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SUBJECT: Forwards response to NRC 840719 requests for addl info re health physics aspects of proposed amend to spent fuel storage facility expansion.

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FPL
FLORIDA POWER & LIGHT COMPANY

August 22, 1984
L-84-211

Office of Nuclear Reactor Regulation
Attention: Mr. Steven A. Varga, Chief
Operating Reactor Branch #1
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Varga:

Re: Turkey Point Units 3 & 4
Docket Nos. 50-250 & 50-251
Proposed Amendment to
Spent Fuel Storage Facility Expansion
Additional Information

By letter dated July 19, 1984, the NRC requested additional information regarding health physics aspects of the proposed modification. The specific questions and FPL responses are included as an attachment to this letter. As part of the response to Question No. 1, a calculation is being performed to determine the dose rate from a spent fuel assembly with 9 feet of water shielding. The results of this calculation will be submitted upon completion. If Technical Specifications are required, they will be provided at that time.

If additional information is needed, please contact us.

Very truly yours,

J.W. Williams, Jr.
Group Vice President
Nuclear Energy

JWW/GJK/mp

Attachment

cc: J.P. O'Reilly, Region II
Harold F. Reis, Esquire

A001
1/1

QUESTION 471.01: (1) Dose Rates from Fuel Assemblies, Control Rods, Burnable Poison Rods

(a) 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 stored in the pool. Additionally, the dose rate from individual fuel assemblies, as they are being placed into the fuel racks, should also be given. 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', or the dose rate 3' above the (SFSF) water is 5mr/hr above ambient radiation levels, then a technical specification should be submitted by the licensee 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.

(b) Dose rate changes at the sides of the pool concrete shield walls, where occupied areas are adjacent to these walls, should be reviewed as a result of the modification. Increasing the capacity of the pool may cause spent fuel assemblies to be in an increase of radiation levels in occupied areas. Discuss this potential problem.

RESPONSE:

(a) The spent fuel assemblies, control rods, burnable poison rods and any miscellaneous materials stored in the spent fuel pit (SFP) contribute a negligible dose rate to the pool area due to the depth of water shielding. No significant increase in dose rates above the pool due to direct radiation from spent fuel will result from the increased storage capacity of the SFP.

The minimum depth of water shielding for the transfer of spent fuel from the upender to the storage racks is 7'-11" above the top of the fuel assembly (see Turkey Point Updated FSAR Section 11.2). This minimum shielding depth will be increased after the rerack since the new racks with lead in devices are at a lower elevation than the existing racks as shown in Figure 1. Since the top of the new racks are at a lower elevation than the upender, the SFP bridge crane upper hoist limit switch will be reset to provide adequate clearance between the bottom of the fuel assembly and the top of the upender. In addition, the fuel handling

Q471.01 (continued)

procedures for transferring spent fuel from the upender to the racks will be revised to require a minimum water level of 56'-10". These changes in design and procedures will provide a minimum water shield equal to or greater than 9 feet above the top of the fuel rods. A calculation is being performed as requested to determine the dose rate from the fuel assembly being transferred with a water shield of 9 feet. It is not anticipated that the dose rate above the pool will exceed 5 mrem/hr since past radiation measurements obtained during refueling have shown no significant increase in ambient radiation levels while a fuel assembly is being transferred. If the calculated dose rate is greater than 5 mrem/hr, a proposed Technical Specification for: (1) the minimum SFP water level, and (2) the SFP bridge crane hoist setpoint will be submitted for tranferring freshly discharged spent fuel into the spent fuel racks.

(b) The dose rate adjacent to the spent fuel pit walls has been calculated using conservative assumptions. These assumptions include no water shielding, no distance between the fuel and the concrete wall, no spacing between fuel assemblies, and that the most recently discharged fuel is placed closest to the wall. The maximum calculated dose rate on contact with the outer surface of the spent fuel pit wall is 10.7 mrem/hour. Actual dose rates from spent fuel in the SFP are expected to be much less than this conservatively calculated value. However, in order to keep radiation doses ALARA and maintain low radiation dose rates outside the spent fuel pool, administrative controls for spent fuel location in the new racks will be employed. By controlling the placement of the radioactively hotter assemblies, radiation doses due to spent fuel storage will be maintained less than 1 mr/hr outside the spent fuel pool. Radiation surveys around the pool perimeter will be procedurally required after fuel movement to verify that this criteria is maintained. This is consistent with the commitments made in Table 11.2-5 of the Turkey Point UFSAR, and no revision to the radiation zone classification is required due to reracking. In addition, the outside walls of the SFP are within the Radiation Controlled Area (RCA) as shown in Turkey Point Updated FSAR Figures 1.2-1, 11.2-1 and 11.2-2. Access to the RCA is controlled and limited to those individuals authorized for entry. Since actual radiation levels will be low, and access to the adjacent areas is controlled, FPL considers the new rack design acceptable.

QUESTION 470.02: In Table 5-4, "Gamma Isotopic Analysis of Spent Fuel Pool Water," the radionuclide concentrations for ^{60}Co and ^{58}Co are indicated to be greater than 10^{-2} uCi/ml. Assuming a concentration of 10^{-2} uCi/ml, the staff estimates approximately 200 mR/hr dose rate 1 meter above the spent fuel pool from $^{60}Co/^{58}Co$. Demonstrate that these dose rates are ALARA, and explain why the spent fuel pool clean-up system should be considered adequate for ALARA purposes.

