The racks are designated ANS Safety Class 3 and Seismic Category I and are designed to withstand normal and postulated dead loads, live loads, and loads caused by the operating basis earthquakes and safe shutdown earthquake events.

The design of the racks is such that K_{eff} remains less than or equal to 0.95 under all conditions, including fuel-handling accidents and the optimum moderation configuration. Due to the use of fuel barriers and the close spacing of the cells, it is impossible to insert a fuel assembly in other than design locations or between the rack periphery and the pool wall.

The racks are also designed with adequate energy absorption capabilities to withstand the impact of a dropped fuel assembly from the maximum lift height of 5 feet over the top of the racks. The fuel storage racks can withstand an uplift force equal to 2000 pounds.

All materials used in construction are compatible with the fuel building/vault environment and all surfaces that come into contact with the fuel assemblies are made of annealed austenitic stainless steel. All the materials are corrosion resistant and do not contaminate the fuel assemblies or vault environment.

9.1.2 Spent Fuel Storage

9.1.2.1 Design Bases

The spent fuel pool, located in the fuel building, is designed to accommodate fuel racks (Figure 9.1-1) that store spent fuel assemblies. At the time of initial operation, installed capacity was at least one and one-third cores.

The spent fuel is stored in racks which are located under water in the spent fuel pool. There are 756 fuel storage locations in 21 storage racks. Each rack consists of cells welded to a grid base and welded together at the top through an upper grid to form an integral structure (Figure 9.1-1). The vertical corners of adjacent cells are also welded (91-21 6/92) together to form an integral structure. The spent fuel pool has the heat load design capacity for 2169 fuel assemblies (Section 9.1.3).

The rack arrays (Figures 9.1-2 and 9.1-3) have a center-to-center spacing of 10.35 inches. Each storage cell incorporates a neutron absorber and is composed of boron carbide in a homogeneous stable matrix. This material is encapsulated in stainless steel for support but is not sealed as it is compatible with the pool environment. The spacing and the design of the racks are such that there is a 95 percent probability that the effective multiplication factor, including uncertainties, does not exceed 0.95 at a 95 percent confidence level.

(97-109 4/97) For the storage of fuel assemblies with nominal enrichment levels between 3.85 and 5.0 w/o U_{235}, a regionalized fuel storage/pool configuration is implemented as follows:

- High enriched, low (or no) burnup fuel is stored in Region I in a 3-out-of-4 array with the fourth storage location blocked. Up to a maximum of 100 storage locations will be blocked as shown in Figure 9.1-2A. (11/89)

- Low enriched, high burnup fuel is stored in Region II in a 4-out-of-4 array due to reactivity credit for burnup being taken into account as permitted by NRC Regulatory Guide 1.13.

Each rack module is provided with adjustable leveling pads at the center of the four corner cells within the module (Figure 9.1-5).

9.1.2.2 Facilities Description

The spent fuel pool (Figure 3.8-63) is an L-shaped structure located in the southwestern quadrant of the fuel building. Two adjacent areas, which are accessible from the spent fuel pool by means of sealable gates, are the transfer canal and the spent fuel shipping cask pit.

9.1.2.3 Safety Evaluation of Spent Fuel Racks

The design and safety evaluation of the spent fuel racks is in accordance with the NRC position paper, Review and Acceptance of Spent Fuel Storage and Handling Applications, April 1978.

The racks are designated ANS Safety Class 3 and Seismic Category I and are designed to withstand normal and postulated dead loads, live loads, loads due to thermal effects, and loads caused by the operating basis earthquakes and safe shutdown earthquake events.

The design of the racks is such that K_{eff} remains less than or equal to 0.95 under all conditions, including fuel handling accidents. Because of the close spacing of the cells, it is impossible to insert a fuel assembly in other than design locations. Inadvertent insertion of a fuel assembly between the rack periphery and the pool wall, placement of a fuel assembly adjacent to, but outside the periphery of a fuel rack, placement of a fuel assembly across the top of a fuel rack, misloading of a fuel assembly in Region 1 or Region 2 are considered postulated accidents and, as such, realistic initial conditions such as 800 ppm boron in the water can be taken into account. This condition has an acceptable K_{eff} of less than 0.95. (11/89)

The racks are also designed with adequate energy absorption capabilities to withstand the impact of a dropped fuel assembly with a dry weight of up to 2,400 pounds from the maximum lift height of the spent fuel bridge and hoist. The new fuel handling crane, which is capable of carrying loads heavier than a fuel assembly, is prevented by interlocks or administrative controls, or both, from bringing the load over the spent fuel pool. The fuel storage racks can withstand an uplift force equal to the uplift capability of the spent fuel bridge and hoist. (97-183 6/97)

All materials used in construction are compatible with the spent fuel pool environment and all surfaces that come into contact with the fuel assemblies are made of annealed austenitic stainless steel. All the materials are corrosion resistant and do not contaminate the fuel assemblies or pool environment.

