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SUBJECT: Discusses reactor auxiliary bldg emergency exhaust sys design & licensing basis issues.Description of proposed changes to FSAR which incorporate results of dose assessment reanalysis & details of administrative controls encl.

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SHEARON HARRIS NUCLEAR POWER PLANT
DOCKET NO. 50-400/LICENSE NO. NPF-63
REACTOR AUXILIARY BUILDING EMERGENCY EXHAUST SYSTEM
DESIGN AND LICENSING BASIS ISSUES

Gentlemen:

On August 24, 1995 a discrepancy related to the original design of the Reactor Auxiliary Building (RAB) Emergency Exhaust System was determined to constitute a condition outside the design basis as described in the Harris Nuclear Plant (HNP) Final Safety Analysis Report (FSAR). The dose assessments in the FSAR assumed that Emergency Core Cooling System (ECCS) Loss of Coolant Accident (LOCA) leakage outside containment would be filtered by the Reactor Auxiliary Building (RAB) Emergency Exhaust System. FSAR Section 6.5.1 describes the ECCS equipment areas covered by the RAB Emergency Exhaust System to be the pump rooms, heat exchanger rooms, and containment penetration areas. The Technical Specification Basis (3/4.7.7) also states that this system ensures that radioactive materials leaking from ECCS equipment within the pump room following a LOCA are filtered prior to reaching the environment. However, there are additional areas outside this exhaust system boundary which contain ECCS recirculation equipment. Therefore, any postulated leakage from these components would not be filtered, thus potentially increasing the radiological consequences of a postulated LOCA. This issue was previously discussed with the NRC staff via teleconference on September 12, 1995 and reported in Licensee Event Report (LER) 95-006 dated September 22, 1995.

Since substantial and extensive modifications would be required to add the additional areas to the RAB Emergency Exhaust System boundary, the approach taken by HNP to resolve this issue was to reanalyze the dose assessments, utilizing an administrative limit on external leakage that would occur in ECCS components outside the exhaust system boundary. This approach was also discussed during the September 12, 1995 teleconference. The major assumptions used to recalculate the 30 day Low Population Zone (LPZ) doses were: (1) 50 gpm gross passive failure leakage from the piping and valves outside of the ventilation boundary was not applicable (the pumps are within the exhaust system boundary); (2) one gpm continuous ECCS leakage, with two gallons per hour outside the exhaust system boundary

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established as an administrative limit and the remainder (approximately 0.97gpm) inside the boundary; (3) 2% flashing fraction per current licensing basis (FSAR); and (4) original atmospheric dispersion (X/Q) values. The Exclusion Area Boundary (EAB) and control room dose assessments were similarly recalculated. The Technical Support Center (TSC) dose was recalculated using the X/Q methodology of NUREG/CR 6331, Atmospheric Relative Concentrations in Building Wakes, published in May 1995. The above-calculated doses were within regulatory limits, with the 30 day LPZ thyroid dose being the most limiting.

During review of this issue, a question was raised regarding the venting of the Equipment Drain System to the RAB normal exhaust, which could potentially, although unlikely, bypass the emergency exhaust system. To resolve the concern, a simple modification is being considered which would vent the Equipment Drain System to the RAB Emergency Exhaust System following a LOCA. Changes to the FSAR which may result from this issue would be processed in accordance with the plant modification process. This modification will be completed prior to proceeding to Mode 4.

The enclosures to this letter contain a brief description of the proposed changes to each FSAR section, the proposed FSAR revisions (by FSAR section) which incorporate the results of the dose assessment reanalysis, and the details of the administrative controls discussed above. The administrative controls described in the enclosure will be implemented prior to proceeding to Mode 4 and will replace those described in LER 95-006.

This issue has been determined to be an unreviewed safety question by CP&L and is being submitted for NRC review and approval pursuant to the requirements of 10CFR50.59(c) and 10CFR50.90. The no significant hazards and environmental considerations are also enclosed.

Questions regarding this matter may be referred to Mr. T. D. Walt at (919) 362-2711.

Sincerely,

J. W. Donahue
(for W. R. Robinson)

RWP/rwp

Enclosures

J. W. Donahue, General Manager, Harris Plant, being duly authorized and having been first duly sworn, did depose and say that the information contained herein is true and correct to the best of his information, knowledge and belief; and the sources of his information are officers, employees, contractors, and agents of Carolina Power & Light Company.

Marilyn V. Pease
Notary (Seal)

MARILYN V. PEASE NOTARY PUBLIC WAKE COUNTY, NC

My commission expires: October 19, 1995

c: Mr. S. D. Ebneter
Mr. S. A. Elrod
Mr. N. B. Le

FSAR SECTION CHANGE SUMMARY

FSAR Section 6.5.1.1.2 - RAB Emergency Exhaust System

Modified the description of the RAB Emergency Exhaust System to indicate that it serves "selected" potentially contaminated portions of the RAB. Added a paragraph describing the portions of the post accident ECCS recirculation flow path outside of the RAB Emergency Exhaust System. Postulated leakage from components in these areas is not filtered and will be limited to two (2) gallons per hour. Also, in the design basis section, revised the system basis to indicate that the system is designed to maintain post-accident radiological releases within the guidelines of 10CFR100 if a postulated leak occurs in the containment sump water recirculation system. Further clarified that the guidance of SRP 15.6.5, Appendix B, was followed in assessing "offsite" doses. Associated radiological consequences are discussed in FSAR Section 15.6.5.4.

FSAR Section 7.5.1.4.11.1 - Reactor Auxiliary Building Emergency Exhaust System

Modified the description of the RAB Emergency Exhaust System to indicate that it serves "selected" equipment essential for safe shutdown.

