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SUBJECT: Forwards response to NRC 870921 request for addl info in area of radioactive sources, dose rate & dose assessment to support 870612 proposed license amend to permit replacement of spent fuel pool rack at facility.

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

Gentlemen:

Re: St. Lucie Unit 1
Docket No. 50-335
Spent Fuel Pool Rerack -
Radioactive Sources, Dose Rate and Dose Assessment

By letter L-87-245, dated June 12, 1987, Florida Power & Light Company (FPL) submitted a proposed license amendment to permit replacement of the spent fuel pool racks at St. Lucie Unit 1 to ensure that sufficient future capacity exists for storage of spent fuel.

By letter dated September 21, 1987 (E. G. Tourigny to C. O. Woody) the NRC Staff requested additional information in the area of radioactive sources, dose rate and dose assessment it needed to continue its review of this proposed license amendment.

Attached is FPL's response to this request.

If additional information is required, please contact us.

Very truly yours,

C. O. Woody
Group Vice President
Nuclear Energy

COW/EJW/gp

Attachments

cc: Dr. J. Nelson Grace, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

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ATTACHMENT

RESPONSES TO NRC LETTER

DATED SEPTEMBER 21, 1987

(E. G. Tourigny to C. O. Woody)

QUESTION RPB #1:

Question a - Sources in the Spent Fuel Pool Water

Provide a description of fission and corrosion product sources in the spent fuel pool (SFP) water from: (a) introduction of primary coolant in SFP water, (b) movement of fuel from the core into the pool, and (c) defective fuel stored in the pool. Include a listing of the radionuclides and their concentrations (expressed in μCi/ml) expected for measure during normal operations and refueling. The radionuclides of interest should include ^{58}Co, ^{60}Co, ^{134}Cs and ^{137}Cs.

Response a - Table 5-4 of the St Lucie Plant Unit No 1 Spent Fuel Storage Facility Modification, Safety Analysis Report, transmitted via letter L-87-245 dated June 12, 1987, provides the concentration of radionuclides in the SFP water. In addition to ^{3}H, each of the four radionuclides of interest are included in Table 5-4. The data in Table 5-4 was collected during the October 1985 refueling -- it therefore includes the effects of the introduction of primary coolant and the movement of fuel from the core. Because of its higher concentration the introduction of primary coolant is the major contributor to SFP water radionuclide concentration . The more dense storage of spent fuel will not have any impact on the contribution to the SFP water concentration from the introduction of primary coolant.

The only contributor to the SFP water radionuclide concentration that could be impacted by the more dense storage of fuel is from defective fuel stored in the pool. Leakage from defective fuel is not expected to increase the spent fuel pool concentration; first, because defective fuel is not the major contributor to SFP water radionuclide concentrations (see above) and, second, because the SFP Cleanup System can be used to maintain the radionuclide concentration at a lower level.

In conclusion, the SFP water radionuclide concentrations are expected to remain at the values given in Table 5-4.

QUESTION RPB #1:

Question b - Airborne Radioactive Sources

Provide a description of radioactive materials that may become airborne as a result of failed fuel and evaporation (e.g. ^{85}Kr and ^{3}H, respectively). The radionuclide description should include calculated or measured concentrations expected during normal operations and during refuelings.

Response b - Table 5-8 of the St Lucie Plant Unit No 1 Spent Fuel Storage Facility Modification, Safety Analysis Report, transmitted via letter L-87-245 dated June 12, 1987, provides the airborne concentration of radionuclides from the SFP. These concentrations were measured during the movement and reconstitution of fuel. The only two radionuclides with airborne concentrations above the lower level of detection were ^{131}I(1×10^{-9} μCi/ml) and ^{133}Xe (3.4×10^{-10} μCi/ml). No significant increase in the airborne radionuclide concentrations are expected to occur from the more dense spent fuel storage. The airborne concentrations (including the concentrations of ^{85}Kr, ^{131}I and ^{133}Xe) are below the 10 CFR Part 20 maximum permissible concentrations (MPC).