RESPONSE: Recent spent fuel pool (SFP) dose rate survey and isotopic concentration data are provided in Table 1 (attached). This data indicates that for gross gamma isotopic concentrations of 10^{-2} uCi/ml, the measured dose rate above the spent fuel pool (approximately at waist level) is less than 20 mrem/hour. Area dose rates of 200 mrem/hour above the pool resulting from isotopic concentrations of 10^{-2} uCi/ml in the pool water have not been experienced at the Turkey Point Plant.

Prior to and during the rerack, operation of the SFP cleanup system will be directed to the spent fuel pit to reduce radionuclide concentrations in the pool water to as low as practicable levels. As indicated in Table 1, when the SFP cleanup system is in service to the spent fuel pit (see FSAR Figure 9.3-3 for details), significant reductions can be achieved in gross isotopic concentration and resulting dose rates. The isotopic concentrations and dose rates measured during cleanup of the spent fuel pit are comparable to those reported at other plants.

Area dose rates assumed for the various phases of the reracking operation are provided in Table 3 (see the response to Question 470.07). These dose rates used in Table 3 are based on the more recent data reported in Table 1 and are lower than those initially used to establish the original occupational exposure estimate of 88-130 person-rem. Based on the demonstrated ability of the SFP cleanup system to purify the SFP, the dose rates assumed in Table 3 in establishing the revised 59 person-rem exposure estimate are considered representative of the radiological conditions expected during the rerack.

The potential for stirring up crud in the pool during rack handling, rack decontamination, and fuel shuffling operations is accounted for in these revised dose rates. General area dose rates of 20 mrem/hour during rack washdown, 15 mrem/hour in the SFP, and 10 mrem/hour during fuel shuffles have been conservatively assumed despite the ability of the cleanup system to maintain lower dose rates. (This is particularly evidenced by the measured dose rates of 6 - 8 mrem/hour above the Unit 4 spent fuel pool during the Spring 1984 refueling).

Q470.02 (continued)

Lower dose rates are also expected since the reracking operation in the SFP will take place no sooner than 1525 hours after shutdown for the last batch of spent fuel placed in the SFP. This will alow decay and cooling of the stored spent fuel. As discussed in References 1 and 2, experience indicates that there is little radionuclide leakage from stored spent fuel after the fuel has cooled for several months. As a result, isotopic concentrations and dose rates from the pool water will be low during the rerack.

Based on the above discussion, the dose rate of 200 mrem/hr. estimated by the NRC is extremely conservative based on actual data measured at Turkey Point. Therefore, the dose rates and the spent fuel pool cleanup system are considered adequate for ALARA purposes.

References:

1. Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission, Safety Evaluation and Environmental Impact Appraisal Regarding Main Yankee Spent Fuel Storage, June 16, 1982.

2. Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission, Safety Evaluation and Environmental Impact Appraisal Regarding Arkansas Nuclear One Spent Fuel Storage, April 15, 1983.

QUESTION 470.03: In Sections 5.2.3 b, c, e, f, g provide the operational experiences including specific exposure control techniques that support your conclusion that:

(1) "No significant increase in radioactivity levels in the spent fuel water or dose rates above the pool (are expected)."

(2) "negligible concentrations of airborne radioactivity from the spent fuel storage facility/and dose rates at the top of the pool from this source are negligible."

RESPONSE: The potential increases in radioactivity levels in the spent fuel pool (SFP) water from expansion of storage capacity have been evaluated and have not been found to be significant.

The following information is provided in response to the NRC's request:

SAR Section 5.2.3.b: SFP Water Activity/Stored Fuel

The majority of radioactivity is released to the SFP during refueling operations by the mixing of the SFP water with primary system water and the dislodgement of crud deposits on the fuel during transfer from the reactor core to the spent fuel racks. Once fuel-handling operations are completed, the mixing of pool water with primary system water ceases and these sources of radionuclides decrease significantly; only dissolution of fission products absorbed on the surface of fuel assemblies and possible low-level erosion of deposits remain. For fuel aged for more than a few months, neither of the latter sources would be expected to contribute significantly to the concentrations of radionuclides in the storage pool.

During and after refueling, operation of the SFP cleanup system reduces the radioactivity concentrations. Most failed fuel contains small, pinhole-like perforations in the fuel cladding at reactor operating conditions. A few weeks after refueling, the spent fuel cools in the spent fuel pool so that fuel clad temperature is relatively cool. The substantial temperature reduction should reduce the rate of release of fission products from the fuel pellets and decrease the gas pressure in the gap between pellets and clad, thereby tending to retain the fission products within the gap.

More recent spent fuel pool dose rate and isotopic concentration data are provided for Turkey Point in the response to Question 470.02. In addition, Table 2 provides gross isotopic concentrations for the Unit 3 SFP for the period of time from December 1978 through May 1981. This period of time involved three refuelings and significant addition of spent fuel to the pool. This data demonstrates the

Q470.03 (continued)

ability of the SFP cleanup system to control isotopic concentrations and dose rates during refueling and to reduce them to acceptable levels during the storage period.

As discussed in the response to Question 471.01, Item (1), stored spent fuel contributes no significant dose rate to the SFP area due to the amount of water shielding provided. This is not expected to change with expanded storage. Changes in dose rates above the SFP in the past have resulted from changes in pool water activity which have been adjusted by operation of the purification system. In addition, the radiation emitted from stored fuel decreases with time due to decay. For the more conservative condition of a fuel assembly in transit (with minimum water shielding), experience at Turkey Point indicates that there has been no significant increase detected in ambient radiation levels above the SFP. Therefore, the lack of a significant increase in radiation levels from spent fuel in storage or in transit demonstrate that adequate water shielding exists. This mass of water prevents a significant increase in ambient radiation levels above the pool due to increased spent fuel inventory.

