Progress Energy

Crystal River Nuclear Plant
Docket No. 50-302
Operating License No. DPR-72

Ref. 10 CFR 50.90

February 8, 2007
3F0207-05

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Crystal River Unit 3 – License Amendment Request #294, Revision 0
Elimination of Spent Fuel Pool Missile Shields

Dear Sir:

In accordance with the provisions of 10 CFR 50.90, Florida Power Corporation, doing business as Progress Energy Florida, Inc. (PEF), hereby submits License Amendment Request (LAR) #294, Revision 0. The proposed amendment will eliminate the Final Safety Analysis Report (FSAR) commitment for maintaining the Crystal River Unit 3 (CR-3) Spent Fuel Pool missile shields. The missile shields have been part of the CR-3 Licensing Basis since initial plant licensing. There are no CR-3 Improved Technical Specification (ITS) pages affected by this LAR.

This amendment would change the basis for protection of spent fuel while stored in the Spent Fuel Pool (SFP). Currently, tornado generated missiles are precluded from impacting the stored fuel by missile shields. CR-3 is proposing that adequate protection is provided by the volume of water above the spent fuel assemblies stored in the SFP.

CR-3 has two pools for spent fuel storage in the fuel handling area of the Auxiliary Building. Under present FSAR requirements, Sections 5.4.3, 9.3.2, and 9.6, the missile shields are required to protect the spent fuel from tornado generated missiles. During Refueling evolutions and other operations in the SFP, the missile shields are removed but are replaced on notification of a tornado watch in the vicinity of the plant. Postulated beyond design basis events necessitate that this commitment be eliminated to allow for immediate access to the spent fuel pools. Consequently, PEF is requesting approval of this amendment by October 1, 2007, with the amendment being implemented within 60 days of issuance. This schedule will permit prompt implementation of mitigating strategies for spent fuel pool external events described by Nuclear Energy Institute 06-12, "B.5.b. Phase 2 and 3 Submittal Guideline."

This letter establishes no new regulatory commitments.

The CR-3 Plant Nuclear Safety Committee has reviewed this request and recommended it for approval.

Progress Energy Florida, Inc.
Crystal River Nuclear Plant
15760 W. Powerline Street
Crystal River, FL 34428

A001

If you have any questions regarding this submittal, please contact Mr. Paul Infanger, Supervisor Licensing and Regulatory Programs at (352) 563-4796.

Sincerely,

Daniel L. Roderick
Director Site Operations
Crystal River Nuclear Plant

DLR/par

Attachments:

A. Description of the Proposed Change, Background, and Justification for the Request
B. Regulatory Analysis (No Significant Hazards Consideration Determination and Environmental Impact Evaluation)
C. Proposed FSAR Page Changes – Strikeout and Shadowed Text Format (for information only)

STATE OF FLORIDA

COUNTY OF CITRUS

Daniel L. Roderick states that he is the Director Site Operations, Crystal River Nuclear Plant for Florida Power Corporation, doing business as Progress Energy Florida, Inc.; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

Daniel L. Roderick
Director Site Operations
Crystal River Nuclear Plant

The foregoing document was acknowledged before me this 8th day of Feb., 2007, by Daniel L. Roderick.

Ellen Deppolder

Signature of Notary Public
State of Florida

ELLEN DEPPOLDER
MY COMMISSION # DD 408539
EXPIRES: July 8, 2009
Bonded Thru Notary Public Underwriters

(Print, type, or stamp Commissioned Name of Notary Public)

Personally Known ✓ -OR- Produced Identification ______

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #294, REVISION 0

ATTACHMENT A

DESCRIPTION OF THE PROPOSED CHANGE, BACKGROUND, AND JUSTIFICATION FOR THE REQUEST

DESCRIPTION OF THE PROPOSED CHANGE BACKGROUND, AND JUSTIFICATION FOR THE REQUEST

DESCRIPTION OF PROPOSED CHANGE:

The proposed amendment to the Crystal River Unit 3 (CR-3) licensing basis eliminates the commitment for maintaining missile shields over the Spent Fuel Pool (SFP). Specifically, Final Safety Analysis Report (FSAR) Sections 5.4.3, 9.3.2, and 9.6 will be revised to delete the requirements to maintain tornado missile protection for the SFP. A calculation was performed to demonstrate that tornado missiles are not limiting accidents and consequences are bounded by the dropped fuel analysis. The elimination of the missile shield commitment will facilitate mitigation strategies for spent fuel pool external events described by Nuclear Energy Institute 06-12, "B.5.b. Phase 2 and 3 Submittal Guideline."

No CR-3 Improved Technical Specifications (ITS) pages are affected by this License Amendment Request (LAR).

