Florida Power
CORPORATION
Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72

October 3, 2000
3F1000-08

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

Subject: License Amendment Request #262, Revision 0
Alternative Source Term and Control Room Emergency Ventilation System

Dear Sir:

Florida Power Corporation (FPC) hereby submits License Amendment Request (LAR) #262, Revision 0, requesting changes to the Crystal River Unit 3 (CR-3) Facility Operating License No. DPR-72 in accordance with 10 CFR 50.90 and 10 CFR 50.67. LAR #262 requests full implementation of an alternative source term for CR-3 and proposes changes to Improved Technical Specifications (ITS) 3.7.12, "Control Room Emergency Ventilation System (CREVS)," ITS 5.6.2.12, "Ventilation Filter Testing Program (VFTP)," ITS 3.3.16, "Control Room Isolation - High Radiation," and ITS 3.7.18, "Control Complex Cooling System." The proposed ITS changes are based on the results of revised public and control room dose calculations for CR-3 design basis radiological accidents using an alternative source term. LAR #262 is being submitted in accordance with the guidance provided in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," and Standard Review Plan (SRP) 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms."

Discussions of each of the changes proposed by LAR #262 are provided in Attachment A of this submittal. Supporting information is provided in the submittal Appendices, which include a revised CR-3 Control Room Habitability Report, a summary of the revised dose calculations for each of the CR-3 design basis radiological accidents, and the dose calculation inputs/assumptions for each of the analyzed accidents.

Portions of the current ITS 3.7.12 were approved by the NRC until the beginning of operating Cycle 13 by the Safety Evaluation for License Amendment No. 185. Therefore, FPC is requesting approval of LAR #262 by August 2001 with implementation prior to the CR-3 refueling outage scheduled to begin in October 2001. The requested approval date and implementation period will allow FPC to conduct outage activities in accordance with the revised ITS requirements proposed by LAR #262.

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The issuance of License Amendment No. 185 was based, in part, on an FPC justification for continued operation (JCO) which included compensatory measures for the control room emergency ventilation system and the control complex habitability envelope as described in FPC letter 3F0198-20 dated January 7, 1998. It is FPC's intention to close this JCO following NRC approval of LAR #262.

The information provided in this submittal on toxic gas detectors and their interaction with the Control Room Emergency Ventilation System is based on the current plant configuration. FPC is implementing modifications that will reduce the existing toxic gas sources and eliminate the potential for any toxic gas release that requires automatic isolation of the CR-3 control complex by the toxic gas detectors. FPC will notify the NRC, in a supplement to this submittal, when reduction of the toxic gas sources has been completed.

If you have any questions regarding this submittal, please contact Mr. Sid Powell, Manager, Nuclear Licensing at (352) 563-4883.

Sincerely,

John J. Holden
Vice President and Site Director

JJH/jal

xc: Regional Administrator, Region II
Senior Resident Inspector
NRR Project Manager
State of Florida, Department of Health and Rehabilitative Services

Attachments:

A. Description of Proposed Changes, Background, Reason for Request, and Evaluation of Request
B. No Significant Hazards Consideration Determination
C. Environmental Impact Evaluation
D. Proposed Revised Improved Technical Specifications and Bases Change Pages - Strikeout / Shadow Format
E. Proposed Revised Improved Technical Specifications and Bases Change Pages - Revision Bar Format
F. List of Regulatory Commitments

Appendices:

A. CR-3 Control Room Habitability Report
B. Summary of Radiological Analyses for FSAR Chapter 14 Accidents
C. Main Steam Line Break Inputs/Analysis
D. Steam Generator Tube Rupture Licensing Basis Case Inputs/Analysis
E. Steam Generator Tube Rupture Standard Review Plan Case Inputs/Analysis
F. Fuel Handling Accident RADTRAD Inputs
G. Control Rod Ejection Accident Containment Release RADTRAD Inputs
H. Control Rod Ejection Accident Secondary Side Release RADTRAD Inputs
I. LOCA ECCS Leakage RADTRAD Inputs
J. LOCA Containment Leakage RADTRAD Inputs
K. LOCA Hydrogen Purge RADTRAD Inputs
L. Letdown Line Rupture RADTRAD Inputs
M. Waste Gas Decay Tank Rupture RADTRAD Inputs

STATE OF FLORIDA

COUNTY OF CITRUS

John J. Holden states that he is the Vice President and Site Director for Florida Power Corporation; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission the information attached hereto; and that all such statements made and matters set forth therein are true and correct to the best of his knowledge, information, and belief.