SAR Section 5.2.3.c: Airborne Radioactivity

The ventilation system for the Unit 3 SFP area exhausts through the spent fuel pool vent which is provided with a radiation monitor (see response to Question 470.06). Table 2 provides the results of measurements taken by the vent monitor for the period from August 1978 to January 1984. This period of time includes four refuelings and a substantial increase in the quantity of fuel stored in the SFP. As evidenced by the data, there has been no significant increase in the continuous quantities of airborne concentrations released from the spent fuel pool area.

Separate data is not available for Unit 4 as the SFP area ventilation system exhausts through the plant vent along with other areas of the plant. However, the data for Unit 3 is expected to be representative for Unit 4.

SAR Section 5.2.3.e: Radwaste Generation

As discussed under SAR Section 5.2.3.b, above, the greatest increase in radioactivity and impurities in pool water occurs during refueling and spent fuel handling. As the stored spent fuel cools and decays, significant releases of impurities to the pool water are not expected. Since the refueling frequency will not increase due to the reracking and the leakage of impurities from spent fuel in expanded storage is not significant, the proposed quantity of spent fuel to be

Q470.03 (continued)

stored in the SFP will not significantly increase the impurities to be removed by the SFP cleanup system. Therefore, the quantity of radwaste generated by the SFP cleanup system will not significantly increase.

SAR Section 5.2.3.f: Crud Buildup

Visual observations of the Units 3 and 4 spent fuel pools indicate an absence of any significant crud deposition on the pool walls, fuel racks or floor. Radiation surveys were taken on the liner plate of the SFP when the water level has been reduced. Survey data show dose rates basically equivalent to that of the pool water, this indicates a lack of crud buildup on the wall. In addition, radiation surveys were made above the center of the pool and at the pool edge. The observed values were essentially the same, indicating that there is no significant amount of crud deposited on the walls of the pool that might contribute to a higher dose rate at the pool edge.

The majority of crud released to the pool occurs as a result of fuel handling operations. The SFP cleanup system, as discussed in the response to Questions 470.02 and 470.04 Item (3), effectively prevents the buildup of crud in the pool water which reduces deposition in the pool. Therefore, storage of additional fuel due to reracking is not anticipated to contribute significantly to the amount of crud released to the pool. If crud deposits should become a significant contributor to pool doses, measures will be taken to reduce such doses to ALARA.

SAR Section 5.2.3.g: SFP Shielding

The response to Question 470.01 (b) demonstrates that the radiation dose rates will not be affected by the increased storage of fuel. Radiation surveys were taken in February 1983 and August 1984 exterior to the SFP walls. With spent fuel stored in racks adjacent to the walls, measured dose rates were less than 1 mrem/hr.

The discussion under SAR Section 5.2.3.b, above, indicates that there will be no significant increase in dose rates above the pool resulting from radiation emitted directly from the spent fuel due to the depth of water shielding. Insignificant increases in radwaste generation will result from increased storage as discussed under SAR 5.2.3.e, above. Therefore, the man-rem to be received by personnel working in the SFP area is not expected to significantly increase due to the proposed increase in storage capacity.

Q470.03 (continued)

Industry Evaluations

There have been numerous spent fuel pool rerackings in nuclear power facilities. Evaluations performed for these reracks have concluded that storage of increased quantities of spent fuel would not result in significant increases in radioactivity levels. This conclusion is reached in rerack license applications which have been or are being reviewed by the NRC for the following facilities:

Arkansas Nuclear One, Units 1 & 2	Reference 1
Joseph M. Farley Unit 1	Reference 2
Fort Calhoun Unit 1	Reference 3
McGuire Nuclear Station Units 1 & 2	Reference 4
Maine Yankee	Reference 5
Rancho Seco	Reference 6

Operating experience at Turkey Point supports this conclusion. The NRC also reached this same conclusion in their review of the license application for reracking of Arkansas Nuclear One, Units 1 and 2 (See References 7 and 8). Additional industry experience is cited in these references. Therefore, based on the data provided and industry experience, no significant increase in radioactivity levels in the spent fuel pool water, adjacent areas or due to airborne concentrations are expected for the proposed reracking at Turkey Point.

References

1. Letter from W. Cavanaugh III (Arkansas Power & Light Company) to H. R. Denton (NRC) dated November 5, 1982, "Arkansas Nuclear One, Units 1 and 2. Docket Nos. 50-313 and 50-368, License Nos. DPR-51 and NPF-6. Spent Fuel Pools Expansion".

2. Report prepared by Joseph M. Farley Nuclear Plant Unit 1, dated March 1982, "Spent Fuel Pool Modification".

3. Report submitted by Omaha Public Power District to R. A. Clark of the NRC dated March 12, 1982, report title is "Spent Fuel Storage Rack Modifications".

4. Report submitted by H. B. Tucker (Duke Power Company) to H. R. Denton (NRC) via letter dated March 20, 1984, titled "Spent Fuel Pools Rerack Modification Safety and Environmental Analysis."