BACKGROUND

During initial plant licensing, CR-3 revised the FSAR (Amendment 11) to show missile shields for the SFP. In July 1973, CR-3 was asked to describe the SFP missile shielding, including materials of construction, size, weight, shape and properties that prevent missile penetration and permit the shielding to float. This information was developed and provided to the NRC in lieu of a detailed analysis that demonstrated SFP missile shields were not required. The information was then incorporated into Amendment 29 of the FSAR (August 15, 1973). The information provided on the missile shields remains essentially unchanged today.

The missile shields were added to the CR-3 Technical Specifications to assure the missile shields safety function would be performed. During the CR-3 conversion to Improved Technical Specifications (ITS) in the early 1990's, the missile shield specification was removed from ITS as they did not meet the 10 CFR 50.36 criteria for remaining in ITS. The commitment to maintaining the missile shields was retained in the FSAR as part of the design features that qualified the SFP to meet the FSAR Section 1.4, Principal Architectural and Design Criteria (PADC) -2, "Performance Standards," for Class 1 structures.

CR-3 also credited the missile shields for compliance with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," for movement of heavy loads over the SFP. The primary example being movement of the containment tendon surveillance equipment performed once every five years. CR-3 plans to retain the missile shields for this and other potential heavy load lifts over the SFP.

CR-3 has conducted an industry survey and did not identify any other facility with similar SFP missile shields.

CR-3 has evaluated the change to the FSAR commitment and has determined that utilizing a calculation to provide justification for the elimination of the CR-3 SFP missile shields is a methodology change, and as such, this commitment elimination cannot be performed under 10 CFR 50.59.

JUSTIFICATION FOR THE REQUEST

Beyond design basis events are those that were not previously considered credible. Regarding the SFP, these events center on a significant loss of water in the pools or a complete loss of forced cooling that would necessitate the addition of cooler water to preclude fuel damage that would result in a significant release of radioactivity. These events are not required to be postulated only with a recently discharged core, so the event could occur at any time during pool life. With the missile shields installed, dumping large quantities of cooler water into the SFP is limited to piping connections and valve line ups that may be inaccessible. Alternatively, with the missile shields removed, large quantities of water from fire service or other external sources could be dumped directly into the pool with minimal risk to plant personnel.

A calculation was performed which demonstrates, with a high degree of confidence, that the SFP and its contents remain bounded by existing accident analyses without reliance on the mechanical barrier of missile shields. Water in the pool provides sufficient protection against significant damage due to tornado missiles. CR-3 proposes to use a calculational methodology that is based on tornado missiles reaching the pool, kinetic energy of the missiles, and the minimum depth of water above the stored fuel. This methodology has not been approved generically, but has been used at specific plants to justify not having tornado missile shields to protect their SFP. This methodology is used in providing the justification for eliminating the missile shields from the CR-3 SFP.

Safety Evaluation

An Engineering evaluation was performed to provide technical justification which concluded that the impact from credible tornado missiles on the stored fuel, spent fuel racks, and the SFP itself is insufficient to create significant damage, and the dose from such an event is bounded by a dropped spent fuel assembly in the SFP. The evaluation utilized the kinetic energy of the potential tornado missiles and the depth of water remaining to cover the fuel.

Only those windborne objects which could have a significant downward velocity, mass, and kinetic energy on entry into the SFP have the potential for causing damage to the SFP and/ or its contents.

Per Section 5.2.1.2.6 of the CR-3 FSAR, the potential tornado missiles are shown in the table below:

Tornado Missile	**Geometric Properties** **L=Length** **D=Diameter** **A= Minimum Cross Sectional Area**	**Density P (lb/ft^3) or Weight W (lb)**	**Velocity (mph)**
Utility Pole	L = 35 feet, D = 14 inches	50 lb/ft^3	150
Compact Auto	A = 6.25 square feet	2000 lb	150
3 inch Schedule 40 Pipe (piece)	L = 10 feet	75.8 lb	100
Wood Plank	4 inches x 12 inches, L = 12 feet	108 lb	300

Tornado Missile Probability Evaluation

The Individual Plant Evaluation for External Events (IPEEE) for CR-3 developed a quantified risk from tornados that was used in this assessment. The frequency of Class F1 or higher wind speed tornados was quantified to be 2.1 E^{-5}/yr. The consequence was assumed to be a loss of offsite power with conditional probability of core damage of 1.4 E^{-3}/yr. Therefore, the total probability of core damage from tornados was determined to be 2.9 E^{-8}/yr. This core damage probability was determined to be so low, that the additional probability of a large early release was not calculated.