John J. Holden
Vice President and Site Director

Sworn to and subscribed before me this 3rd day of October, 2000, by John J. Holden.

Signature of Notary Public
State of Florida

LISA A. MORRIS
Notary Public, State of Florida
My Comm. Exp. Oct. 25, 2003
Comm. No. CC 879691

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

Personally Known X -OR- Produced Identification ________

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT A

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and Control Room Emergency Ventilation System

Description of Proposed Changes, Background, Reason for Request, and Evaluation of Request

LICENSE AMENDMENT REQUEST NO. #262, REVISION 0 ALTERNATIVE SOURCE TERM AND CONTROL ROOM EMERGENCY VENTILATION SYSTEM

Description of Proposed Changes

Crystal River Unit 3 (CR-3) proposes full implementation of an alternative source term (AST) and the following changes to Improved Technical Specifications (ITS) 3.7.12, "Control Room Emergency Ventilation System," ITS 5.6.2.12, "Ventilation Filter Testing Program (VFTP)," ITS 3.3.16, "Control Room Isolation - High Radiation," and ITS 3.7.18, "Control Complex Cooling System."

1. ITS 3.7.12, "Control Room Emergency Ventilation System (CREVS)"

   a. Applicability of the specification during movement of irradiated fuel assemblies will be deleted.

   b. Current Condition A will be renumbered as Condition B and changed from "One CREVS train inoperable" to "One CREVS train inoperable for reasons other than Condition A."

   c. Current Condition B will be renumbered as Condition A and changed from "CCHE inoperable due to a breach or breaches in excess of the limit AND less than or equal to 1 square foot in excess of the limit" to "CCHE inoperable due to a breach or breaches in excess of the limit." The Completion Time for proposed Condition A will be changed from "7 days" to "24 hours." In addition, the allowable breach margin limit specified in Bases Section 3.7.12 will be increased from 35.5 in^2 to 50 in^2.

   d. Condition C will be changed from "Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4" to "Required Action and associated Completion Time of Condition A or B not met."

   e. Current Conditions D and F will be deleted.

   f. Current Condition E will be renumbered as new Condition D and changed from "Two CREVS trains inoperable or breaches exist in the CCHE that exceed Condition B during MODE 1, 2, 3, or 4" to "Two CREVS trains inoperable for reasons other than Condition A."

   g. SR 3.7.12.4 will be deleted.

2. ITS 5.6.2.12, "Ventilation Filter Testing Program"

   a. The reference to the Auxiliary Building Ventilation Exhaust System (ABVES) in the first paragraph will be deleted.

b. The methyl iodide penetration acceptance criteria of test requirement c. will be changed from “less than 2.5%” to “less than 5.0%.”

c. Test requirements e, f, and g for the Auxiliary Building Ventilation Exhaust System will be deleted.

3. ITS 3.3.16, “Control Room Isolation - High Radiation”

a. ITS 3.3.16 and associated Bases Section B 3.3.16 will be deleted.

4. ITS 3.7.18, “Control Complex Cooling System”

a. Applicability of the specification during movement of irradiated fuel assemblies will be deleted.

b. Current Condition B will be deleted.

c. Current Condition C will be renumbered as new Condition B and changed from “Required Action and associated Completion Time of Condition A not met during Modes 1, 2, 3, or 4” to “Required Action and associated Completion Time of Condition A not met.”

5. Bases Sections B 3.7.12 and B 3.7.18 will be revised to reflect the above listed changes.

Explanations and evaluations of each of the above changes are provided in subsequent sections of this License Amendment Request (LAR).

Background

The CR-3 Control Room Emergency Ventilation System (CREVS), in conjunction with the Control Complex Habitability Envelope (CCHE), is designed to limit operator doses to less than those specified by General Design Criteria (GDC) 19 of 10 CFR 50 Appendix A during applicable design basis accidents. The CREVS consists of two independent trains each consisting of an emergency supply fan, an emergency filter bank, and a return fan. The CCHE, which is the space within the control complex served by CREVS, includes the control complex floor elevations from 108 feet through 180 feet and the stair enclosure from elevation 95 feet to 198 feet. The CCHE is comprised of walls, doors, a roof, floors, floor drains, penetration seals, and ventilation isolation dampers. Together, the CCHE and the CREVS form a zone isolation, filtered recirculated system that provides an enclosed environment from which the plant can be operated following an uncontrolled release of radioactivity or toxic gas.