5. Report submitted by J. H. Garrity (Main Yankee Atomic Power Company) to the NRC via letter dated October 5, 1981, titled "Main Yankee Spent Fuel Storage Modifications"

Q470.03 (continued)

6. Attachment 2 in letter from J. J. Mattimoe (Sacramento Municipal Utility District) to the NRC dated September 28, 1982, title of Attachment 2 is "Licensing Report for High Density Spent Fuel Storage Racks for Rancho Seco Nuclear Generating Station, Sacramento Municipal Utilities District" dated June 1982.

7. Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Amendment No. 76 to Facility Operating License No. DPR-51 and Amendment No. 43 to Facility Operating License No. NPF-6. Arkansas Power and Light Company, Arkansas Nuclear One, Units Nos. 1 and 2. Docket Nos. 50-313 and 50-368, reported issued April 15, 1983.

8. Environmental impact appraisal by the Office of Nuclear Reactor Regulation Relating to the Modification of the Spent Fuel Storage Pool, or Facility Operating License Nos. DPR-51 and NPF-6, Arkansas Power and Light Company, Arkansas Nuclear One, Unit Nos. 1 and 2, Docket Nos. 50-313 and 50-368, report issued April 15, 1983.

QUESTION 470.04: Provide or explain why the following descriptive information was not included in your modification for the spent fuel storage facility:

(1) the manner in which occupational exposure will be kept ALARA during the modification including the need for and manner in which cleaning of the crud on SFSF walls will be performed to reduce exposure rates in the SFSF area;

(2) vacuum cleaning of SFSF floors if divers are used;

(3) clean-up of the SFSF water;

(4) the distribution of existing spent fuel stored in racks to allow maximum water shielding to reduce dose rates to divers;

(5) pre-planning of diver work as required; and

(6) the provision for surveillance and monitoring of the work area by health physics personnel.

RESPONSE: (1) The actions that will be taken to ensure that occupational exposures during each phase of the reracking operation will be kept ALARA include the following:

a. Job Planning

Prior to the start of the reracking operation, there will be a meeting of all groups involved in the modifications to discuss the sequence of work, radiological controls for various portions of the job, radiological conditions anticipated, the clarity of the spent fuel pool, and any other potential problem areas identified.

To avoid increased exposures from freshly discharged fuel, the reracking operation in the SFP will not be initiated until a minimum of 1525 hours after shutdown for the last batch of spent fuel placed in the SFP. The rack removal and installation sequence has been planned in detail so as to minimize the number of installation activities and spent fuel shuffles.

The estimated number of personnel associated with the reracking operation has been carefully reviewed and has been kept to a minimum. Lessons learned from the 1976 rerack experience have been considered in the present reracking program.

Q470.04 (continued)

b. Radiation Surveys and Monitoring

Periodic radiation and contamination surveys will be conducted. Personnel monitoring devices will be used by all personnel in the work area. Radiation levels in the pool area will be continuously monitored by area and airborne radiation monitors while re-racking operations are in progress. Additional information on radiation surveys and monitoring is provided in Section 5.2.4.1 of the SAR and the response to Question 470.06.

c. Job Training and Personnel Protection

Radiological protection training will be provided as described in the response to Question 470.06. Personnel working in radiologically controlled areas will wear protective clothing and respiratory protective equipment as required by work conditions and the applicable Radiation Work Permit.

d. Spent Fuel Pool Cleanup

As discussed in the response to Item (3) below, the spent fuel pool cleanup system will be operated to assure that radiation levels during the reracking operation are maintained ALARA.

e. Spent Fuel Pool Water Level

For all spent fuel assembly relocations performed during the reracking operation, the spent fuel pit will be filled to a minimum water level at El. 56'-10" (see the response to Question 471.01). As the water level will be reduced approximately 8 feet during rack handling operations, the walls of the spent fuel pit will be decontaminated with a water spray and manual cleaning of residual hot spots using brushes or rags, as required.

f. Health Physics Personnel

As discussed in the response to Item (6) below, health physics technicians will provide support for each phase of the reracking operation to assure compliance with the FPL Health Physics Program and to maintain radiation doses ALARA.

g. Rack Decontamination and Disposal

The underwater rinsing operation described in the response to Question 470.05 will remove loose contamination from the old racks while causing

relatively low exposures to decontamination personnel. This procedure minimizes subsequent personnel exposures during handling and packaging of the racks for shipment and disposal.

Prior to shipment offsite, the intact racks will be appropriately wrapped and crated. Intact rack disposal provides a substantial savings in radiation exposure and labor costs over dismantling the racks and crating them for burial.

(2) Use of divers is not anticipated to be required during the reracking at Turkey Point. If a need for divers is identified at a later date, detailed procedures will be developed and submitted to the NRC.

(3) During normal operation, the spent fuel pool clean-up system, which is described in Section 9.3 of the Turkey Point Updated FSAR, is operated intermittently, as required, to maintain acceptable concentration levels in the spent fuel pool and the refueling water storage tank. The clean-up system branches off the spent fuel pool cooling loop downstream of the spent fuel pit cooling pump and returns the filtered water downstream of the spent fuel pool heat exchanger (See Figure 9.3.3 of the Turkey Point Updated FSAR for details). The clean-up system consists of a demineralizer and three cartridge filters. The demineralizer contains a mixed bed resin and is designed for a flow rate of 100 gpm which corresponds to approximately 5 percent of the spent fuel pool cooling loop flow. Each cartridge filter is designed for a flow of 150 gpm and has a 5 micron rating. Normally, two filters are in service at one time with the third serving as a backup for use during cartridge changeout.

