFREQUENT LIQUID TRANSFER OPERATIONS.
C. DENOTES EXPOSURE DURING HPCI SYSTEM OPERATIONS.
D. DENOTES EXPOSURE DURING TIP REMOVAL.
E. DENOTES EXPOSURE DURING RCIC OPERATION.
F. DENOTES MAX. EXPOSURE DURING SHUTDOWN.

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**Fermi 2**
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 12.1-8

FERMI 2 RADIATION ZONES – FIFTH FLOOR PLAN