FSAR Section 9.4.3 - Auxiliary and Radwaste Area Ventillation Systems

Modified the description of the RAB Emergency Exhaust System to indicate that it maintains "selected" potentially contaminated areas of the RAB below atmospheric pressure following a safety injection signal and that it "minimizes" unfiltered outleakage of airborne radioactive materials. FSAR Section 6.5.1.1.2 is referenced.

FSAR Section 9.4.3.1.1 - RAB Normal Ventillation System (Design Bases)

Modified the description to indicate that it isolates service to "selected" post accident, potentially contaminated areas upon receipt of a safety injection signal to enble the RAB Emergency Exhaust System to maintain these areas below atmospheric pressure. FSAR Section 6.5.1.1.2 is referenced.

FSAR Section 9.4.3.2.1 - RAB Normal Ventilation System (System Description)

Modified the description to indicate that under accident conditions, spaces containing major containment penetrations and other "selected" potentially contaminated areas are automatically isolated, the normal ventilation system shuts down, and the air from those areas is treated by the filtered RAB Emergency Exhaust System prior to release to the environment. FSAR Section 6.5.1.1.2 is referenced.

FSAR SECTION CHANGE SUMMARY

FSAR Section 12.3.2.16.2 - Access to Vital Areas

Modified the description to note that postulated post-accident assumptions and source terms are described in FSAR Section 15.6.5.4.4 and to indicate that the atmospheric dispersion factors (X/Q) used in the Technical Support Center (TSC) dose calculations were developed using the methodology described in NUREG/CR 6331, Atmospheric Relative Concentrations in Building Wakes, May 1995.

FSAR Section 15.6.5.4.2 - Engineered Safety Features Components Leakage Outside of Containment

Modified the description of the RAB Emergency Exhaust System to clarify that it is provided to filter airborne leakage only from the described areas prior to release to the environment. Further expanded the description to indicate that portions of the post-accident ECCS recirculation flow path are located outside of the RAB Emergency Exhaust System boundary and that postulated leakage from these components is not filtered. FSAR Section 6.5.1.1.2 is referenced.

Replaced the existing ECCS leakage and dose discussion (which assumed all filtered leakage) with a new paragraph which establishes a limit of two (2) gallons per hour (0.033 gpm) for those portions of the ECCS recirculation flow path outside of the RAB Emergency Exhaust System boundary. For conservatism, the remainder of the assumed one (1) gallon per minute total system leakage (0.967 gpm) is assumed to occur simultaneously inside the RAB Emergency Exhaust System boundary. For calculational purposes, this apportioned leakage rate is then doubled (similar to the existing calculational philosophy), resulting in 95 Rem to the thyroid (LPZ 30 day). Combining this value with the dose from containment leakage (unchanged from the original calculation) results in 263 Rem to the thyroid (LPZ 30 day). The maximum allowable ECCS leakage outside of the RAB Emergency Exhaust System boundary would be four (4) gallons per hour (0.067 gpm). When combined with the remainder of the one (1) gallon per minute (0.933gpm) leakage inside the boundary and calculationally doubled, the resulting total dose (again cosidering the same containment leakage) becomes 300 Rem (LPZ 30 day), which is the limit established by 10CFR100.

In the Assumptions and Parameters section, in addition to the numbers discussed above, the following items were revised:

c. Time after LOCA when ECCS recirculation begins changed from 30 minutes to 20 minutes to more realistically model the beginning of recirculation time.

FSAR SECTION CHANGE SUMMARY

d. Total volume of containment sump changed from 4.47 x 10^5 gallons to 3.59 x 10^5 gallons to more accurately reflect that the entire volume of the Refueling Water Storage Tank (RWST) would not be introduced into containment following a LOCA due to physical piping arrangement. (Analytically this increases the relative concentration of radioactive material.)

e. The anticipated ECCS leakage was apportioned (inside and outside the exhaust system boundary).

f. Sump solution temperature (230°F) is an approximate value, not the maximum. As discussed in an added footnote, actual temperature follows a time-dependent profile. The footnote also discusses the cooling effects of the Residual Heat Removal (RHR) heat exchanger.

h. ECCS area particulate filter efficiency was reduced from 99% to 95% for conservatism and consistency with the elemental and organic efficiencies. A footnote was also added to emphasize that ECCS leakage from components outside of the RAB Emergency Exhaust System boundary would be assumed to be unfiltered.

The dose summary tables were revised to reflect the previously discussed LPZ 30 day thyroid dose from ECCS component leakage alone and from combined ECCS and containment leakage. The EAB 2 hour thyroid and whole body and the LPZ 30 day whole body doses were also revised accordingly.

A statement noting that exposures received offsite from ECCS components were small compared to those received from containment leakage was deleted, and the time at which the temperature of the sump water is reduced to 212°F was changed to approximately 4 hours to more accurately reflect the sump temperature response during a LOCA.

The reference to the Standard Review Plan (SRP) Section 6.5.2 and Figure 6.5.2-1 was clarified to note that the figure was in Revision 1 to Section 6.5.2.

FSAR SECTION CHANGE SUMMARY

FSAR Section 15.6.5.4.4 - Doses to Control Room Personnel

Added an assumption to be applied to the calculations of the dose to the control room occupants following a LOCA, which stated that the dose contribution from postulated leakage from ECCS components outside of containment, based on the limits discussed in FSAR Section 15.6.5.4.2, was included. The original FSAR analysis did not include postulated leakage from ECCS components outside of containment.

FSAR Table 15.6.5-12 - Westinghouse-Calculated Radiological Consequences of a Postulated Loss of Coolant Accident

Revised the appropriate thyroid and whole body doses for the Exclusion Area Boundary and Low Population Zone, and for the control room personnel. The LPZ 30 day dose increased to 263 Rem thyroid (as discussed above), while the 30 day dose to to the control room personnel increased to 7.1 Rem thyroid. A note was also added to the control room personnel dose to indicate that the listed doses included contributions from ECCS leakage outside containment. An FSAR section reference was also revised.