Additionally, a skimmer system is installed for removal of pool surface contamination which may not be removed by the normal clean-up system. The skimmer system is composed of two skimmers, one strainer, one pump and three cartridge filters (5 micron rating). The design flow of the skimmer system is 100 gpm. Similar to the cleanup system, two filters are normally in service with the third serving as a backup.

The two pool cleaning systems described above will provide adequate clean-up of the pool to assure that radiation doses during the reracking operation are maintained as low as is reasonably achievable.

Q470.04 (continued)

(4) See the response to Item (2) of this question.

(5) See the response to Item (2) of this question.

(6) It is planned for three health physics technicians to be available to man the access control point at the spent fuel pool to ensure compliance with normal health physics procedures for activities in the spent fuel pool area. These technicians will not be on the work platform itself, but will normally be in a low background area controlling access to the work area, releasing tools, ensuring that step-off pad procedures are complied with, etc. These technicians will also monitor the replaced racks as they exit the pool. Three other health physics technicians will be available to be located outside the spent fuel building to survey the preparation of the replaced racks for shipment and to ensure that all Department of Transportation shipment regulations are met.

QUESTION 470.05: For the disposition of existing racks, describe the following:

(a) The method that will be used to remove, decontaminate and dispose of the old racks. Disposal alternatives should include crating intact racks for disposal at a low-level waste burial site or cutting and drumming them for burial. If the racks are to be decontaminated and stored on-site, then this alternative should be described.

(b) The number of workers that will be required for each operation including divers, if necessary.

(c) The dose rate associated with each phase of rack removal and disposal, occupancy times and the total man-rems that will be received by all workers.

The licensee should also demonstrate that his methodology for disposal of racks will provide as low as is reasonably achievable (ALARA) exposures considering (a) (Section 5.2.4 of the SAR), (b) and (c) above, cost, burial space available at burial sites, etc.

RESPONSE: (a) Removal of the existing spent fuel storage racks is briefly discussed in Section 4.7.4.2.2 of the SAR. A work platform will be installed in the cask laydown area in the spent fuel pit. This platform will be used as a staging area for the transfer of new and existing rack modules between the temporary construction crane and the fuel cask crane. The fuel cask crane will be used to lift the racks above the spent fuel pit operating deck and to transfer the racks to a staging area outside the spent fuel building. Once outside the building, the racks will be packaged, loaded onto a truck, and prepared for offsite shipment.

Prior to removal from the spent fuel pit, the old racks will be rinsed, as necessary, with a high pressure water spray to remove loose contamination. This rinsing operation will be performed underwater to minimize airborne radioactivity levels. Prior to removal from the spent fuel building, the racks will be allowed to drip dry. Depending on residual contamination levels, the racks will be further decontaminated by manual brushing and/or wipe down. The racks will not be dismantled for final disposal; they will be appropriately wrapped and crated intact for shipment to Richland, Washington for burial. Currently, the Richland, Washington facility places no restrictions on disposal waste volume. Therefore, based on the radiation exposure and labor cost savings, dismantling of the old racks for disposal is not justified from an ALARA standpoint.

Q470.05 (continued)

(b),(c) An estimate of the number of workers, the dose rates, the occupancy times (task hours), and the personnel exposure (person-rem) associated with each phase of the reracking operation are provided in Table 3.

Divers are not anticipated to be used during the reracking operation. No underwater work is necessary except some simple manipulations which can be performed from above the surface of the pool using long-handle tools.

A further discussion of the methods to ensure that exposures are as low as is reasonably achievable during all phases of the reracking operation is provided in the response to Question 470.04.

QUESTION 470.06: Provide a brief description of your radiation protection program during spent fuel pool modifications for the following (Specific reference to relevant information in the FSAR is acceptable):

(1) Area radiation and airborne monitoring systems,
(2) Surveillance and monitoring,
(3) Training and,
(4) Decontamination procedures.

RESPONSE: The FPL radiation protection program is described in Section 11.2 of the Turkey Point Updated FSAR. FPL's Health Physics Group is responsible for implementing the radiation protection program to assure compliance with established procedures and to maintain radiation doses ALARA. FPL's radiation protection program was reviewed prior to the last rerack and was determined adequate without revision. This was found acceptable by the NRC in Section F of Reference 1. The radiation protection program was reviewed again with respect to the operations involved in the proposed rerack and no changes were determined necessary. Following are responses to the specific requests for information:

(1) Airborne radioactivity monitoring is provided by monitors R-14, RaD-6304 and RaD-6418. Area radiation is monitored by the following area monitors: RD-1407, RD-1408, RD-1411, RD-1412, RD-1421 and RD-1422. For further information on these monitors, refer to Section 11.2.3 of the Turkey Point Updated FSAR. Additional temporary airborne and area radiation monitoring will be performed as determined necessary by FPL's radiation protection procedures.

(2) The radiological protection program for the rerack effort is briefly described in SAR Section 5.2.4.1 and will be in accordance with the FPL Health Physics Manual and its implementing procedures.

All workers who are planned to enter a radioactively contaminated area will be given an initial bioassay at the start of their employment. Subsequently, workers will be given bioassays, as necessary, to comply with requirements set forth in the FPL Health Physics Manual and FPL Procedure HP-31.

All personnel entering the work area will be provided with thermoluminescent dosimeters (TLDs) and self-reading pocket dosimeters in accordance with the FPL Health Physics Manual and FPL Procedure HP-30.