Table 5-8 does not provide the airborne concentration of ^{3}H due to evaporation. The maximum ^{3}H airborne concentration can be estimated by assuming that the air is completely saturated with water vapor at the same ^{3}H mass concentration as the SFP water. Using the ^{3}H SFP water concentration from Table 5-4 and assuming that the temperature inside the Spent Fuel Building during personnel access is at 100°F, the maximum ^{3}H airborne concentration is 3.5×10^{-6} μCi/ml which is below the 10 CFR Part 20 MPC. This method of estimating the concentration is very conservative in that it assumes that the SFB air is at 100% relative humidity and that all of the water vapor evolved from the spent fuel pool.

QUESTION RPB #1:

Question c - Miscellaneous Sources of Exposure

Address the effects of more frequent replacement of demineralizer filters on cumulative dose equivalent if this is a factor that results from the modification.

Response c - The current frequency of resin change out for the spent fuel pool (SFP) purification system is approximately once per year. It is estimated that a minimal amount of additional spent resins will be generated by the SFP system during reracking/normal operation and no significant increase in volume of solid radioactive wastes is expected due to the new racks. These effects are as described in Section 5.2 of the St Lucie Plant Unit No 1 Spent Fuel Storage Facility Modification, Safety Analysis Report, transmitted via letter L-87-245 dated June 12, 1987. Additional details are provided in the referenced document.

QUESTION RPB #2:

Question a - Dose Rates from Fuel Assemblies, Control Rods, and Burnable Poison Rods

Provide a description of the dose rate at the surface of the pool water from the fuel assemblies, control rods, burnable poison rods or any miscellaneous materials that may be stored in the pool. Additionally, provide the dose rate from individual fuel assemblies as they are being placed into the fuel racks. Information relevant to the depth of water shielding the fuel assemblies as they are being transferred into the racks should be specified. If the depth of water shielding over a fuel assembly while it is being transferred to a spent fuel rack is less than 10 feet, or the dose rate 3 feet above the spent fuel pool (SFP) water is greater than 5 mR/hr above ambient radiation levels, then submit a Technical Specification specifying the minimum depth of water shielding over the fuel assembly as it is being transferred to the fuel rack and the measures that will be taken to assure that this minimum depth will not be degraded.

Response a - The dose rate at the surface of the pool water from the fuel assemblies, control rods, burnable poison rods or any miscellaneous materials that may be stored in the spent fuel pool fuel racks is conservatively estimated as less than 0.05 mR/hr. When fuel assemblies are being placed into the fuel racks the dose rate at the surface of the pool water is conservatively estimated as less than 0.5 mR/hr. This radiation dose rate occurs when the fuel handling machine has lifted the fuel assembly to the upper limit of travel, at which time there is 9'-0" of water covering the fuel assembly. Under this condition, the dose rate at 3 feet above the pool water due to the radiation emitted from fuel assemblies during transit to the spent fuel racks is conservatively estimated at 0.25 mR/hr. This travel limitation, together with water level control, results in the maintenance of a minimum water cover of at least 10'-0" over the top of the active fuel. If the travel stops should fail and there were no operator action, the spent fuel handling machine cannot raise the assembly above a 9'-0" water-to-active-fuel length height because of the physical limits of the spent fuel handling machine design. This condition will result in a radiation level of 5 mR/hr or less at 3 feet above the surface of the water.

Therefore, a Technical Specification specifying a minimum depth of water shielding over the fuel assembly as it is being transferred to the fuel rack is not warranted.

QUESTION RPB #2:

Question b - Dose Rates from Fuel Assemblies, Control Rods, and Burnable Poison Rods

Address the dose rate changes at the sides of the pool concrete shield walls, where occupied areas are adjacent to these walls, as a result of the modification. Increasing the capacity of the pool may cause spent fuel assemblies to be relocated closer to the concrete walls of the pool, resulting in an increase of radiation levels in occupied areas. Please evaluate this potential problem.