FSAR Table 15.6.5-15 - Siemens Power Corporation (SPC)-Calculated Doses Resulting From a Loss of Coolant Accident

Revised the appropriate thyroid and whole body doses. The calculated thyroid doses from Table 15.6.5-12 above are more limiting than those calculated in this table (LPZ 30 day dose of 250 Rem thyroid and control room 30 day dose of 6.74 Rem thyroid).

PROPOSED FSAR REVISIONS

6.5.1.1.2 RAB Emergency Exhaust System

The RAB Emergency Exhaust System serves to limit the post-accident radiological releases from selected potentially contaminated portions of the RAB. These areas include the charging pump, RHR heat exchanger, containment spray and RHR pump room, mechanical, electrical and H&V rooms and mechanical, electrical and H&V penetration areas. Since leakage in these areas following a SIAS is a potential source of additional offsite dose, the RAB Emergency Exhaust System is provided to ensure that such airborne leakage is filtered prior to release to the environment.

Portions of the Post Accident ECCS Recirculation flow path are outside of the RAB Emergency Exhaust System boundary. These areas include the mezzanine above the CSIP rooms and the CVCS filter area and valve galleries. Other areas affected or potentially affected by the ECCS recirculation flow path pressure boundary include various heat exchanger rooms and valve galleries. Postulated leakage from components in these areas (valves, strainers, filters) is not filtered and will be limited to 2 gallons per hour. Radiological consequences of leakage from ECCS is discussed in 15.6.5.4.

The RAB Emergency Exhaust System will meet the following design bases:

a) The system is designed to maintain the post-accident radiological releases within the guidelines of 10CFR100 if a postulated leak occurs in the containment sump water recirculation system. The guidance provided in SRP 15.6.5, Appendix B, has been followed in assessing the offsite doses.

b) The system is designed to satisfy all applicable requirements of GDC 61 of 10CFR50, Appendix A.

c) The fission product removal capacity of the filters is based on the requirements of Regulatory Guide 1.52, Revision 2.

d) The system establishes and maintains selected potentially contaminated areas of the RAB below atmospheric pressure following a SIAS, minimizing unfiltered outleakage of airborne radioactive materials.

e) The system is designed with sufficient redundancy to meet single active failure criteria.

f) The system is designed to withstand the SSE without loss of function.

g) The components of the system are designed and sized in accordance with Regulatory Guide 1.52, Revision 2 with the exceptions listed in Table 6.5.1-2.

PROPOSED FSAR REVISIONS

7.5.1.4.11.1 Reactor Auxiliary Building Emergency Exhaust System

The Reactor Auxiliary Building Emergency Exhaust System serves that portion of the RAB which contains selected equipment essential for safe shutdown. The charging pump area, RHR heat exchanger area, containment spray pump area, and RHR pumps rooms, mechanical room, electrical room, H&V room, and mechanical, electrical & H&V penetration areas are provided coverage. In normal operation, the normal supply and normal exhaust system are in operation. On receipt of a safety injection signal, the normal supply and exhaust systems stop and the emergency exhaust system starts (see Section 7.3.1.3.4 for system description).

A multipoint seismically qualified temperature recorder (TR-0005) is provided to record the electric heater coil and HEPA filter inlet and outlet air temperature. A flow and differential pressure recorder (UR-0006) is also provided to record Δp across the HEPA filter, Δp across overall emergency filtration system and exhaust airflow.

The display instrumentation system is listed in Table 7.5.1-6.

PROPOSED FSAR REVISIONS

9.4.3 AUXILIARY AND RADWASTE AREA VENTILATION SYSTEMS

The Reactor Auxiliary Building (RAB) Ventilation System and Waste Processing Building (WPB) HVAC System are two separate and independent systems.

The Reactor Auxiliary Building (RAB) Ventilation System consists of the following systems:

a) RAB Normal Ventilation System, which provides normal ventilation for the Reactor Auxiliary Building during normal plant operation. Refer to Sections 9.4.3.1.1, 9.4.3.2.1 and 9.4.3.3.1 for a detailed discussion.

b) RAB Emergency Exhaust System, which maintains selected potentially contaminated areas (see Section 6.5.1.1.2) of RAB below atmospheric pressure following a safety injection signal (SIS) and minimizes unfiltered outleakage of airborne radioactive materials. Refer to Section 6.5.1 for a detailed discussion.

c) RAB NNS-Ventilation Systems, which are discussed in Sections 9.4.3.1.2, 9.4.3.2.2 and 9.4.3.3.2.

d) RAB ESF Equipment Cooling System which provides emergency cooling by means of fan-coolers, for areas containing equipment essential for safe shutdown. Refer to Section 9.4.5 for a detailed discussion.

e) RAB switchgear rooms, and the RAB electrical equipment protection rooms are ventilated by two separate systems which are discussed in Section 9.4.5.

The portions of the RAB Normal Ventilation System, which are also connected to the RAB Emergency Exhaust System, will be isolated automatically following a SIS signal. At that time, the RAB Emergency Exhaust System will be actuated and will keep the areas connected to the emergency exhaust systems under a slightly negative pressure. All exhaust will be passed through filtration system for treatment before release.

The local ESF fan coolers will start simultaneously with the RAB Emergency Exhaust System and are completely separated and independent from any other RAB ventilation system. The fan coolers will circulate air in rooms containing equipment essential for safe shutdown.