To provide proper control of radiation and contamination, detailed surveys will be performed, as required, throughout the rerack effort. These surveys will be conducted in accordance with FPL Procedures HP-20, HP-21 and

Q470.06 (continued)

HP-22. The types of portable radiation survey instruments available for use during the rerack effort are listed in Table 11.2-9 of the Turkey Point Updated FSAR.

(3) As appropriate, personnel will be given the comprehensive course in radiological protection described in the FPL Health Physics Manual and FPL Procedure HP-81. This course will consist of approximately 20 hours of instruction and demonstrations covering in detail the basic theory and practice of radiation protection principles, emergency planning, and the Radiological Protection Program. Successful completion of this course and/or passing an associated comprehensive examination will allow personnel to have unescorted access to the work area.

Personnel unable to pass the examination and/or those who take only the orientation course, which consists of one 3-hour class to acquaint individuals with basic safe health physics practices and emergency procedures, will be required to be escorted in the work area.

(4) All decontamination will be performed in accordance with Section 5.4 of the FPL Health Physics Manual and FPL Procedures HP-70 and HP-71. The walls of the spent fuel pit will be decontaminated using water sprays and manual brushing, as necessary. As discussed further in the response to Question 470.05, the old racks will be decontaminated prior to removal from the spent fuel pit.

The FPL Health Physics Manual and its implementing procedures are available onsite for NRC review if desired.

References

1. Turkey Point Plant Units 3 and 4, Docket Nos. 50-250 and 50-251, Safety Evaluation by the Office of Nuclear Reactor Regulation Supporting Amendment No. 23 to License No. DPR-31, and Amendment No. 22 to License No. DPR-41.

QUESTION 470.07: (a) The occupational dose equivalent of 130 person-rems, shown in Table 5-7, is much greater than relevant experience indicates. Similar operations performed by other licensees during their SFP modification have shown a much lower collective dose equivalent for this operation (e.g. 25 person-rems for two units). Therefore, justify that your dose assessment of 130 person-rems is ALARA by showing: (1) that your SFP clean-up system is adequate to provide ALARA dose rates in adjacent areas, and, (2) that the existence of any material that may be stored in the pool, other than spent fuel, doesn't effect background radiation levels.

(b) Revise Table 5.7, by tabulating the following information for Units 3 and 4: (1) average dose rate in occupied areas, (2) exposure time per event, and (3) number of workers.

RESPONSE: (a) As shown in revised SAR Table 5-7 (attached as Table 3 to these responses), the estimated collective occupational dose equivalent for the reracking operation has been reduced to approximately 59 person-rem. This reduced dose assessment is based on: 1) more recent spent fuel pool dose rate survey and isotopic concentration data, and 2) revised manhour estimates resulting from continuing development of detailed engineering. As discussed in the response to Question 470.02, the revised spent fuel pool data is more representative of the radiological conditions expected during the rerack.

The spent fuel pool (SFP) operational data presented and discussed in the response to Question 470.02 demonstrate the ability of the SFP cleanup system to control isotopic concentrations and dose rates during refueling and to reduce them to acceptable levels during the storage period. The significant decay and cooling of stored spent fuel, along with the operation of the SFP cleanup system, will considerably reduce SFP activity levels (and resulting dose rates) during the reracking operation. Pool water concentrations during the modification are assumed higher than during normal storage conditions due to rack handling and decontamination. The general area dose rates expected during the rerack (see Table 3) are not inconsistent with those estimated by other licensees for their SFP modifications.

While the 59 person-rem is greater than relevant experience indicates, this conservative pre-modification estimate accounts for several considerations and operational constraints associated with the rerack activities as follows:

Q470.07 (continued)

a. To promote the safe and efficient handling of spent fuel racks, the spent fuel pool water level will be lowered approximately 8 feet during rack handling operations. A transfer of rigging for the rack modules must be made between the temporary construction crane and the fuel cask crane while the rack is on the work platform. As a result, increased exposures are anticipated for personnel to decontaminate the SFP walls, to work on the bridge of the temporary construction crane, and to extend the suction line of the SFP cooling and cleanup system.

b. Divers are not anticipated to be used during the reracking operation since the existing spent fuel storage racks are freestanding without interconnection and since only about 3" of clearance exists in some areas between the racks and the SFP walls. Any underwater work is planned to be performed using long-handled tools thus increasing the exposure time to personnel.

c. As of February 15, 1984, the Unit 3 spent fuel pit contained 372 spent fuel assemblies. The Unit 4 pit contained 313 spent fuel assemblies and one new assembly. The large number of fuel assemblies present during the reracking operation will require at least 3 spent fuel shuffles. As a result, increased exposures to personnel involved in fuel handling operations are expected. In addition, the temporary construction crane must be removed from the spent fuel pit prior to each spent fuel shuffle, thus further increasing the exposure estimate.

d. For each unit, 12 spent fuel storage modules will be replaced during the reracking operation which, in many cases, is more than the number of modules replaced during reracks at other plants. The large number of storage modules and the anticipated need to decontaminate each module to remove crud accumulated over the last 7 years since the last rerack also increases the estimated occupational dose assessment.

Based on the above discussion and the actions outlined in the response to Question 470.04, the estimate of 59 person-rem for the reracking operation is considered to be ALARA.

As discussed in the response to Question 471.01 spent fuel assemblies and other components stored in the SFP contribute an insignificant dose above the surface of the spent fuel pool due to the depth of water shielding.