Response b - The dose rate around the outside of the pool concrete shield is described in Section 5.2.3f of the St Lucie Plant Unit No 1 Spent Fuel Storage Facility Modification, Safety Analysis Report, transmitted via L-87-245 dated June 12, 1987, which states that "...the radiation dose rate around the outside of the pool could increase locally up to 0.53 mR/hr should freshly discharged fuel be located in the cells adjacent to the pool liner. This dose rate will decrease to below 0.25 mR/hr after approximately 25 days.

The temporary increase in dose levels possibly seen outside the Fuel Handling Building will require Health Physics to identify this area as a Radiation Zone II area instead of the current Radiation Zone I area. Per the St Lucie Unit 1 FSAR, through Amendment 6 Subsection 12.1.1, a Radiation Zone II area is identified as "occupational access". Zone II is a restricted radiation area to which plant personnel can have continuous access during the regular 40 hr/wk work schedule with out exceeding the allowable whole body dose of 1-1/4 rems per calendar quarter. It is anticipated that this temporary increase to Level II from Level I will only be for a period of three weeks. Therefore the increased dose that will be seen by workers is negligible. All areas that surround the Fuel Handling Building that may be upgraded to Level II are within the Radiation Control Area and all personnel are equipped with personal monitoring devices.

QUESTION RPB #3:

Question a - Dose Rates from SFP Water

Provide information on the dose rates at the surface of SFP water resulting from radioactivity in the water. Include: (1) dose rate levels in occupied areas and along the edges and center of the pool and on the fuel handling crane; (2) effects of crud buildup; and (3) based on refueling water activity, the dose rates before, during, and after refueling.

Response a - The dose rates at the surface of SFP water resulting from radioactivity in the water are measured as follows:

1) Dose rates in occupied areas are 1-2 mR/hr along the edges, 2 mR/hr center of the pool and 1-2 mR/hr on the spent fuel handling machine.

2) The dose rates at the surface of the spent fuel pool resulting from the effects of crud buildup is negligible since there is minimal crud buildup.

3) The dose rates before, during and after refueling are:

	Fuel Pool Edge	Pool Center	Spent Fuel Handling Machine
Before -	< 1-2 mR/hr	1-2 mR/hr	1 mR/hr
During -	1-2 mR/hr	3-5 mR/hr	4-5 mR/hr
After -	< 1-2 mR/hr	1-2 mR/hr	1 mR/hr

QUESTION RPB #4:

Question a - Dose Rates from Airborne Isotopes

Based on the source terms, provide the dose rates from submersion and dose commitments from inhalation of airborne activity for exposure to the concentrations of ^{85}Kr and ^{3}H.

Response a - Using the measured ^{85}Kr and conservatively estimated (see RPB #1 Response b) ^{3}H airborne concentration, the whole body dose rates are:

^{85}Kr	Submersion	1.0×10^{-5} mR/hour
^{3}H	Inhalation	6.9×10^{-1} mR/hour

QUESTION RPB #5:

Question a - Dose Assessment from Modification Procedures

Discuss the manner in which occupational exposure will be kept ALARA during the modification. Include the need for and the manner in which cleaning of the crud on SFP walls will be performed to reduce exposure rates in the SFP area.

Response a - During the overall planning and procedural development for the work assignment, particular attention is to be given to the reduction of personnel radiation exposure. Throughout the job, measures to further minimize worker doses will be incorporated into work procedures where they are deemed practical.

A weekly exposure record will be maintained for each individual working on the rerack project. The weekly exposure record will be reviewed to control the distribution of the radiation exposure to each person.