PROPOSED FSAR REVISIONS

9.4.3.1 Design Bases

9.4.3.1.1 RAB Normal Ventilation System

a) The RAB Normal Ventilation System (RABNVS) is designed to provide normal ventilation for areas containing equipment essential for safe shutdown including CVCS chiller area, 480 V auxiliary bus area, areas containing non-essential equipment, surrounding access aisles and RAB stairways and H&V equipment rooms. Refer to Figures 9.4.3-1 and 9.4.3-2 for all areas ventilated. The RABNVS is also designed to maintain space temperatures as indicated in Table 9.4.0-1 during normal plant operation.

b) Ventilation system discharges are monitored to detect and control the release of airborne radioactivity. Refer to Sections 11.5 and 12.3.4 for details.

c) The normal supply and exhaust systems are designed with sufficient redundancy to ensure continuous reliable performance during normal plant operations. The supply systems are provided with two 100 percent capacity redundant operating fans (one operating and one standby), the exhaust systems are provided with four 25 percent capacity operating fans. Also, as described in Section 9.4.7, the containment pre-entry purge exhaust unit serves as a standby unit for RAB Normal Exhaust System.

d) Maintain air flow from areas of low potential radioactivity to areas of progressively higher potential radioactivity.

e) Isolate service to selected post accident, potentially contaminated areas (see Section 6.5.1.1.2) upon receipt of a safety injection signal to enable the RAB Emergency Exhaust System to maintain these areas below atmospheric pressure.

f) The system isolation valves which are required to function following a design basis accident, will be powered by redundant electric safety buses A and B.

PROPOSED FSAR REVISIONS

9.4.3.2 System Description

9.4.3.2.1 RAB Normal Ventilation System

The RAB Normal Ventilation System (RABNVS) is shown on Figures 9.4.3-1 and 9.4.3-2. Design data for principal system components are presented in Table 9.4.3-1. The once through type system consists of a supply system, a normal exhaust and a filtered emergency exhaust system. Under accident conditions, spaces containing major containment penetrations and selected potentially contaminated areas (see Section 6.5.1.1.2) are automatically isolated, the normal ventilation system shuts down, and the air from those areas is treated by the filtered RAB Emergency Exhaust System prior to release to the environment.

The filtered RAB Emergency Exhaust System, is an Engineered Safety Feature (ESF) which contains high efficiency particulate air (HEPA) filters and a charcoal adsorber. This system is described and evaluated in detail in Section 6.5.1.

The RAB Normal Ventilation Supply System consists of an outside air intake equipped with a self acting tornado damper and an evaporative air cooler. The evaporative air cooler includes, in the direction of air flow, a medium efficiency filter, an electric heating coil, an air washer, and two 100 percent vane-axial fans arranged in parallel (one operating-one standby).

Each fan is provided with an inlet and outlet isolation damper to prevent air recirculation through an idle fan. The fan capacity and design data is shown in Table 9.4.3-1. Outside air is drawn through the system and supplied to the entire RAB except the H&V equipment room; air is distributed through a sheet metal ductwork distribution system. Redundant isolation dampers, mounted in series, are provided at each supply ventilation penetration into the areas containing equipment essential for safe shutdown.

In addition to the supply system, the CVCS chiller area and the 480 V auxiliary bus area are cooled by fan coolers. The NNS fan coolers are factory fabricated air handling units; each unit consists of a fan section, cooling coil section and a filter section. Design data for system components are presented in Table 9.4.3-1.

The NNS fan coolers circulate the rooms air across the cooling coil and discharge the cooled air to the space served. Sheet metal ductwork is provided as required to distribute the cooled air.

As indicated on Figures 9.2.8-1 and 9.2.8-2 and described in Section 9.2.8, the chilled water for the cooling coils is supplied from the Essential Chilled Water System.

PROPOSED FSAR REVISIONS

9.4.3.2.1 RAB Normal Ventilation System (Con't)

The RABNVS Exhaust System consists of our subsystems, each having a pneumatic inlet damper, medium efficiency filter, HEPA filter, charcoal adsorber and a centrifugal fan with variable inlet vanes. The exhaust units are arranged in parallel and each fan is provided with a pneumatic inlet damper and a gravity discharge damper to prevent air recirculation through any idle fan during maintenance.

Air is exhausted from the RABNVS through a vent stack located on the roof of the Reactor Auxiliary Building (see Table 9.4.0-2). As in the supply duct system redundant isolation dampers, mounted in series, are provided at each exhaust penetration from the areas containing equipment essential for safe shutdown.

The RAB Normal Exhaust System serves as containment pre-entry purge backup and normal containment purge during normal plant operation. Also, the Pre-Entry Purge System as shown on Figure 6.2.2-3 and described in Section 9.4-7 serves as a standby unit for the RAB Normal Exhaust System.

In the event of an accident or loss of offsite power, the RABNVS will shutdown. Air will be exhausted by an independent Emergency Exhaust System.

Air sampling systems in the normal exhaust ducts will detect the radioactivity level as described in Sections 11.5 and 12.3.4.

Upon detection of smoke in the Ventilation System, the supply fans will automatically be tripped to prevent the spread of smoke and reduce the supply of air to the fire in accordance with NFPA 90A.

PROPOSED FSAR REVISIONS

12.3.2.16.2 Access to Vital Areas

The radiation level in areas requiring continuous occupancy are less than 15 mR/hr. These areas have been defined above. Exposures in these areas will contribute to an integrated dose of less than 5 rem for the duration of the accident and can satisfy GDC19 of 10 CFR 50 Appendix A. Postulated post-accident assumptions and source terms are described in FSAR Section 15.6.5.4.4. Atmospheric dispersion factors used in the Technical Support Center dose calculations were developed using the methodology described in NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes," May 1995.

Areas requiring possible frequent access have radiation levels between 15 mR/hr. and less than 100 mR/hr. Examples of such areas are control panels which are located outside the cubicles housing radioactive sources.