Additionally, the IPEEE determined that there was a more destructive tornado with a frequency of 6.3 E^{-8}/yr that could cause damage to Category 1 structures; hence the total core damage frequency from tornados was given as 9.2 E^{-8}/yr.

Existing Evaluation for SFP Storage Racks

Amendment 193 to the CR-3 Facility Operating License was issued to permit the most recent SFP re-rack in order to permit high density fuel storage racks in the B SFP. An accidental fuel drop analysis was performed by Westinghouse for CR-3 that considered a dropped fuel assembly and handling tool combination, weighing 2750 lbs. It was determined that the potential deformation to the racks was minor and did not impact the functional capability of the racks. The worst case bearing loads on the liner (506 thousand pounds force (kips)) was determined to be favorable to the allowable bearing loads (688 kips) and the punching load on the concrete was significantly less (506 kips) than the allowable load for punching shear (2,322 kips).

Structural Evaluation

The four missiles described in the FSAR were reviewed to determine applicability and damage assessment in relation to elimination of the SFP missile shields.

Utility Pole

The utility pole is described in the CR-3 FSAR as a 14 inch diameter, 35 foot long pole with a density of 50 lbs/ft^3 traveling at a velocity of 150 mph. Stated in NUREG 0800, (Revision 2 – July 1981), "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (SRP)," Section 3.5.1.4, is a note that indicates utility poles need not be considered as a credible tornado missile above 30 feet above grade. The CR-3 SFP operating deck is 43 feet, 6 inches above the berm, which itself is 20.5 feet above the surrounding grade, and as such, the utility pole missile does not have to be evaluated as a potential tornado missile in the SFP.

Compact Auto

The automobile is described in the CR-3 FSAR as a compact auto with an area of 6.25 square feet, weighing 2000 pounds, traveling at a velocity of 150 mph. The note in SRP 3.5.1.4, (Revision 2 – July 1981) also states automobiles do not have to be considered as a credible tornado missile at greater than 30 feet above grade. As such, with the elevation of the top of the SFP above grade, the automobile does not have to be considered as a potential tornado missile in the SFP.

3 inch Schedule 40 Pipe (piece)

The parameters of the 3 inch pipe are described in the CR-3 FSAR. The 3 inch Schedule 40 pipe is a credible tornado missile in the SFP. The velocity of the pipe at a pool depth of 18.5 feet was 90 ft/sec. The evaluation demonstrates that the force imparted to the B SFP racks is less than that of a dropped fuel assembly. Also, the evaluation demonstrated that although the initial kinetic energy for an impact to the A SFP racks is slightly higher than that previously evaluated, the rack stresses remain within allowables. Additionally, the spent fuel assembly(s) were evaluated for a pipe impact. It was determined that 69 rods could potentially receive damage from a tornado missile impact versus 208 during a fuel handling accident. Therefore, the damage consequences remain bounded by the dropped fuel analysis.

Wood Plank

The parameters for the wood plank described in the CR-3 FSAR are 4 inches thick by 12 inches wide by 12 feet long. The wood plank is a credible tornado missile in the SFP. Due to geometry and buoyant forces, the velocity of the plank at a pool depth of 18.5 feet was 55 ft/sec. Based on the analysis of the 3 inch pipe, the forces imparted to the spent fuel rack and spent fuel assembly(s) envelope the forces from the wood plank.

For both the 3 inch pipe and the wood plank, the maximum impact is from the object entering the SFP vertically. Any other orientation created significant drag and maximum velocities and imparted forces that are less than calculated.

Other missiles that may become airborne due to their aerodynamic geometry (metal building siding and roofing) will not have sufficient mass and velocity to penetrate the SFP enough to cause any fuel damage.

Additional items without aerodynamic geometries may be on the SFP operating deck at the time of a tornado, and enter the SFP as a result. These items will not have large amounts of kinetic energy and are not expected to cause any significant fuel damage.

New Fuel Storage

Although there is no commitment for the new fuel storage to maintain missile shields, the same procedural requirements exist for the SFP missile shields. The evaluation that was performed for the SFP also concluded that damage would occur to the new fuel, but will not result in an offsite radioactive release and no criticality concerns are created by the elimination of the missile shields. The evaluation also demonstrates that if a missile were to impact the new fuel vault (NFV) slab, there will not be a structural failure and all of the systems, structures and components below the NFV will remain protected.

Criticality control is maintained by spacing and lack of a moderator, although, calculations have demonstrated that accidental criticality would not occur even with the optimum moderator. Since the rods have not been irradiated, no release of significant radioactive material will occur in the event of damage to an assembly. Therefore, new fuel is an economic concern only and does not require protection in order to safeguard the public.