In order to monitor the effectiveness of neutron absorber material, design provisions have been made for a materials monitoring program. The program consists of two surveillance coupon assemblies. Each assembly has eight packets, each containing three neutron absorbing material coupons of the same neutron absorbing material used in the full racks. The packets are attached to each other by hanger rods which allow removal and periodic inspection to verify the effectiveness of the neutron absorbing material.

One assembly is used for short term testing and the other for long term surveillance. The short term assembly has one packet removed and analyzed after each of the first eight refuelings; the long term assembly has one packet removed and analyzed every 5 years over the 40-year life of the plant.

After each refueling, the short term assembly is moved to a location adjacent to a newly removed spent fuel assembly in order to assure a conservative evaluation of the neutron absorbing material. This phase of the materials monitoring program is completed after eight refuelings. There are three coupons in each packet to provide a statistical significance to the test.

Design of the facility in accordance with Regulatory Guide 1.13 ensures adequate safety under normal and postulated accident conditions.

The methodology used in the criticality analysis is discussed in Section 4.3.2.6.

9.1.3 Fuel Pool Cooling and Purification System

The fuel pool cooling and purification system (Figure 9.1-6) removes decay heat from spent fuel stored in the fuel pool and provides adequate clarification and purification of water in the fuel pool, refueling cavity, and refueling water storage tank. Table 9.1-1 lists the principal component design characteristics for the system. Table 9.1-2 gives the fuel pool cooling system performance characteristics. Figure 3.8-63 shows equipment locations.

9.1.3.1 Design Bases

The fuel pool cooling and purification system is designed in accordance with the following criteria:

1. General Design Criterion 2 (Section 3.1.2.2), as related to structures housing the system and the cooling portion of the system itself being capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods, established in Chapters 2 and 3.

2. General Design Criterion 4 (Section 3.1.2.4), with respect to structures housing the systems and the cooling portion of the system being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks.

3. General Design Criterion 5 (Section 3.1.2.5), as related to shared systems and components important to safety being capable of performing required safety functions.

4. General Design Criterion 44 (Section 3.1.2.44), to include:

   The capability to transfer heat loads from safety related structures, systems, and components to a heat sink under both normal operating and accident conditions.