Areas requiring infrequent access are those with radiation levels greater than 100 mR/hr. The direct dose due to airborne activity in the containment atmosphere outside the cylindrical structural wall is estimated to be 8 R/hr. High radiation doses indicate contributions from highly radioactive sources in the areas. Since it is extremely difficult to separate the radiation zones in the absence of the shield walls, a range of radiation levels exist.

The overall result of the analysis is that vital areas required to be accessible to place the plant in a stable shutdown condition following the accident are accessible at the time required for entry. All operations required to mitigate the accident and place the plant in RHR recirculation mode can be performed from the Control Room.

Dose rate zone maps, which identify dose rates in vital areas, are shown on Figures 12.3A-1 through 12.3A-21. Occupancy requirements for various areas following an accident are summarized in Table 12.3.2-3. The dose rates for various time references (one hour, one day and one month) were calculated using source terms discussed in FSAR Section 12.2.1.12 and subsection 12.3.2.16. Sources of radiation were airborne and coolant activity in the containment building and the coolant activity in the RHR, containment spray and safety injection systems outside containment.

PROPOSED FSAR REVISIONS

15.6.5.4 Westinghouse Radiological Consequences Analysis of a Postulated Loss-of-Coolant Accident.

15.6.5.4.2 Engineered safety features components leakage outside of containment. Following a postulated LOCA, the Residual Heat Removal System (RHRS) and Containment Spray System (CSS) are operational. During the recirculation phase, leakage could occur through components such as pump flanges, valves, and heat exchangers. The RAB Emergency Exhaust System is provided to filter such airborne leakage from these areas prior to release to the environment. Portions of the Post Accident ECCS Recirculation flow path are located outside of the RAB Emergency Exhaust System boundary (see Section 6.5.1.1.2). Postulated leakage from these components is not filtered.

As part of the radiological consequences of a design basis loss-of-coolant accident, an evaluation of the leakage from ESF components outside containment has been provided. The calculational models, assumptions, parameters, and results of dose calculations are presented below.

To ensure that the limits of 10CFR100 are not exceeded, a limit of 2 gallons per hour (0.033 gpm) has been established for those portions of the ECCS Recirculation flow path outside of the RAB Emergency Exhaust System boundary. For conservatism, the remainder of 1 gallon per minute leakage (0.967 gpm) in the system is assumed to occur simultaneously inside of the RAB Emergency Exhaust System boundary. As indicated by the results, the dose resulting from twice this leakage rate (2 times 0.033 gpm outside, 2 times 0.967 gpm inside) is 95 rem to the thyroid (LPZ 30 day). Combining the dose received from containment leakage with this value results in 263 rem to the thyroid (LPZ 30 day). Utilizing the same model and assumptions presented below, the maximum allowable ECCS leakage rate outside of the RAB Emergency Exhaust System boundary would be 4 gallons per hour (0.067 gpm) and again assuming the remainder of 1 gpm leakage (0.933 gpm) occurs inside. The dose resulting from twice the maximum allowable leakage (2 times 0.067 gpm outside, 2 times 0.933 gpm inside) is 300 rem, including dose from containment leakage which is the acceptable limit established in 10CFR100.

PROPOSED FSAR REVISIONS

15.6.5.4.2 Engineered safety features components leakage outside of containment. (Con't)

1. The Calculational Models

a. The following equation mathematically models the radioiodine activity in the containment sump water at the time when recirculation begins. The radioiodine activity comprises that released directly into the sump water from the core.

Sump water activity =

$A_s\ t(_o) = -\lambda_R t_o$

where: $A_s(o)$

$A_s(t_o)$	=	sump water activity at time t_o (Ci)
$A_s(o)$	=	initial activity in sump water (Ci)
λ_R	=	radiological decay constant for each isotope of radioiodine (hr^{-1})
t_o	=	time when recirculation begins (hr)

b. The following equation gives the activity released as a result of ECCS component leakage, integrated over the time of the accident.

$$A_{ECC}(t) = \frac{L_{ECC} \cdot A_s(t_o)\ (1-e^{-X(t-t_o)})}{X}$$

where:

$A_{ECC}(t)$	=	radioiodine activity released from ECCS components (Ci)
L_{ECC}	=	leakage of ECCS components (fraction of total volume per hour)
X	=	removal of radioiodine due to leakage and radiological decay (hr^{-1})

2. Assumptions and Parameters

The following table below lists the assumptions and parameters utilized in our evaluation of the radiological consequences of ECCS leakages following a LOCA.

PROPOSED FSAR REVISIONS

15.6.5.4.2 Engineered safety features components leakage outside of containment (Con't)

Assumptions and Parameters		Value
a.	Percent radioiodine core activity directly transferred to containment sump water.	50%
b.	Radioiodine form and percent composition.	
	Elemental	91%
	Particulate	5%
	Organic	4%
c.	Time after LOCA when ECCS recirculation begins.	20 min.
d.	Total volume of containment sump.	3.59×10^5 gal.
e.	Anticipated ECCS leakage (this value was multiplied by 2 in the evaluation).	OUTSIDE 0.033 GPM INSIDE 0.967 GPM
f.	Sump solution temperature.*	230°F
g.	Iodine flashing fraction.	2% (see discussion below)
h.	ECCS area filter efficiencies.**	
	Elemental	95%
	Organic	95%
	Particulate	95%
i.	Dose calculation parameters.	See FSAR Section 15.0A

* Temperature used to determine flashing fraction. Although sump temperature may approach 240°F at the start of recirculation, it is reduced to less than 230°F within 1.5 hours and to less than 212°F within 4 hours. ECCS fluid at the RHR heat exchanger outlet will be less than 200°F following the start of recirculation. ECCS recirculation piping that is located outside the Emergency Exhaust System boundary is also downstream of the RHR heat exchanger; therefore, fluid in this piping will be sufficiently subcooled to prevent flashing.