Upon receipt of an Engineered Safeguards Actuation System (ESAS) signal on high reactor building pressure or a toxic gas signal (chlorine or sulfur dioxide), the CREVS and the CCHE will align to the normal recirculation mode. In this mode, dampers for the outside air intake and the exhaust to the controlled access area will automatically close, isolating the CCHE from outside air, and the system return damper will open, allowing air in the CCHE to be

recirculated. The return fan and the control complex normal duty filter and normal duty supply fan remain in operation in the normal recirculation mode.
Upon detection of high radiation by RM-A5 or a manual actuation signal initiated by the control room operators, the CREVS and the CCHE will align to the emergency recirculation mode. In this mode, the outside air intake and controlled access area exhaust dampers will automatically close, the return fan and control complex normal duty supply fan will trip, and their corresponding isolation dampers will close. Manual actions at the Heating, Ventilation and Air Conditioning (HVAC) panel in the main control room are required to restart a return fan and place an emergency fan and filter in operation.

In the event of a loss of offsite power, the outside air intake dampers, atmospheric relief discharge dampers and controlled access area exhaust dampers will fail closed, and the running normal duty supply fan and return fan will trip.

The current ITS requirements for the CREVS and the CCHE are based on NUREG-0737, Item III.D.3.4, "Control Room Habitability Requirements," and the results of revised dose calculations performed in 1997 and 1998 using the source terms from Technical Information Document (TID) 14844. Calculations were performed for a design basis Loss of Coolant Accident (LOCA) with and without offsite power available, a letdown line rupture accident with and without offsite power available, a fuel handling accident, and a steam generator tube rupture. The assumptions and inputs used in the revised calculations reflected modifications and improvements implemented during the 1997 design outage to minimize CCHE in-leakage, and the results of an integrated leak test of the CCHE boundary using tracer gas technology. The calculation assumptions and results were submitted to the NRC in July 1998 in a revised Control Room Habitability Report. The report was submitted as part of Revision 1 to License Amendment Request #222, Control Room Emergency Ventilation and Emergency Filters.

LAR #222, Revision 1 proposed the following changes to ITS 3.7.12 and ITS 5.6.2.12 based on the results of the revised dose calculations:

1. The calculations identified a design basis LOCA with offsite power available as the bounding radiological accident in Modes 1, 2, 3, and 4. With no loss of offsite power, the auxiliary building ventilation exhaust system and filters remain functional and are credited in the control room dose analysis. As a result, the auxiliary building ventilation filters were added to ITS 5.6.2.12, "Ventilation Filter Testing Program" (VFTP).

2. The standards for laboratory carbon adsorber testing were updated and test conditions were changed to better match the operating conditions inside the control complex following the postulated design basis radiological accident. In addition, the laboratory test acceptance criteria was changed to less than 2.5% methyl iodide penetration.

3. Lower acceptable values of CREVS flowrate and filter differential pressure were established that matched the values in the control room dose calculations.

4. Based on the margin between calculated control room doses and the dose limits of 10 CFR 50 Appendix A GDC 19, an allowable breach margin of 35.5 in^2 was calculated. ITS 3.7.12 was changed to allow breach margins in excess of this limit, up to an additional 144 in^2, provided that the total breach margin was restored to the 35.5 in^2 limit within seven days. The seven-day Completion Time provided sufficient time, following an unsuccessful CCHE leak rate test at power, to determine the cause of the excessive leakage, correct it, and perform a retest.

5. A new surveillance requirement was added for the performance of an integrated leakage test of the CCHE boundary on a twenty-four month frequency to ensure that CCHE integrity remained within design limits.