Spent Fuel Pool Liner

In the unlikely event that a tornado generated missile misses a fuel rack and contacts the 3/16 inch thick stainless steel pool liner, it has been demonstrated that the missile will not penetrate the liner due to not having sufficient kinetic energy on impact. The pipe missile velocity at a depth of 33.167 feet has been determined to be 70.73 feet per second. The total resultant penetration of the liner is 0.139 inches where the liner minimum thickness is 0.1875 inches. The orientation used in the calculation is vertical with respect to the pool as any other orientation would create a velocity at impact less than that for the vertical tornado generated missile.

Any impact with the pool walls above the fuel but deep enough to be a draining concern would require the missile to enter the pool at an angle. This would allow additional surface area of the object to be exposed to additional drag coefficients and would produce an impact velocity less than the vertical missile impact. Traveling through the pool at an angle would also increase the effective distance that the missile would travel before impacting the liner. Additionally, impacting a vertical wall at an angle would only transfer a portion of the missile's kinetic energy. Therefore, a missile traveling through the SFP at an angle would have insufficient kinetic energy to damage the pool wall sufficiently to create a significant water loss in the pool.

Conclusion

The probability of a tornado passing over the SFP is very small. Based on the above evaluation, the credible tornado missile that can achieve the required velocity and height to enter the SFP and cause catastrophic damage to the SFP, storage racks or fuel does not exist onsite. The design basis missiles would not cause catastrophic damage to the spent fuel assemblies, spent fuel racks or liner. Any consequences from a tornado missile are bounded by the design basis fuel handling accident outside containment as described in the FSAR. This LAR will permit elimination of the commitment to maintain SFP missile shields over the SFP when pool or fuel activities are not occurring. CR-3 currently plans on keeping the missile shields onsite, and will utilize them as required for heavy lifting activities over the SFP.

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302/LICENSE NUMBER DPR-72

LICENSE AMENDMENT REQUEST #294, REVISION 0

ATTACHMENT B

REGULATORY ANALYSIS
(NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION AND ENVIRONMENTAL IMPACT EVALUATION)

NO SIGNIFICANT HAZARDS CONSIDERATION

Florida Power Corporation (FPC), doing business as Progress Energy Florida, Inc. (PEF), has evaluated the proposed License Amendment Request (LAR) against the criteria of 10 CFR 50.92(c) to determine if any significant hazards consideration is involved. FPC has concluded that this proposed LAR does not involve a significant hazards consideration. The following is a discussion of how each of the 10 CFR 50.92(c) criteria is satisfied.

(1) Does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The LAR proposes to eliminate the commitment for maintaining the Spent Fuel Pool (SFP) missile shields. Removal of the missile shields increases the probability of an accident (damaging fuel assemblies in the SFP), but the increase is not significant. Based on the Individual Plant Evaluation for External Events (IPEEE) for the Crystal River Nuclear Plant (CR-3), the frequency of a tornado, Class F1 or greater, that could create tornado missiles is 2.1 E^{-5}/year and has a total probability of core damage of 9.2 E^{-8}/year. This probability falls below the threshold of credible accidents.

Fuel Handling Accidents (FHAs) are analyzed in Section 14.2.2.3 of the CR-3 Final Safety Analysis Report (FSAR). The FHA outside the Reactor Building (RB) event is described as the dropping of a fuel assembly into the spent fuel storage pool that results in damage to a fuel assembly and the release of the gaseous fission products. The current FHA assumes all 208 fuel pins in the dropped assembly are damaged and the gas gap activity released. The results of that analysis demonstrate that the applicable dose acceptance criteria, 10 CFR 50.67 and Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," are satisfied.

An engineering evaluation performed for this proposed change has determined that with the credible tornado missiles, any impact that a missile would impart on a SFP storage rack, spent fuel assembly, or the SFP floor or walls would be enveloped by the fuel handling accident. Any interaction between a tornado missile and the new fuel stored in the new fuel storage vault would potentially result in significant damage to an assembly, but no significant offsite radiation would be released and no criticality concerns exist.

Because neither the probability nor the consequences of a FHA are significantly increased, and because there are no radiological safety concerns with the new fuel storage, it is concluded that the LAR does not involve a significant increase in the probability or consequences of an accident previously evaluated.

(2) *Does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

Onsite storage of spent fuel assemblies in the spent fuel pools is a normal activity for which CR-3 has been designed and licensed. As part of assuring that this normal activity can be performed without endangering the public health and safety, the ability of CR-3 to safely accommodate different possible accidents in the spent fuel pools, such as dropping a fuel assembly or the misloading of a fuel assembly, have been analyzed with acceptable results. The interaction between a tornado missile and spent fuel in the SFP has a very low probability of occurrence, and the SFP storage racks and the normal water layer would provide significant protection to the fuel. The SFP integrity would not be compromised so there is not expected to be any significant loss of water above the fuel.