(b) SAR Table 5-7 has been revised (attached as Table 3 to these responses) to provide an estimate of the number of workers, the dose rates, the occupancy times (task hours), and the personnel exposure (person-rem) associated with each phase of the reracking operation. As discussed in the response to Item (a) above, the expected occupational dose equivalent for the reracking operation has been reduced to approximately 59 person-rem. Since this exposure estimate is based on a conservative operational plan that assumes a maximum number of hours for each task and conservative dose rates, actual occupational exposures are anticipated to be less than this bounding estimate.

TABLE 1

1984 SPENT FUEL POOL ACTIVITY AND GAMMA DOSE RATE DATA

UNIT 3 SPENT FUEL PIT

Date	Total Gamma Activity ($\mu Ci/ml$)	Dose Rate Above SFP (mrem/hour)	Dose Rate on SFP Operating Deck (mrem/hour)	Activity in Progress
Jan. 5	1.4×10^{-2}	12	8	See Note 1
Jan. 12	1.6×10^{-2}	18	10	See Note 1
Jan. 19	8.2×10^{-2}	25	14	See Note 1
Jan. 26	2.2×10^{-2}	12	6	See Note 1
Feb. 2	2.3×10^{-2}	20	10	See Note 1
July 19	5.9×10^{-2}	60	20	See Note 1
July 26	6.6×10^{-2}	48	30	See Note 1
Aug. 2	5.2×10^{-3}	6	3	See Note 2

UNIT 4 SPENT FUEL PIT

Date	Total Gamma Activity ($\mu Ci/ml$)	Dose Rate Above SFP (mrem/hour)	Dose Rate on SFP Operating Deck (mrem/hour)	Activity in Progress
Mar. 29	5.9×10^{-3}	6	5	See Note 3
Apr. 5	5.9×10^{-3}	8	5	See Note 3
Apr. 12	4.8×10^{-3}	8	4	See Note 3
Apr. 26	7.0×10^{-3}	8	4	See Note 3
May 3	1.5×10^{-2}	12	6	See Note 3
May 10	3.2×10^{-2}	30	14	See Note 4

Notes:

1. No fuel handling - Demineralizer in service to Unit 3 Refueling Water Storage Tank.

2. No fuel handling - Demineralizer in service to Unit 3 Spent Fuel Pit.

3. Refueling conditions - Demineralizer in service to Unit 4 Spent Fuel Pit.

4. No fuel handling - Demineralizer in service to Unit 4 Refueling Water Storage Tank.

TABLE 2

TURKEY POINT NUCLEAR PLANT UNIT NO. 3
SPENT FUEL POOL WATER AND AIRBORNE
RADIOACTIVITY CONCENTRATION SAMPLE DATA

DATE	GROSS β+γ (μCi/ml)	ISOTOPIC CONCENTRATION (μCi/ml) Co-57	Co-58	Co-60	I-131	Cs-134	Cs-137	NOTE
12-14-78	2.2×10^{-3}							1, 6
04-19-79	1.8×10^{-3}							1, 6
04-26-79	1.9×10^{-3}							1, 6
05-03-79	3.0×10^{-3}							1, 6
11-21-79	1.4×10^{-2}							2, 6
11-29-79	1.6×10^{-2}							2, 6
02-07-80	2.3×10^{-2}							2, 6
02-14-80	2.4×10^{-2}							2, 6
02-21-80	2.9×10^{-2}							2, 6
02-28-80	2.7×10^{-2}							2, 6
02-05-81	5.2×10^{-3}							3, [illegible]
02-12-81	2.1×10^{-2}							3, 6
02-19-81	8.0×10^{-3}							3, 6
02-26-81	1.0×10^{-3}							3, 6
04-23-81	2.2×10^{-2}							3, 6
04-30-81	3.9×10^{-2}							3, 6
05-07-81	3.5×10^{-2}							3, 6
05-14-81	3.7×10^{-2}							3, 6

TABLE 2 (continued)

DATE	GROSS Bγ (μCi/ml)	ISOTOPIC CONCENTRATION (μCi/ml) Co-57	Co-58	Co-60	I-131	Cs-134	Cs-137	NOTE
09-01-83				6.7×10^{-2}			4.0×10^{-4}	4, 7
09-08-83		2.9×10^{-5}		6.1×10^{-2}			1.8×10^{-4}	4, 7
09-15-83				7.2×10^{-3}		2.2×10^{-4}	3.1×10^{-4}	4, 7
09-22-83				1.6×10^{-3}		2.0×10^{-4}	2.8×10^{-4}	4, 7
09-29-83				2.0×10^{-3}				4, 7
01-05-84		2.6×10^{-5}	4.6×10^{-3}	7.6×10^{-3}		8.5×10^{-4}	1.2×10^{-3}	4, 7
01-12-84		2.3×10^{-5}	4.9×10^{-3}	8.8×10^{-3}		9.3×10^{-4}	1.4×10^{-3}	4, 7
01-19-84		6.9×10^{-5}	8.5×10^{-4}	8.0×10^{-2}		2.6×10^{-4}	5.3×10^{-4}	4, 7
01-26-84		4.1×10^{-5}	6.2×10^{-3}	1.3×10^{-2}		1.4×10^{-3}	2.0×10^{-3}	4, 7
3rd week of 08-78				4.2×10^{-13}	4.3×10^{-13}			1, 5
4th week of 08-78			1.0×10^{-13}	1.4×10^{-13}	1.3×10^{-12}			1, 5
1st week of 09-78				2.3×10^{-13}	1.0×10^{-12}			1, 5
2nd week of 09-78					3.7×10^{-13}			1, 5
3rd week of 04-79				3.2×10^{-13}				1, 5
4th week of 04-79			5.8×10^{-12}	2.0×10^{-12}				1, 5
5th week of 04-79			7.2×10^{-13}	4.5×10^{-13}				1, 5
1st week of 05-79			4.0×10^{-13}	4.2×10^{-13}				1, [illegible]
1st week of 11-79				4.8×10^{-13}		1.5×10^{-13}	3.3×10^{-13}	2, 5
2nd week of 11-79				4.2×10^{-13}		2.2×10^{-14}	4.0×10^{-13}	2, 5
3rd week of 11-79				4.2×10^{-13}		9.2×10^{-14}	1.5×10^{-13}	2, 5
3rd week of 02-80				2.7×10^{-13}				2, 5
4th week of 02-80				3.0×10^{-13}				2, 5
1st week of 03-80				2.5×10^{-13}				2, 5
2nd week of 03-80				1.5×10^{-13}				2, 5