6. LAR #222 also revised Bases Section B 3.7.12 to reflect the above listed changes to ITS 3.7.12 and ITS 5.6.2.12.

LAR #222, Revision 1 was approved by the NRC and issued as License Amendment No. 185 to the CR-3 Technical Specifications in August 1999. Approval of LAR #222 was based, in part, on NRC acceptance of an FPC justification for continued operation (JCO) which included compensatory measures for the control room emergency ventilation system and the control complex habitability envelope pending resolution of unreviewed safety questions identified by the revised analyses. In addition, the Safety Evaluation for License Amendment No. 185 only approved the changes to ITS 3.7.12 until the start of operating cycle 13 to allow resolution of generic issues associated with the change.

Reason For Request

There are two reasons for this request. The first is to license CR-3 to the alternative source term rule in accordance with 10 CFR 50.67 and the guidance contained in Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors." The second is to revise CR-3 technical specifications related to control room habitability based on the results of revised dose calculations using an alternative source term (AST).

Revised public and control room dose calculations have been performed for each of the applicable accidents identified in Regulatory Guide 1.183 with the exception of the PWR locked rotor accident, which does not result in core damage at CR-3. In addition, a public dose calculation has been performed for a waste gas decay tank rupture. For the Regulatory Guide 1.183 accidents which result in core damage at CR-3, the calculations were run using RADTRAD Code Version 3.02 and an AST based on the guidance in NUREG-1465. The calculations were performed in accordance with Draft Guide (DG)-1081. The fuel handling accident calculation was subsequently modified due to differences between DG-1081 and Regulatory Guide 1.183. For the analyzed accidents that do not result in core damage, dose calculations and required conversions to total effective dose equivalent (TEDE) doses were performed in accordance with the inputs, assumptions and methodologies provided in the applicable Appendices to this submittal.

The results of these calculations indicate that the public doses at the exclusion area boundary and the low population zone will not exceed the limits specified in Regulatory Guide 1.183 and SRP 15.0.1. In addition, the revised control room dose calculations for the analyzed accidents indicate that a number of the requirements of ITS 3.7.12 and ITS 5.6.2.12 approved by License Amendment No. 185 can be relaxed while still ensuring that control room dose limits specified in 10 CFR 50.67 are not exceeded for CR-3 design basis radiological accidents.

Evaluation of Request

The following evaluations of the ITS changes proposed by this submittal are based primarily on the revised dose calculations discussed above. In order to assist the NRC staff in evaluating the proposed changes, summaries of the calculations for each of the analyzed accidents are provided in Appendix B, and detailed information on the calculations, including RADTRAD code Version 3.02 inputs where applicable, are provided in Appendices C through M.

ITS 3.7.12 Applicability During Movement of Irradiated Fuel Assemblies

The revised control room dose calculation performed for a fuel handling accident takes no credit for automatic or manual isolation of the control complex or the control complex emergency filters. The revised calculation indicates that with control complex ventilation in the normal operation mode the control room dose for a fuel handling accident will not exceed 5 REM TEDE.

Based on the results of the revised calculation, FPC proposes to limit the applicability of ITS 3.7.12 to Modes 1, 2, 3, and 4, delete current ITS 3.7.12 Conditions D and F, and delete the references to Modes 1, 2, 3, and 4 in current Conditions C and E.

ITS 3.7.18 Applicability During Movement of Irradiated Fuel Assemblies

The current requirement for the control complex cooling system to be operable during movement of irradiated fuel assemblies is based on the need to provide control complex cooling in the event of a CREVS actuation as the result of a fuel handling accident.

Based on the proposed change to limit ITS 3.7.12 applicability to Modes 1, 2, 3, and 4, FPC also proposes to limit the applicability of ITS 3.7.18 to Modes 1, 2, 3, and 4, delete current ITS 3.7.18 Condition B, and delete the reference to Modes 1, 2, 3, and 4 in current Condition C.

Allowable Breach Margin

The results of the revised calculations indicate that the dose resulting from a LOCA is the bounding dose for control room habitability. Based on the difference between the calculated LOCA control room dose using an AST and the 10 CFR 50.67 control room dose limit of 5 REM TEDE, a revised allowable CCHE breach margin limit of 50 in^2 has been calculated. This breach margin corresponds to the maximum amount of CCHE in-leakage, in addition to the in-leakage value assumed in the control room dose calculations (1000 cfm), that can exist without exceeding the 5 REM TEDE limit. CR-3 proposes to revise Bases Section B 3.7.12 to reflect this increased allowable breach margin limit.