**ECCS leakage from components outside of the RAB Emergency Exhaust System boundary will be assumed to be unfiltered, i.e., filter efficiency is zero.

PROPOSED FSAR REVISIONS

15.6.5.4.2 Engineered safety features components leakage outside of containment (Con't)

3. Results and Conclusions

The following tables provide the results of our analysis:

Dose Received from ECCS Component Leakage Following a Design Basis LOCA (rem)

	Thyroid	Whole Body
EAB 2 hr	21	5.34×10^{-2}
LPZ 30 day	95	1.68×10^{-1}

Total Dose Received from Containment and ECCS Following a Design Basis LOCA (rem)

EAB 2 hr	174	2.6
LPZ 30 day	263	1.75

The combined containment and ECCS thyroid and whole body exposures following a design basis LOCA are within 10 CFR 100 guidelines.

The 2 percent value for iodine releases from the fluid leaking into the ECCS area is based upon a conservative set of assumptions.

In the analysis, the temperature of the sump water has been conservatively assumed to be constant at 230 F although the temperature is reduced to 212 F after approximately 4 hours following the start of recirculation.

A fraction of water would flash into steam after leaking into the ECCS area. The fraction has been found to be 2 percent based on heat balance. After flashing, the remaining liquid would be collected in the drains and removed from the area. The fraction of iodine, (PF) that would become airborne is calculated using the following model (Reference 15.6.5-29):

PROPOSED FSAR REVISIONS

15.6.5.4.2 Engineered safety features components leakage outside of containment (Con't)

$$PF = \frac{S}{W} \times 1700 \times \frac{1}{PC}$$

where,

PF	=	partition factor
S	=	mass fraction of steam
W	=	mass fraction of water
PC	=	partition coefficient, (μ Ci/cc liquid)/(μCi/cc gas)
1700	=	the ratio of vapor to liquid specific volumes at 212 F

Standard Review Plan (SRP) Section 6.5.2, Rev. 1, indicates that long term iodine retention with no significant re-evolution may be assumed when the equilibrium sump pH, after mixing and dilution with the primary coolant and ECCS injection, is above 8.5. This view is supported by L. F. Parsly (Reference 15.6.5-30) by indicating high values of PC at pH of 9 and above, when iodate formation is significant. A value of 1.765×10^9 has been indicated at 212 F, pH equal to 9 and concentration of aqueous iodine of 3×10^{-3} moles/liter. The PC indicated in SRP Section 6.5.2, Rev. 1; Figure 6.5.2-1 is 5×10^3. Conservatively, selecting 5×10^3, PF is calculated as follows:

$$PF = \frac{.02}{.98} \times 1700 \times \frac{1}{5 \times 10^3} = 6.9 \times 10^{-3}$$

This suggests that only .69 percent of the iodine leaking into the ECCS area would become airborne and be removed with the exhaust.

Therefore, 2 percent value, in effect, does not account for partition and is a conservative estimate in the dose evaluation.

15.6.5.4.3 Offsite doses. The potential radiological consequences resulting from a postulated loss-of-coolant accident have been analyzed, using the assumptions and models discussed in the previous sections. The whole-body dose due to immersion and the thyroid dose due to inhalation have been analyzed for the initial two hour period at the exclusion area boundary and for the initial 30-day period at the outer boundary of the low population zone. These doses are listed in Table 15.6.5-12 and are below the guideline values of 10 CFR 100.

15.6.5.4.4 Doses to control room personnel. In the event of a LOCA, the safety injection actuation signal initiates instantaneous closure of the control room isolation dampers. Since the dampers are equipped with fail-closed operators, isolation is effected even if offsite power is lost. After isolation, and once power is available (if it was interrupted), the Control Room Emergency Filtration System can be brought into operation so that all air entering the control room passes through iodine adsorbers, as described in Section 9.4.1.

PROPOSED FSAR REVISIONS

15.6.5.4.4 Doses to control room personnel (Con't)

The following assumptions are applied in the calculations of the dose to the control room occupants following the LOCA:

1. The design basis assumptions presented in Section 15.6.5.4.1 are applied.

2. A constant air intake flow rate of 400 cfm is assumed. This makes up for losses caused by leaks and maintains the control room pressure at a level slightly above the ambient pressure.

3. The control room iodine adsorbers are sized for a 4000 cfm flow rate. This is the sum of the intake and recirculation flow rates.

4. The control room iodine absorbers are assigned a 99 percent removal efficiency.

5. Occupancy of the control room is based on the following occupancy factors:

Time Period	Occupancy Factor
0 to 24 hours	1.0
1 to 4 days	0.6
4 to 30 days	0.4

6. The methodology recommended in Reference 15.6.5-23 has been used to calculate the post accident atmospheric dispersion.

7. A net free control room volume of $.71 \times 10^5$ cubic feet.

8. The control room dose analysis is based on the models described in Appendix 15.0A.

9. Dose contribution from postulated leakage from ECCS components outside of containment, based on the limits discussed in 15.6.5.4.2, are included.

Using the above assumptions and procedures, the initial 30 day whole body and skin immersion doses and the thyroid inhalation dose have been calculated and are listed in Table 15.6.5-12. The whole body dose is less than the limiting value of 5 rem, as specified in 10CFR50, Appendix A, "General Design Criteria for Nuclear Power Plants", Criterion 19. The thyroid dose and skin dose are both less than the limiting value of 30 rem, as specified in Standard Review Plan, Section 6.4.