Currently, the SFP missile shields are removed when refueling, maintenance, and other fuel and tool movement activities in the SFP are ongoing. Removing the requirement for missile shields does not introduce a new plant configuration that could introduce a new type of accident.

Any interaction between a credible tornado missile and the new fuel stored in the new fuel storage vault is not considered an accident under the guidance of Regulatory Guide 1.70, Revision 3, November 1978, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," as the rods are not irradiated and no significant radiation would be released in the event of a complete loss of assembly integrity. This event would have financial implications, but is not considered an accident under RG 1.70 criteria.

(3) *Does not involve a significant reduction in a margin of safety*

The purpose of the missile shields is to prevent tornado missiles from damaging fuel and racks in the SFP. Although the missile shields provide a barrier, they are not alone in providing margin to the SFP to protect the public health and safety.

The margin of safety for the SFP also includes the amount of water in the pool above the top of the fuel, the amount of soluble boron in the pool, the distance between assemblies, and the fixed neutron absorbers in the storage racks. These are design parameters that prevent inadvertent criticality as well as a significant release of radiation in the event of a dropped (damaged) fuel assembly. The elimination of the CR-3 commitment to maintain missile shields over the SFP during all times, when not working with the fuel or in the pool, will not have any significant impact on these parameters.

As already noted in FSAR Section 9.3.2.6.1, a tornado directly over the SFP is not postulated to cause the loss of any significant amount of water in the SFP due to a 3 psi pressure drop caused by a tornado. A credible tornado missile that enters the SFP is expected to cause the loss of some pool inventory, but not a significant amount. The removal of the missile shields will therefore, not cause or allow a significant loss of pool inventory.

Unless a significant volume of borated water is lost from the pool from either the tornado suction or the missile splash down, the boron concentration will not change significantly once refilled. Additionally, CR-3 takes credit for soluble boron only as margin to 0.95 K effective for a misloaded fuel assembly. Subcriticality is maintained even with the SFP filled with un-borated water. The SFP storage racks are designed and constructed with the specific center to center distances between the cells (9.11 inch for Pool B and 10.5 inch for Pool A). Any impact from a tornado missile may cause some local rack deformation, but is not expected to change cell spacing for any racks. This logic also holds for the neutron absorber in the SFP storage racks. There may be some local rack deformation, but no significant movement of the fixed poison is expected to occur.

Therefore, a significant reduction in a margin of safety is not expected to occur from the permanent removal of the SFP missile shields.

ENVIRONMENTAL IMPACT EVALUATION

10 CFR 51.22(c)(9) provides criteria for and identification of licensing and regulatory actions eligible for categorical exclusion from performing an environmental assessment. A proposed amendment to an operating license for a facility requires no environmental assessment if the amendment changes a requirement with respect to use of a facility component within the restricted area provided that (i) the amendment involves no significant hazards consideration, (ii) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, and (iii) there is no significant increase in individual or cumulative occupational radiation exposure.

Florida Power Corporation, doing business as Progress Energy Florida, Inc. (PEF), has reviewed this license amendment and has determined that it meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22, no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of the proposed license amendment. The basis for this determination is that this amendment does not change spent fuel storage configurations located inside the restricted area and:

(i) The proposed license amendment does not involve a significant hazards consideration, as described in the significant hazards evaluation.

(ii) As discussed in the Justification for the Request and the No Significant Hazards Evaluation, this change does not result in a significant change or significant increase in the release associated with any Design Basis Accident. The bounding accident involved, the FHA, has release rates unaffected by the permanent removal of the missile shields. Likewise, there will be no significant change in the types or a significant increase in the amounts of any effluents released offsite during normal operation.

(iii) The proposed amendment does not increase spent fuel storage capacity over that previously analyzed, and it does not change fuel handling methodologies. It deletes the commitment to maintain the SFP missile shields. There is no additional handling of radioactive or contaminated material for implementation of the amendment. Water shielding currently in place for fuel handling and storage remains unchanged. The missile shields do not act as a radiation shield. Therefore, the proposed license amendment does not result in a significant increase to the individual or cumulative occupational radiation exposure because the missile shields have to be removed in order to obtain access to the SFP or fuel.

PROGRESS ENERGY FLORIDA, INC.

CRYSTAL RIVER UNIT 3

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ATTACHMENT C

Proposed FSAR Page Changes

Strikeout and Shadowed Text Format (for information only)

5.4.3.1 CODES

Same as Section 5.2.3.1 a, b, c, and e.

5.4.3.2 LOADS

The design has been based upon normal operating loads, earthquake loads, and accident loads as described in Sections 5.4.1.1 and 5.4.1.2.