The current ITS 3.7.12 allows a breach in excess of the 35.5 in^2 limit, up to an additional 144 in^2 for up to seven days. As discussed in LAR #222, Revision 1, the 144 in^2 value was based on providing increased flexibility in planning and scheduling work activities. The current seven day limit was based on the time required to restore breaches in excess of the allowable limit discovered during an integrated CCHE leakage test, and subsequently verify the breach margin to be within allowable limits through re-performance of the leakage test.

CR-3 proposes to revise current ITS 3.7.12 Condition B and the associated Required Action and Completion Time to reflect the guidance contained in ITS 3.7.10 of NUREG-1430, "Babcock and Wilcox Standard Technical Specifications." NUREG-1430 allows an unlimited size CCHE breach to exist for up to 24 hours. As discussed in Bases Section B 3.7.10 of NUREG-1430, the acceptability of allowing an unlimited breach for up to 24 hours is based on the low probability of a Design Basis Accident (DBA) during this time period and the existence of preplanned compensatory measures during the time that the CCHE is inoperable. At CR-3, the guidance provided in Compliance Procedure (CP)-147, "Control Complex Habitability Envelope (CCHE) Breaches," ensures this latter condition is satisfied. CP-147 includes instructions for personnel discovering a CCHE breach, planning for activities that will cause a breach in the CCHE (including requirements for preplanned compensatory actions), and for documenting and tracking breaches.

Elimination of the current 7 day Completion Time is contingent upon approval of the proposed change that eliminates the CCHE integrated leak test requirement.

Bases Section B 3.7.12 requires an intact CCHE in order for CREVS to be operable. Adding the words "for reasons other than Condition A" to proposed Conditions B and D is intended to ensure that the appropriate Condition is entered in the event that the CCHE becomes inoperable due to a breach or breaches in excess of the limit.

<u>SR 3.7.12.4 Integrated Leakage Testing</u>

The 1998 operator dose calculations for the limiting radiological accident assumed a maximum unfiltered CCHE in-leakage of 523 cubic feet per minute (cfm). This value was based on an actual in-leakage of 463 cfm measured by tracer gas testing, adjusted for the worst case differential pressure between the CCHE and the auxiliary building. The worst case differential pressure will occur when the auxiliary building exhaust fans remain in operation with the auxiliary building supply fans tripped due to a high radiation signal from the auxiliary building exhaust vent radiation monitor. The results of revised control room calculations using an AST indicate that CCHE in-leakage can be as high as 1000 cfm under all conditions without exceeding control room dose limits.

Based on the large margin between actual measured CCHE in-leakage and the 1000 cfm in-leakage assumed in the dose calculations, FPC proposes to eliminate the surveillance requirement for performance of tracer gas testing currently specified in ITS 3.7.12. The acceptability of this proposed change is based on the following:

1. The assumed 1000 cfm in-leakage value is approximately twice the maximum expected leak rate based on the results of the CCHE integrated leak tests performed in 1997 and 1999. This large margin would require significant undetected/uncorrected CCHE boundary degradation to occur in order to invalidate the results of the revised control room dose calculations.

2. The measured in-leakage for both the 1997 and 1999 CCHE integrated leakage tests were essentially the same when adjusted for actual control complex to auxiliary building differential pressure. The consistency of the 1997 and 1999 test results indicates that the CCHE boundary is not degrading over time, and that current CR-3 administrative controls and surveillance and maintenance procedures are sufficient to ensure CCHE integrity without periodic performance of an integrated leakage test.

3. Following approval of LAR #262, FPC will continue to apply current administrative controls for identifying, tracking, and closing CCHE breaches, and continue to perform required inspection and maintenance activities for CREVS dampers, CCHE doors, penetration seals, and floor drains to ensure that margin is maintained between actual in-leakage and the 1000 cfm value assumed in the dose calculations.

ITS 5.6.2.12 Testing Requirements for the Auxiliary Building Ventilation Exhaust System

The revised dose calculations do not take credit for the auxiliary building ventilation exhaust system filters. Therefore, CR-3 proposes to eliminate testing requirements e, f, and g from ITS 5.6.2.12, "Ventilation Filter Testing Program (VFTP)." Following approval of LAR #262, the auxiliary building ventilation exhaust system filters will remain in service and be tested based on the guidelines contained in Regulatory Guide 1.140, "Design, Testing and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."