PROPOSED FSAR REVISIONS

TABLE 15.6.5-12

WESTINGHOUSE-CALCULATED RADIOLOGICAL CONSEQUENCES OF A POSTULATED LOSS-OF-COOLANT ACCIDENT

	Doses (rem)		
	Thyroid	Whole Body	Skin
0-2 Hour Dose at the Exclusion Area Boundary*	174	2.6	
0-30 Day Dose at the Low Population Zone*	263	1.75	
0-30 Day Dose to the Control Room Personnel*	7.1	0.6	14

*These doses include contributions from ECCS leakage outside containment (refer to Section 15.6.5.4.2 for further information).

PROPOSED FSAR REVISIONS

TABLE 15.6.5-15

SPC-CALCULATED OFFSITE DOSES RESULTING FROM A LOSS OF COOLANT ACCIDENT

	Thyroid Dose Limit (rem)	Thyroid Dose (rem)	Whole Body Dose Limit (rem)	Whole Body Dose (rem)
0 - 2 Hour Dose at the Exclusion Area Boundary	300.	165	25.	2.72
0 - 30 Day Dose at the Low Population Zone	300.	250	25.	1.86
0 - 30 Day Dose to the Control Room Personnel	300.	6.74	25.	0.61

ADMINISTRATIVE CONTROLS

ECCS LEAKAGE (DESIGN BASIS)

1.0 OPERATIONAL REQUIREMENTS

1.1 External leakage from the Emergency Core Cooling System (ECCS) recirculation flow path pressure boundary located outside the Reactor Auxiliary Building (RAB) Emergency Exhaust System boundary shall be limited to a cumulative total of 2 gallons per hour.

APPLICABILITY: MODES 1, 2, 3, and 4

ACTION:

With the above limit exceeded, reduce the leakage rate to within the limit within 24 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

2.0 SURVEILLANCE REQUIREMENTS

2.1 Areas outside of the RAB Emergency Exhaust System boundary, excluding the CVCS filter room, that contain components (valves, flanges, strainers) in the ECCS recirculation flow path pressure boundary shall be inspected for indications of external leakage at least every 72 hours.

2.2 Components in the CVCS filter room shall be inspected for indications of external leakage at least every 31 days.

2.3 Any noticeable external leakage found while performing 2.1 or 2.2 above shall be measured or estimated to ensure total leakage is within the limit.

2.4 This portion of the ECCS system shall be leak tested in accordance with the Leakage Reduction Program requirements of PLP-621 at refueling cycle intervals or less.

REFERENCE: ESR-95-00687

10 CFR 50.92 EVALUATION

The Commission has provided standards in 10 CFR 50.92(c) for determining whether a significant hazards consideration exists. A change involves no significant hazards consideration if it would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the possibility of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety. Carolina Power & Light Company has reviewed this proposed change and determined that it does not involve a significant hazards determination. The basis for this determination follows.

Proposed Change

It is proposed that the FSAR be revised to reflect the presence of portions of the Emergency Core Cooling System (ECCS) recirculation system outside of the Reactor Auxiliary Building (RAB) Emergency Exhaust System boundary. The function of this emergency exhaust system is to filter radioactive releases that may occur because of leaks in the ECCS outside containment following an accident. The original FSAR dose analyses assumed that any radioactive releases from the ECCS recirculation system outside containment would be filtered by the emergency exhaust system. Subsequently, it has been determined that portions of the ECCS recirculation system outside containment, which contain valves and piping, are outside the emergency exhaust system boundary. Potential releases from leaks in these portions of the ECCS recirculation system would not be filtered. Engineering evaluations indicate that modifications to extend the emergency ventilation system boundary to include the areas of the building containing this piping would be substantial and extensive. Therefore, an administrative limit is being established on the amount of operational leakage in those portions of the ECCS recirculation system outside the ventilation boundary. Implementation of this administrative limit results in calculated off-site doses following a postulated accident which are within 10 CFR 100 limits.

The dose assessments were performed utilizing an administrative limit on leakage that may occur in ECCS components outside the exhaust system boundary. The major assumptions used to calculate the 30 day Low Population Zone (LPZ) doses were: (1) 50 gpm gross passive failure leakage was not applicable to the piping and valves outside the ventilation boundary (the pumps are within the ventilation boundary); (2) one gpm continuous ECCS leakage, with two gallons per hour outside the exhaust system boundary established as an administrative limit and the remainder (approximately 0.97 gpm) inside the boundary; (3) 2% flashing fraction per current licensing basis (FSAR); and (4) original atmospheric dispersion (X/Q) values. The Exclusion Area Boundary (EAB) and control room dose assessments were similarly recalculated. The Technical Support Center (TSC) dose was recalculated using the X/Q methodology of NUREG/CR 6331, Atmospheric Relative Concentrations in Building Wakes, published in May 1995. The calculated doses are within regulatory limits, with the 30 day LPZ thyroid dose being the most limiting.

10 CFR 50.92 EVALUATION

Basis

This change does not involve a significant hazards consideration for the following reasons:

1. The proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

   The changes described above have no impact on the probability of occurrence of accidents previously analyzed. The RAB Emergency Exhaust System is an accident mitigation system. Its purpose is to mitigate the consequences of leakage from the emergency core cooling system outside containment. It has no impact on accident initiators. Similarly the revisions to the accident dose analyses have no impact on the probability of occurrence of accidents.

   When the NRC issued the Interim Final Rule regarding "Standards for Determining Whether License Amendments Involve No Significant Hazards Considerations" (48 FR 14864, April 6, 1983), the notice included examples of situations which were likely to involve significant hazards considerations and examples that likely would not involve significant hazards considerations. One of the examples that does not involve significant hazards is a change which either may result in some increase to the probability or consequences of a previously analyzed accident or may reduce in some way a safety margin, but where the results of the change are clearly within acceptable criteria with respect to the system or component specified in the Standard Review Plan.