TABLE 2 (continued)

DATE	GROSS β+γ (μCi/ml)	ISOTOPIC CONCENTRATION (μCi/ml) Co-57	Co-58	Co-60	I-131	Cs-134	Cs-137	NOTE
1st week of 09-83					4.7×10^{-14}			4, 5
2nd week of 09-83					1.3×10^{-14}			4, 5
3rd week of 09-83					6.2×10^{-13}		2.5×10^{-14}	4, 5
4th week of 09-83			Less than minimum detectable activity level (MDA)					4, 5
1st week of 01-84					1.5×10^{-13}			4, 5
2nd week of 01-84					9.0×10^{-14}			4, 5
3rd week of 01-84					9.2×10^{-14}			4, 5
4th week of 01-84			Less than MDA					4, 5

NOTES:

(1) Refueling outage was from January 1, 1979 to April 16, 1979.

(2) Refueling outage was from December 1, 1979 to February 6, 1980.

(3) Refueling outage was from February 28, 1981 to April 19, 1981.

(4) Refueling outage was from October 1, 1983 to January 7, 1984.

(5) Airborne radioactivity concentrations.

(6) Liquid gross β+γ concentrations.

(7) Liquid isotopic concentrations.

TABLE 3

REVISED SAR TABLE 5-7

ESTIMATED ALARA DOSES DURING RE-RACKING

	Number of Men	Total Task Hours(1)	Dose Rate(2) (mrem/Hour)	Person-Rem	
REMOVAL OF OLD RACKS					
Removal of Interferences in SFP Area	9	320	5	1.60	
Decon of SFP Walls	4	96	20	1.92	
Installation of Temporary Extention on SFP Cooling Suction Line	2	20	15	0.30	
Installation of Temporary Construction Crane and Support Stand	4 4	64 8	5 15	0.32 0.12	
Transfer/Positioning of Temporary Construction Crane	3 2	96 64	10 5	0.96 0.32	
Positioning/Removal of Support Stand	3	18	10	0.18	
Positioning of Old Racks Onto Support Stand	4	288	15	4.32	
Decon of Old Racks in SFP	3 2	324 216	20 15	6.48 3.24	
Wipe Down and Decon of Old Racks Prior to Bagging and Package for Shipment	1 1	24 24	5 30	0.12 0.72	
Transfer of Old Racks to Temporary Shed	2	48	5	0.24	
Laydown, Packaging and Loading of Old Racks onto Truck	3 3	168 168	5 30	0.84 5.04	
Construction of Packing Crate on Truck Prior to Shipping	4	192	30	5.76	
		Total for Removal of Old Racks			32.48
SPENT FUEL SHUFFLES					
Operators on Bridge Crane	2	300	10	3.00	
Fuels Engineer	1	150	10	1.50	
		Total for Spent Fuel Shuffles			4.50

TABLE 3 (continued)

	Number of Men	Total Task Hours(1)	Dose Rate(2) (mrem/Hour)	Person-Rem	
INSTALLATION OF NEW RACKS					
Embedment Pad Elevation Measurements	2	12	15	0.18	
	2	12	10	0.12	
Rack Positioning and Leveling	3	432	15	6.48	
	3	432	10	4.32	
Installation of Removed Interferences	6	320	5	1.60	
		Total for Installation of New Racks			12.70
SUPPORT SERVICES					
Health Physics Personnel Outside SFP	3	900	5	4.50	
Health Physics Personnel Rack Disposal	3	270	5	1.35	
	3	90	30	2.70	
QA/QC Personnel	2	150	5	0.75	
		Total for Support Services			9.30
			GRAND TOTAL		58.98

NOTES:

1. Includes only work involving radiation exposure.

2. Based on the following dose rates:

General area dose rate around edge of SFP	5 mrem/hour
General area dose rate around edge of SFP during fuel shuffle	10 mrem/hour
General area dose rate in SFP	15 mrem/hour
General area dose rate in SFP during rack washdown	20 mrem/hour
General area dose rate during decon of SFP walls	20 mrem/hour
Contact dose rate on old racks	30 mrem/hour
Dose rate 6 feet from old racks	5 mrem/hour

FIGURE 1

TURKEY POINT NUCLEAR PLANT SPENT FUEL PIT
EQUIPMENT ELEVATION