Methyl Iodide Penetration Acceptance Test Criteria

The revised control room dose calculations assume a control room emergency filter efficiency of 90% for elemental and organic iodine chemical forms. Based on this assumption and the results of the revised control room dose calculations, CR-3 proposes to change the VFTP test acceptance criteria for methyl iodide penetration for the carbon adsorber from less than 2.5% to less than 5.0%. This acceptance criteria provides the factor of two safety margin specified in NRC Generic Letter 99-02, "Laboratory Testing of Nuclear Grade Activated Charcoal."

ITS 3.3.16 Control Room Isolation - High Radiation

The revised control room dose calculations do not take credit for automatic initiation of the CREVS emergency recirculation mode on high radiation. For the dose calculations that take credit for CREVS emergency recirculation, CCHE isolation is assumed to occur as a result of

either a loss of offsite power or an ESAS actuation on high reactor building pressure. Emergency filtered recirculation is assumed to be manually initiated by the control room operators at 30 minutes into the accident based on the guidance provided in the applicable emergency operating procedures (EOPs). Since isolation of the control room on high radiation is not part of the primary success path to mitigate a design basis accident, this LCO no longer meets Criterion 3 of 10 CFR 50.36 (c) (2) (ii).
Based on the above, CR-3 proposes to delete ITS 3.3.16, "Control Room Isolation - High Radiation." Recognizing the importance of defense in depth afforded by this feature, CR-3 will continue to test and maintain this feature following approval of LAR #262.

Impact on Control Complex Habitability for Non-radiological Accidents

FPC has evaluated the ITS changes proposed in this submittal for non-radiological accidents that have the ability to impact control room habitability. For toxic gas events, calculations using the current limiting toxic gas sources (3 tons of Cl_2 and 17 tons of SO_2 at the helper cooling towers) indicate that CREVS can remain in its normal alignment without exceeding control room toxicity limits within two minutes of nasal detection and physical discomfort. The results of these calculations will not be affected by the changes proposed in the submittal, since with CREVS in its normal alignment, control room toxic gas concentrations are insensitive to CCHE breach size/in-leakage. Two minutes following nasal detection and physical discomfort, the operators are assumed to be in respirators. From that point on, CCHE breach size/in-leakage is not a factor even if the CCHE is subsequently isolated by the operators or by a toxic gas signal. Thus, the consequences of a toxic gas release from any source will not be affected by the changes proposed in this submittal.

FPC plans to replace the chlorine gas currently used onsite with solid chlorine, which will eliminate the threat of a transportation accident. Although this effort is scheduled for completion prior to the end of the year, the following information is being provided in the event that the use of solid chlorine is not implemented or is delayed beyond the requested approval date for this submittal.

An analysis has also been performed for a chlorine transportation accident at the point of nearest approach to the CR-3 control complex. Since automatic isolation by the chlorine gas detector will occur for this accident, an in-leakage value of 1107 cfm following isolation was used to determine control room chlorine concentrations. This value corresponds to the 1000 cfm worst case in-leakage assumed in the dose calculations, plus the additional in-leakage due to a 50 in^2 breach (400 cfm), both adjusted for a normal auxiliary building negative pressure of 0.12 inches of water. The results of the calculation indicate that the 2 minute post detection chlorine concentration will not exceed toxicity limits. As discussed above, in-leakage after this time is not an issue, since the operators are assumed to be in respirators. Thus, the consequences of a toxic gas release due to a transportation accident will not be affected by the changes proposed in this submittal.

CR-3 has also determined that the changes proposed by LAR #262 will not impact control room habitability due to smoke resulting from a fire. This conclusion is based on the following considerations:

1. In the event of a fire in an area adjacent to the CCHE, such as the Turbine Building, it can be assumed that the CREVS will initially be aligned in its normal operating mode. In this mode smoke concentration in the control room, similar to toxic gas concentration, is insensitive to CCHE in-leakage/breach size.

2. If smoke is detected in the control complex ductwork, a main control room alarm will actuate. This alarm, or actual physical detection of smoke by the control room operators, will prompt them to don respiratory gear if required. With the operators in respiratory gear, the effect of smoke on control room habitability is no longer a concern.