   This design discrepancy and its resolution, as described above, does result in increased postulated dose. The limiting increase is to the postulated 30 day dose in the Low Population Zone. Lesser increases in dose were predicted for the control room and for the Technical Support Center. However, the resulting postulated doses remain well below the regulatory limits specified in 10 CFR 100 for offsite doses and 10 CFR 50, Appendix A (GDC 19).

   The postulated 30 day thyroid dose for the Low Population Zone increased by 93 Rem, from 171 to 264 Rem. The increased dose to the thyroid is still well below the 10 CFR 100 limit of 300 Rem. The higher doses are predominately the result of revised basic assumptions on the overall system leakage The revised system leakage is consistent with Technical Specification maximum unidentified RCS leakrate of one (1) gpm.. This represents an increase of more than 40 times the assumed system leakage previously used in the FSAR, with a portion (two gallons per hour) outside the filtered ventilation area. Also, in accordance with the SRP, the leakage value used

10 CFR 50.92 EVALUATION

for input to the dose calculation was doubled. This shows that there is substantial analytical conservatism in the predicted dose.

Therefore, there would be no increase in the probability and no significant increase in the consequences of an accident previously evaluated.

2. The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

   As stated above, the RAB Emergency Exhaust System is not an accident initiating system. Failure of this system does not create the possibility of a new type of accident or equipment malfunction. No safety-related equipment, safety function, or operations of plant equipment will be altered as a result of this change. Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. The proposed change does not involve a significant reduction in the margin of safety.

   The BASES for the RAB Emergency Exhaust System Technical Specification (3/4.7.7) states that this system ensures that radioactive materials leaking from ECCS equipment within the pump room following a Loss of Coolant Accident (LOCA) are filtered prior to reaching the environment. The BASES apparently concentrate on what would likely be the predominant leakage path, i.e., that which would result from a ECCS pump seal failure. Since the ECCS pumps continue to remain within the RAB Emergency Exhaust System boundary, the proposed change has no effect on that basis. Furthermore, the proposal change makes no changes to the RAB Emergency Exhaust System or its performance. Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

ENVIRONMENTAL CONSIDERATIONS

10 CFR 51.22(c)(9) provides criterion for and identification of licensing and regulatory actions eligible for categorical exclusion from performing an environmental assessment. A change requires no environmental assessment if it would not: (1) involve a significant hazards consideration; (2) result in a significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (3) result in a significant increase in individual or cumulative occupational radiation exposure. Carolina Power & Light Company has reviewed this proposed change and 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(b), no environmental impact statement or environmental assessment needs to be prepared in connection with this issue. The basis for this determination follows.

Proposed Change

It is proposed that the FSAR be revised to reflect the presence of portions of the Emergency Core Cooling System (ECCS) recirculation system outside of the Reactor Auxiliary Building (RAB) Emergency Exhaust System boundary. The function of this emergency exhaust system is to filter radioactive releases that may occur because of leaks in the ECCS outside containment following an accident. The original FSAR dose analyses assumed that any radioactive releases from the ECCS recirculation system outside containment would be filtered by the emergency exhaust system. Subsequently, it has been determined that portions of the ECCS recirculation system outside containment, which contain valves and piping, are outside the emergency exhaust system boundary. Potential releases from leaks in these portions of the ECCS recirculation system would not be filtered. Engineering evaluations indicate that modifications to extend the emergency ventilation system boundary to include the areas of the building containing this piping would be substantial and extensive. Therefore, an administrative limit is being established on the amount of operational leakage in those portions of the ECCS recirculation system outside the ventilation boundary. Implementation of this administrative limit results in calculated off-site doses following a postulated accident which are within 10 CFR 100 limits.

The dose assessments were performed utilizing an administrative limit on leakage that may occur in ECCS components outside the exhaust system boundary. The major assumptions used to calculate the 30 day Low Population Zone (LPZ) doses were: (1) 50 gpm gross passive failure leakage was not applicable to the piping and valves outside the ventilation boundary (the pumps are within the ventilation boundary); (2) one gpm continuous ECCS leakage, with two gallons per hour outside the exhaust system boundary established as an administrative limit and the remainder (approximately 0.97 gpm) inside the boundary; (3) 2% flashing fraction per current licensing basis (FSAR); and (4) original atmospheric dispersion (X/Q) values. The Exclusion Area Boundary (EAB) and control room dose assessments were similarly recalculated. The Technical Support Center (TSC) dose was recalculated using the X/Q methodology of NUREG/CR 6331, Atmospheric Relative Concentrations in Building

ENVIRONMENTAL CONSIDERATIONS

Wakes, published in May 1995. The calculated doses are within regulatory limits, with the 30 day LPZ thyroid dose being the most limiting.

Basis

The change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) for the following reasons:

1. As demonstrated in Enclosure 4, the proposed change does not involve a significant hazards consideration.

2. The proposed change does not result in a significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

   The proposed revision to the licensing basis and dose analyses will have no impact on the types of effluents that may be released offsite. The proposed change will increase the postulated release of radioiodine following a loss of coolant accident and, therefore, result in an increase in the postulated offsite dose following this accident. However, as shown in the significant hazards analysis (Enclosure 4), the increase in the postulated offsite dose is not significant, and it is within regulatory limits.

3. The proposed change does not result in a significant increase in individual or cumulative occupational radiation exposure.

   The revised licensing basis and dose analyses will have minimal impact on normal occupational doses. Any change in occupational dose would be associated with plant inspections to comply with the administrative leak rate limit of two gallons per hour. Therefore, the amendment does not result in a significant increase in either individual or cumulative occupational radiation exposure.