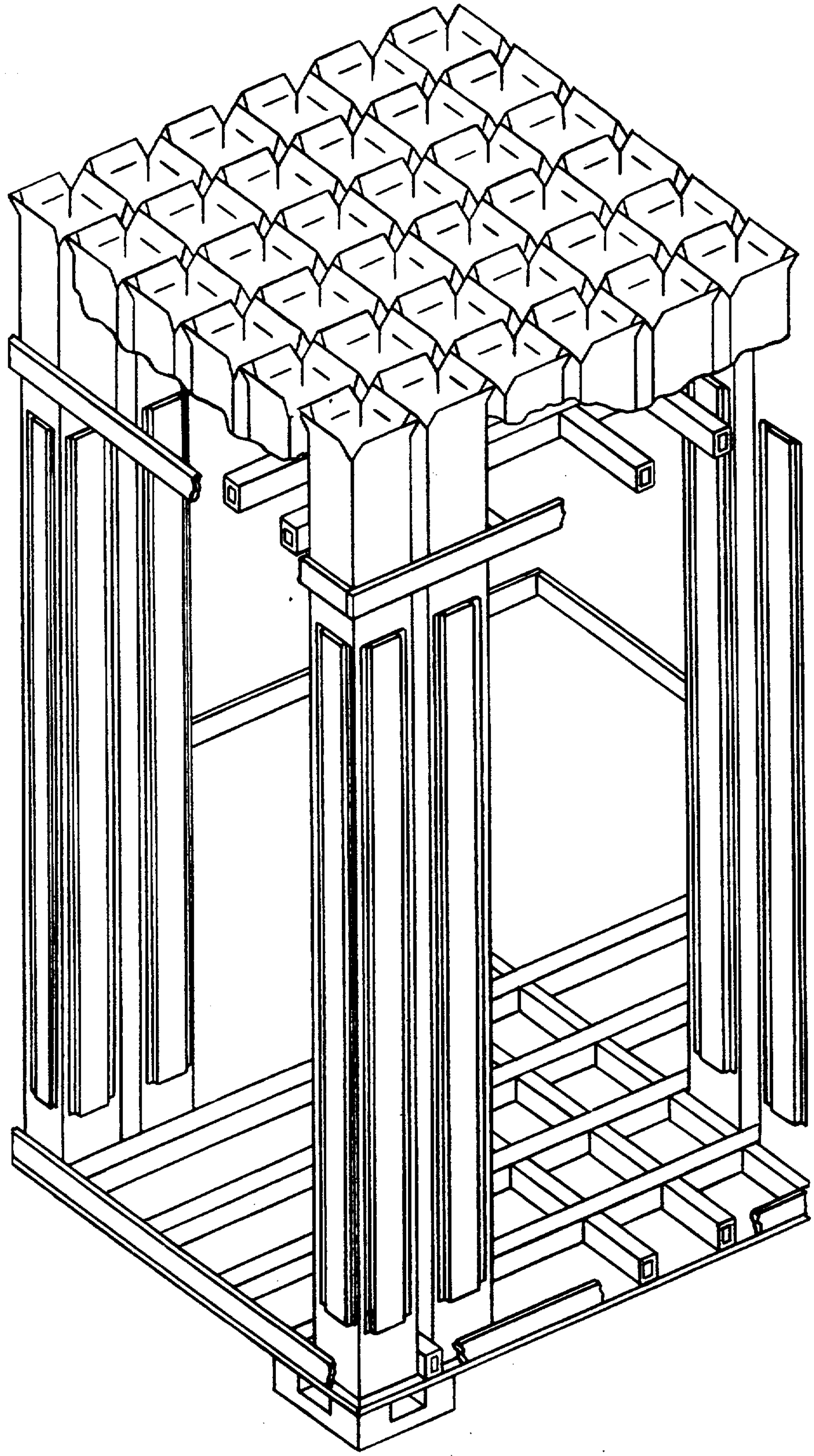


FIGURE 9.1-1
PWR SPENT FUEL RACKS
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