3. CREVS has the capability of being aligned to an outside air purge mode to reduce the concentration of radiation, toxic gas or smoke in the CCHE (assuming the outside air concentration is less than that in the CCHE). In the purge mode, any smoke in-leakage will be a small fraction of the purge flow, allowing smoke concentration in the CCHE to be rapidly reduced following purge initiation.
4. Due to the relatively large size of the CR-3 control complex (365,000 ft^3), the worst case in-leakage rate of 1107 cfm discussed above would result in only an 18% volume change per hour in the unlikely event that the control complex was isolated at the time of the fire.

Other Source Term Effects

In addition to design basis radiological accidents discussed in Appendix B of this submittal, an accident radiological source term is also used to determine: 1) Environmental Qualification (EQ) program applicability and integrated doses; 2) the dose to operators performing accident mitigation missions outside the control room; 3) the dose to personnel in the onsite Technical Support Center (TSC); and 4) the design and range requirements for post-accident radiation monitoring instrumentation and the post accident sampling system (PASS).

The post-accident doses used at CR-3 for EQ are based on the TID-14844 source term as required by NUREG-0737. The EQ doses have not been reanalyzed using an AST. The continued use of EQ doses based on the NUREG-0737 source term is considered acceptable based on the following:

1. The NRC has initiated a Generic Safety Issue to address the consequences of increased Cesium in the NUREG 1465 source term vs. the TID-14844 source term. This issue applies to all operating plants and not just those making an AST submittal. In Regulatory Guide 1.183, the NRC has specified that a licensee making an AST submittal can continue to use the TID-14844 source term for EQ pending the resolution of the Generic Safety Issue.

2. Based on previous technical analyses, the in-containment doses are slightly higher using the TID-14844 source term. For equipment exposed to recirculated containment sump water outside the containment, the dose rates and integrated doses during the first few weeks are approximately equal for the two source terms. Although using an AST

results in higher longer term integrated doses (beyond a few weeks) for equipment exposed to recirculated sump water, the doses are only 10-20% higher for a 6 month integrated dose.

3. The small increase in long term doses is compensated by the significant conservatism incorporated into EQ dose assessments and program practices. These conservatisms include: application of the worst dose in a zone to most components in the zone, assumption that all piping that could contain post-accident activity does contain such activity, and neglecting the shielding effects of intervening equipment. In addition, significant margin typically exists between a component's calculated dose and the component's qualification dose. For most components, there is also additional margin between the qualification dose and the dose that would cause component failure.

Based on the above, CR-3 has concluded that the current EQ doses based on TID-14844 source terms provide adequate justification for the continued operability of EQ components.

Current mission dose calculations are based on the TID-14844 source term as required by NUREG-0737. The mission doses have not been re-analyzed using an AST. The current mission doses are conservative, as all mission doses were calculated for time periods typically within the first day of the event (the only exception is hydrogen purge missions, which occur during days 10 through 14 after the event). During the first day, the TID-14844 dose rates are higher than AST dose rates due to the higher levels of iodine in the sump and higher containment shine and plume dose rates. For the hydrogen purge mission dose, the dose rates after 1-2 weeks are comparable for the two source terms.

Unlike the control room, a reanalysis of TSC habitability using an AST is not required. The control room doses had to be reanalyzed since changes were made to control room dose assessment assumptions, i.e., increased in-leakage rate and decreased filter efficiency. There are no changes being made to the TSC design requirements. Using an AST, the integrated releases from the containment decrease compared to the TID-14844 LOCA dose assessment. Therefore, the TSC dose calculation performed for the TID-14844 LOCA analysis bounds the TSC dose using an AST assessment.

In regard to the design and range requirements for the post-accident radiation monitoring instrumentation and the PASS system, no reassessment based on an AST source term is required. These instruments are designed for the worst case DBA concentrations, which occur during the first hour of a DBA LOCA. As noted above, during these short-term time periods, the TID-14844 source term is conservative compared to the AST.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT B

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

No Significant Hazards Consideration Determination

No Significant Hazards Consideration Determination

This license amendment proposes full implementation of an alternative source term (AST) and the following changes to Improved Technical Specifications (ITS) 3.7.12, "Control Room Emergency Ventilation System (CREVS)," ITS 5.6.2.12, "Ventilation Filter Testing Program (VFTP)," ITS 3.3.16, "Control Room Isolation - High Radiation," and ITS 3.7.18, "Control Complex Cooling."