5.4.3.2.1 AT NORMAL OPERATING CONDITIONS

The stresses in the concrete and reinforcing steel resulting from combinations of those loads listed in Section 5.4.1.1 are in accordance with ACI 318-63, "Working Stress Design".

5.4.3.2.2 ABNORMAL LOADS

The other Class I structures have been designed to withstand short term tornado loadings, including tornado generated missiles where such structures house systems and components whose failure would result in an inability to safely shutdown and isolate the reactor. Structures that are so designed include the following:

a. Control building.

b. Auxiliary building, excluding the steel roof support structure.

   The concrete portion of the auxiliary building which houses Class I items is designed for tornado generated missiles. The spent fuel pool ~~is provided with a tornado missile shield~~ and new fuel vault have been evaluated for tornado generated missiles by calculation S06-0010.

   The roof was designed considering seismic loads but the roof will not act as a barrier against a tornado missile.

c. Diesel generator building, including the radiator exhaust air deflector wall and its support structure (EGX-2).

   The deflector wall is missile resistant, not missile proof. Structural failure (collapse) of the wall will not occur, but it is not designed to prevent local deformation of the structure or puncture of the wall (Ref. 68).

d. NSSS intake pump structure.

e. Intermediate building.

f. Exterior safety related piping and component missile shields.

The tornado design requirements are described in Section 5.2.1.2.6.

The structural design is in accordance with ACI 318-63, "Ultimate Strength Design".

The SF System performance is based upon two storage conditions with the Nuclear Services Closed Cycle Cooling (SW) System providing cooling to the SF heat exchangers. The Nuclear Services and Decay Heat Seawater (RW) System is assumed to be operating with an Ultimate Heat Sink (UHS) temperature of 95°F.

Defueling Storage

The Defueling Storage condition establishes the design basis heat removal capacity for the SF system since it has the highest heat load. The reactor vessel is defueled and the SF Pools contain the previously discharged spent fuel assemblies, plus a full-core offload of 177 fuel assemblies. The full-core discharge is 177 assemblies irradiated at 2568 MWt for 700 EFPDs for each cycle burned. These 177 assemblies are transferred from the reactor vessel to the storage racks. At 156 hours after shutdown, the maximum decay heat load is 29.6 x 10^6 Btu/hr which is comprised of 26.6 x 10^6 Btu/hr for the 177 fuel assemblies in the off-loaded core plus 3.0 x 10^6 Btu/hr for all previously-discharged fuel assemblies stored in the pool. With two operating SF heat exchangers (14% plugged), two SF pumps at 1300 gpm each, and the SW System operating with 1250 gpm at 100°F to each SF heat exchanger, the Spent Fuel Pool water temperature does not exceed 160°F.

Normal Storage

The Normal Storage condition is established after refueling is completed, after the balance of the off-loaded core is returned to the reactor vessel. The worst-case analysis assumes the limiting SW System temperature (110°F) and a 14% plugged SF heat exchanger. One train of SF cooling can maintain 160°F in the pool 15.3 days after the reactor shutdown.

The heat load at 30 days is 8.74 x 10^6 Btu/hr. This heat load is composed of the heat generated from the newly discharged assemblies (5.74 x 10^6 Btu/hr) plus 3.0 x 10^6 Btu/hr for all previously-discharged fuel assemblies stored in the pool. With one operating SF heat exchanger (14% plugged), one SF pump operating at 1300 gpm, and the SW System operating with 900 gpm at 110°F to the SF heat exchanger, the Spent Fuel Pool water temperature does not exceed 151°F.

9.3.2 SYSTEM DESCRIPTION

The SF System piping which contains pumps, heat exchangers, inlets, and outlets to the pools along with the piping located within the Reactor Building is Seismic Class I as described in Section 5.1.1. The SF System piping is designed in accordance with USAS B31.1.0, "Power Piping Code," 1967 edition. The SF System was fabricated, erected, and inspected to USAS B31.7, "Nuclear Power Piping Code," 1969 edition. The non-seismic portions of the system which contains the demineralizer (SFDM-1), filters (SFFL-1A and SFFL-1B), and the Borated Water Recirculation Pump (SFP-2) can be isolated from the Seismic Class I portions by manual Seismic Class I isolation valves.

The Spent Fuel Pool is designed to withstand tornado generated missiles in accordance with Section 5.2.1.2.6., and is covered with missile shields at all times except for activities associated with handling fuel in the pool including, but not limited to, pool maintenance, bridge testing and maintenance, source movement, or fuel integrity monitoring. Should a Tornado Watch be received during a fuel handling operation, installation of the shields shall begin immediately.