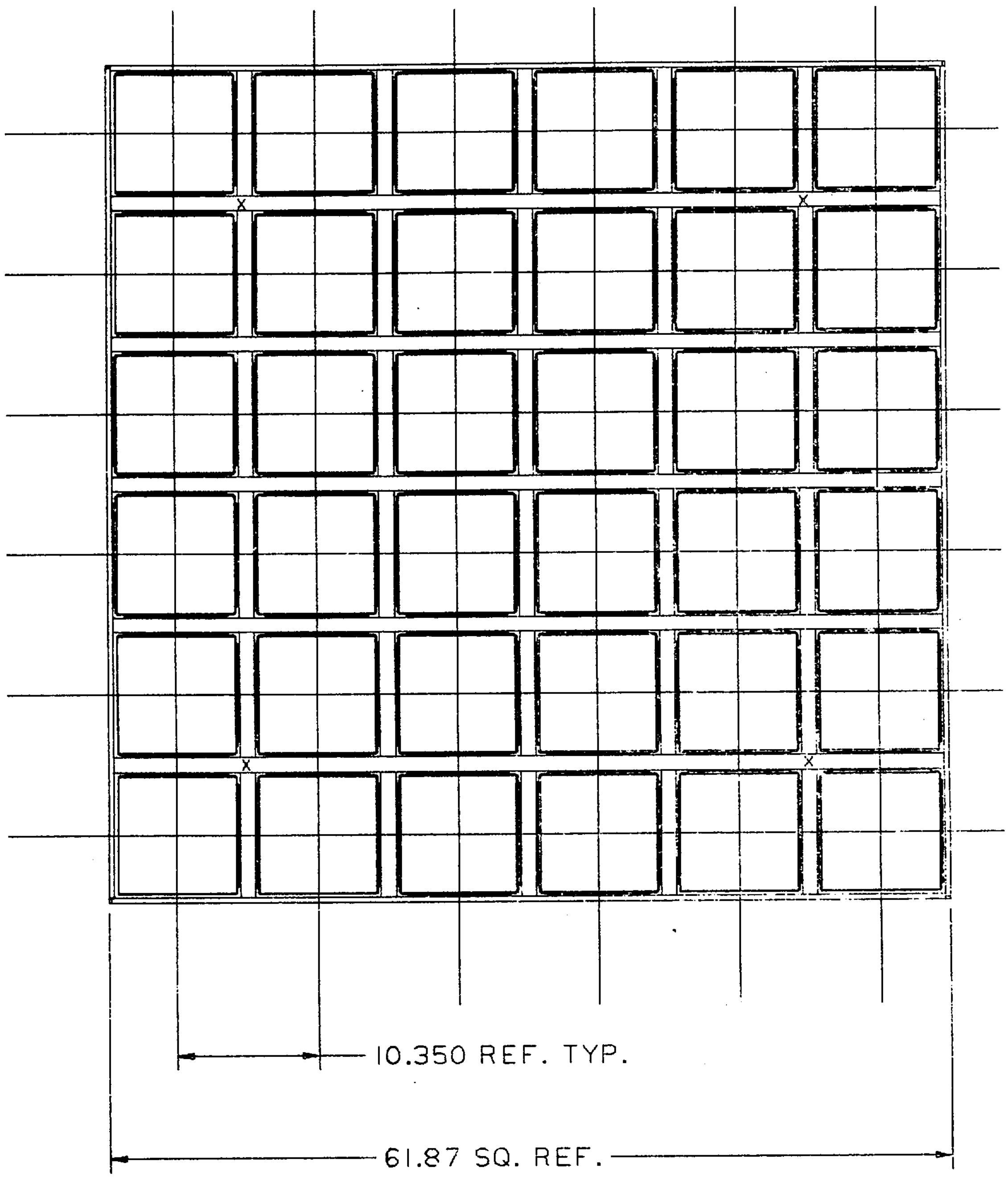
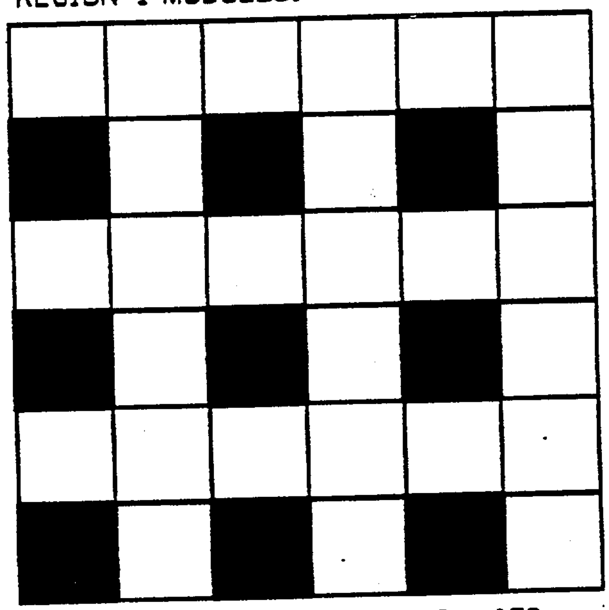


FIGURE 9.1-2
TOP VIEW OF 6x6 RACK ARRAY
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT



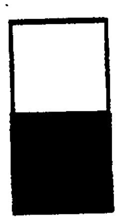


FIGURE 9.1-2A
REGION I, THREE OF FOUR SPENT FUEL ASSEMBLY LOADING SCHEMATIC FOR A TYPICAL EXE STORAGE MODULE
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