The contractor that will be utilized has procedures that have been proven by experience to result in occupational exposures that are ALARA for this type of modification. The St Lucie Unit 1 specific procedures prepared by this contractor will be reviewed for ALARA by FPL's Health Physics department including FPL personnel that have experience with similar modifications at Turkey Point.

Based on current conditions there is negligible crud on the SFP walls, thereby negligible exposure results from any crud. However should crud develop on the SFP walls that results in significant exposure potential, hydrolasing of the walls below the surface and low pressure hosing of the walls near the surface will be performed, as necessary.

QUESTION RPB #5:

Question b - Dose Assessment from Modification Procedures

Discuss vacuum cleaning of SFP floors if divers are used and the distribution of existing spent fuel stored in racks to allow maximum water shielding to reduce dose rates to divers.

Response b - Divers will not be used to perform vacuum cleaning. All vacuuming will be performed remotely from the surface.

QUESTION RPB #5:

Question c - Dose Assessment from Modification Procedures

Describe plans for cleanup of the SFP water to minimize radioactive contamination and to ensure fuel pool clarity and underwater lighting acceptance criteria to help ensure good visibility.

Response c - The fuel pool purification system augmented by the underwater vacuum system will be utilized to maintain radioactive contamination ALARA and maintain fuel pool clarity to ensure good visibility. These systems have proven to be very effective in the past in similar situations to minimize radiation contamination and to ensure acceptable visibility and water clarity.

QUESTION RPB #5:

Question d - Dose Assessment from Modification Procedures

Discuss underwater radiation surveys that will be made before any diving operation. These surveys should be performed before or after any fuel movements or movements of any irradiated components stored in the pool.

Response d - Divers are not anticipated to be used during the rerack. However, if divers are required, as a minimum a radiation survey of the diving area will be conducted daily before any diving operation. This survey will be performed, whenever fuel movement occurs and after any movement in the dive area of irradiated components, using two independent radiation exposure monitoring devices. The survey map of the pool will be updated to reflect current status of the on-going fuel rack modification.

QUESTION RPB #5:

Ouestion e - Dose Assessment from Modification Procedures

State your intent to equip each diver with a calibrated alarming dosimeter and personnel monitoring dosimeters, which should be checked periodically to ensure that prescribed dose limits are not being exceeded.

Response e - Divers are not anticipated to be used during the rerack. However, if divers are required, as a minimum each diver will be equipped with a calibrated alarming dosimeter or a personal radiation monitor. These instruments will be checked each day before diving operations begin. Each diver will be equipped with a remote readout radiation detector which can be continuously monitored by HP technicians.

The divers will surface and have their dosimetry checked periodically. Any significant deviation from the expected dive work pattern or radiation levels will be grounds for dive termination.

QUESTION RPB #5:

Question f - Dose Assessment from Modification Procedures

Discuss any preplanning of work by divers as required.

Response f - Divers are not anticipated to be used during the rerack. However, if divers are required, prior to entry into the pool, a briefing will be held to discuss the work scope planned for that day and to review the results of the pool radiation level survey.

QUESTION RPB #5:

Question g - Dose Assessment from Modification Procedures

Discuss your provision for surveillance and monitoring of the spent fuel pool work area by Health Physics personnel during the modification.

Response g - Work performed in the SFP during the modification will be performed under a Radiation Work Permit (RWP) detailing the Health Physics requirements necessary to safely accomplish the work. Health Physics personnel covering the work will have the authority to stop work and will use this authority should the radiation conditions change significantly to warrant its use.

All work performed in the spent fuel pool work area during the modification will be under constant surveillance from the Health Physics personnel. Health Physics personnel will monitor all equipment removed from the spent fuel pool and will provide directions to working personnel to enhance contamination control and for segregation of materials to reduce sources of exposure.

Existing plant procedures addressing radiation and contamination control, personnel exposure, respiratory protection and radioactive material movement and control will be used during the modification. If the need arises for specific radiological control procedures, these procedures will be developed and approved.