The SF System is required to maintain SF pool water level at 21 feet above an assumed failed fuel assembly lying on top of the spent fuel racks to afford iodine and particulate removal during a Fuel Handling Accident (FHA). Maintaining the pool level at a minimum of 156'-0" plant datum ensures more than the required 21 feet.

The SF System is used to maintain a boric acid concentration of at least 1925 ppm which precludes the spent fuel elements from achieving a critical state. This concentration is not required to be maintained after Spent Fuel Pool Verification has been performed.

9.3.2.2 RELIABILITY CONSIDERATIONS

The Spent Fuel Cooling System provides adequate capacity and component redundancy to assure the cooling of stored spent fuel, even when a full-core offload is in storage. Ample time is available to assure that protective actions can be taken even in the unlikely event of multiple component failures or complete cooling loss.

The inlet and exit lines of the spent fuel pools are located well above the spent fuel racks. This arrangement precludes a rupture of piping from potentially draining the Spent Fuel Pool. The normal water level of the pools is 4 feet above the inlet and exit lines. The siphoning line located in the spent fuel cask area is equipped with a siphon break line and valve (SFV-90) which is administratively locked open during normal operation. Thus, the system is so arranged that no uncontrolled loss of water from the pool is possible by piping or by component failure.

The spent fuel pools are provided with leak chase trenches which gravity drain to a leak test hopper/funnel. The test hopper is equipped with administratively open valves. Leakage from the spent fuel pools and cask loading area through these valves is monitored daily. If significant leakage is detected through these valves, then the valves can be closed to isolate the leakage until a spent fuel pool liner repair can be performed. The leak test system performs no emergency function and is not directly connected to the Reactor Coolant System (RCS).

If needed to support heavy load movement, the spent fuel pools ~~are provided with 5 different~~ can be covered with the spent fuel pool missile shields ~~types~~ which are fabricated from coated A-36 steel. They are closed-welded box plate girder with flange plates. The weight of a typical shield is approximately 215 lbs/linear foot compared to the weight of water displaced at 245 lbs/linear foot. This indicates the typical shield will float with the SF Pool water temperature as warm as 160°F. Missile shields SP-2 and SP-3 do not float, however, the movement of these shields are administratively controlled so that they will not be moved over the pool.

The demineralizer is a mixed bed type containing cation and anion resins. The cation resins have an affinity for cesium and sodium among others, whereas the anion resins have an affinity for iodines, chlorides, fluorides, and sulfates. According to the manufacturer's data sheets, the cation resins will maintain their effectiveness up to fluid temperatures of 250°F, but anion resins begin to lose their effectiveness above 140°F. To assure that the resins do not degrade due to elevated water temperatures, plant operating procedures instruct the operators to isolate the demineralizer when the pool temperature reaches 140°F.

9.3.2.3 CODES AND STANDARDS

Each component of the SF System is designed to the code or standard, as applicable, as noted in Table 9-7.

9.3.2.4 FUEL LEAKAGE CONSIDERATIONS

If a leaking Fuel Assembly is transferred from the fuel transfer canal to the spent fuel pool, a small quantity of fission product activity may enter the spent fuel pool cooling water, even though the assembly's cladding temperature is lowered and leakage may reasonably be expected to be minimized. The purification loop removes these fission products and other contaminants from the water.

to verify FHCR-5 interlocks and/or physical stops which prevent crane travel with heavy loads over the pool.

5. The Spent Fuel Pool and new fuel vault structures are ~~is~~ designed to withstand tornado generated missiles in accordance with Section 5.2.1.2.6.~~, and is covered with missile shields at all times except for activities associated with handling fuel in the pool including, but not limited to, pool maintenance, bridge testing and maintenance, source movement, fuel accountability or fuel integrity monitoring. In addition, should a Tornado Watch be received during a fuel handling operation, installation of the shields shall begin immediately.~~
6. When irradiated fuel assemblies are in the Spent Fuel Pool, the Auxiliary Building Ventilation Exhaust System servicing the Spent Fuel Pool area is required. Procedures exist to test the ventilation filter trains.
7. Only one new fuel assembly may be handled at a time outside of approved fuel containers with FHCR-5.
8. Non-fuel Special Nuclear Material (SNM) will be limited to 400 grams total onsite, and no more than 15 grams of non-fuel SNM in any one package or location. Non-fuel SNM assemblies containing beryllium, graphite or hydrogenous material enriched in deuterium shall be stored and shipped separate from other non-fuel SNM. Implementing these restrictions from 10 CFR 71.53 for shipping SNM ensures the non-fuel SNM onsite is less than the quantity necessary for a critical mass.
9. Radiation monitors capable of detecting excessive radiation levels and alarming personnel are provided in fuel handling and storage areas.