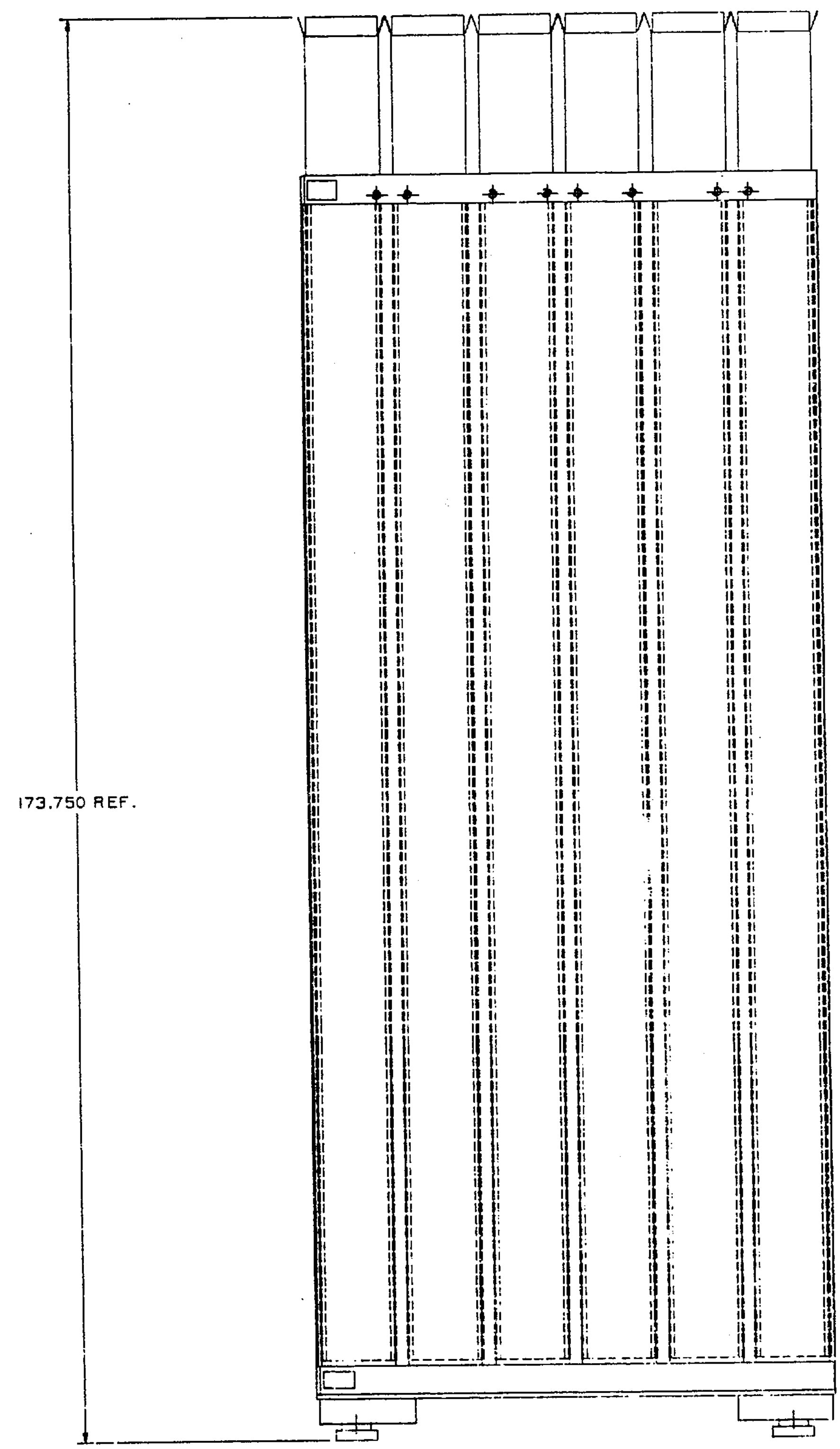


FIGURE 9.1-3
SIDE VIEW OF 6x6 RACK ARRAY
MILLSTONE NUCLEAR POWER STATION
UNIT 3
FINAL SAFETY ANALYSIS REPORT

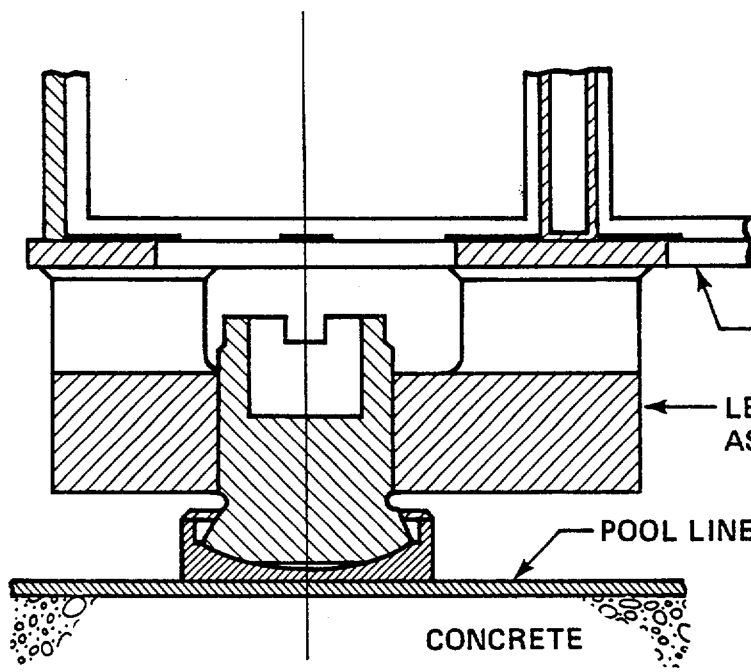


FIGURE 9.1-5
ADJUSTABLE FUEL RACK LEVELING PAD
MILLSTONE NUCLEAR POWER STATION UNIT 3
FINAL SAFETY ANALYSIS REPORT