9.6.3 CAPABILITY FOR ONSITE STORAGE OR OFFSITE DISPOSAL

CR-3 is licensed for storage of 1474 fuel assemblies. Before that limit is reached, it will be necessary for CR-3 to consider additional onsite storage capacity or offsite disposal. The original CR-3 design assumed that spent fuel would not be stored in Spent Fuel Pool B. That pool area was to have been used for cask loading. Therefore, rearrangement of Spent Fuel Pool B will be required prior to implementing spent fuel cask operations.

The following discussion is general information to describe the provisions that have been made in the design of CR-3 to accommodate transfer of spent fuel either onsite or offsite. However, the handling of heavy loads for cask movement will be subject to review by FPC and the NRC in accordance with the requirements of Bulletin 96-02, "Movement of Heavy Loads Over Spent Fuel, Over Fuel In The Reactor Core, Or Over Safety-Related Equipment."

9.6.3.1 SPENT FUEL ASSEMBLY REMOVAL

Following a decay period, the spent fuel assemblies will be removed from storage and loaded into the spent fuel shipping cask underwater for removal from the site. The Auxiliary Building Overhead Crane (FHCR-5) will be used to handle the casks. When the Auxiliary Building Overhead Crane is operated in the cask removal mode, there is no spent fuel stored in spent fuel pool B and the gate between pools A and B is in place and sealed.

The spent fuel cask will not be moved over any stored spent fuel. The movement of the cask will be limited to the cask storage area in the pool (near column line K, Figure 1-11), to the adjacent decontamination pit (on column line M1), then through the hatch between column lines Q1 and S1 to a truck.

c. In the Reactor Building, during the integrated leak rate test, the Ventilating System maintains a constant temperature with minimum air temperature gradient throughout compartments and elevations.

d. In the Reactor Building, the post-accident function of the Ventilating System is discussed in Section 6.3.

e. In the Reactor Building, during Operational Modes 5 and 6 purging, supply filtered [85% efficiency] and tempered air for purging at rates from 10,000 cfm to 50,000 cfm. Reactor Building Purge Flow control positions damper AHD-91 changing purge supply air flow as required to reduce Reactor Building activity level. The purge air exhausted from the Reactor Building is filtered through roughing, HEPA, and charcoal filters, and then discharged through the unit vent.

f. In the Auxiliary Building, the supply units furnish filtered [85% efficiency] and tempered outside air. Minimum temperature in these areas is nominally 55°F. A nominal value recognizes that homogeneous mixing may not always occur throughout the building, but bulk average temperature will be maintained above 55°F Supply and Exhaust are arranged to direct this air from areas of low to higher activity eventually directing it to the Main Exhaust Filter System and from there through fans to the exhaust vent. The main exhaust filters include roughing, HEPA, and charcoal cells.

The fuel handling area design consists of the Fuel Handling Supply System and the Spent Fuel Pit Supply System. The Fuel Handling Supply System provides outside air which sweeps across the spent fuel building and is exhausted at the spent fuel pool end of the building. The Spent Fuel Pit Supply System provides inside air which continuously sweeps across the top of the spent fuel pools and cask loading pit. The Spent Fuel Pit Supply System includes a continuous row of supply diffusers along the south side of the pools and a continuous row of exhaust outlets along the north side of the pools. Additionally, a continuous exhaust flow is maintained from the ~~enclosed~~ top portion of the pools. ~~when the missile shields are in place.~~ All exhaust flow is directed to the Auxiliary Building Exhaust System where it passes through roughing, HEPA, and charcoal filters before being discharged to the plant vent. The system normally operates continuously, however, it would be inoperative during loss of offsite power or during post-accident periods where outside air should not be admitted to the buildings. The system is not powered by the emergency diesel power supply.

All the Exhaust System equipment for the Fuel Handling and Auxiliary Building areas have a Seismic Class II rating.

1. The normal and emergency total system exhaust flow rate with two fans operating is a nominal 156,680 cfm. Of this total, approximately 30,060 cfm is exhausted from the fuel handling area. The arrangement of outlets and flow rates is such that the air flow across the fuel pools never falls below 50 fpm.

2. Failure of either the Supply or Return System is indicated by flow switches in the supply and exhaust mains and by an automatic trip alarm at the fan circuit breaker. If failure is indicated the redundant unit would be manually started from the control room or from a local station.

3. The exhaust fans are axial flow type, each nominally sized at 78,340 cfm, at 11 inches total pressure.

4. The total nominal filter capacity provided is 160,000 cfm. These filter systems include roughing, HEPA, and charcoal filters. Four 25% capacity units were considered adequate because