1. ITS 3.7.12, "Control Room Emergency Ventilation System (CREVS)"

   a. Applicability of the specification during movement of irradiated fuel assemblies will be deleted.

   b. Current Condition A will be renumbered as Condition B and changed from "One CREVS train inoperable" to "One CREVS train inoperable for reasons other than Condition A."

   c. Current Condition B will be renumbered as Condition A and changed from "CCHE inoperable due to a breach or breaches in excess of the limit AND less than or equal to 1 square foot in excess of the limit" to "CCHE inoperable due to a breach or breaches in excess of the limit." The Completion Time for proposed Condition A will be changed from "7 days" to "24 hours." In addition, the allowable breach margin limit specified in Bases Section 3.7.12 will be increased from 35.5 in^2 to 50 in^2.

   d. Condition C will be changed from "Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4" to "Required Action and associated Completion Time of Condition A or B not met."

   e. Current Conditions D and F will be deleted.

   f. Current Condition E will be renumbered as new Condition D and changed from "Two CREVS trains inoperable or breaches exist in the CCHE that exceed Condition B during MODE 1, 2, 3, or 4" to "Two CREVS trains inoperable for reasons other than Condition A."

   g. SR 3.7.12.4 will be deleted.

2. ITS 5.6.2.12, "Ventilation Filter Testing Program"

   a. The reference to the Auxiliary Building Ventilation Exhaust System (ABVES) in the first paragraph will be deleted.

   b. The methyl iodide penetration acceptance criteria of test requirement c. will be changed from "less than 2.5%" to "less than 5.0%."

c. Test requirements e, f, and g for the Auxiliary Building Ventilation Exhaust System will be deleted.

3. ITS 3.3.16, "Control Room Isolation – High Radiation"

a. ITS 3.3.16 and associated Bases Section B 3.3.16 will be deleted.

4. ITS 3.7.18, "Control Complex Cooling System"

a. Applicability of the specification during movement of irradiated fuel assemblies will be deleted.

b. Current Condition B will be deleted.

c. Current Condition C will be renumbered as new Condition B and changed from "Required Action and associated Completion Time of Condition A not met during Modes 1, 2, 3, or 4" to "Required Action and associated Completion Time of Condition A not met."

5. Bases Sections B 3.7.12 and B 3.7.18 will be revised to reflect the above listed changes.

Florida Power Corporation (FPC) has reviewed the requirements of 10 CFR 50.92(c) as they relate to the full implementation of an alternative source term and the proposed revisions to ITS 3.7.12, ITS 3.3.16, ITS 3.7.18, and ITS 5.6.2.12.

The proposed changes do not involve a significant hazards consideration. In support of this conclusion, the following analysis is provided:

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

The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously analyzed. The CR-3 Control Room Emergency Ventilation System (CREVS) and the Control Complex Habitability Envelope (CCHE) only function following the initiation of a design basis radiological accident. Therefore, the changes to the CREVS specification, the CREVS filter testing criteria, and the deletion of the requirement for control room isolation on high radiation proposed by this amendment will not increase the probability of any previously analyzed accident. The Control Complex Cooling System and Auxiliary Building Ventilation System are not initiators of any design basis accident. Therefore, the changes to the Control Complex Cooling System specification and the changes to the testing guidelines for the Auxiliary Building Ventilation System exhaust filters proposed by this amendment will not increase the probability of occurrence of any previously analyzed accident.

Revised dose calculations, which take into account the changes proposed by this amendment and the use of an AST, have been performed for the CR-3 design basis radiological accidents. The results of these revised calculations indicate that public and control room doses will not exceed the limits specified by 10 CFR 50.67 and Regulatory Guide 1.183. In addition, a comparison between results of the current public dose calculations and the revised public dose calculations indicate that the proposed changes will not result in a significant increase in predicted dose consequences for any of the analyzed accidents. Therefore, the proposed changes do not involve a significant increase in the consequences of any previously analyzed accident.

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

Limiting the requirements for the Control Complex Cooling System and CREVS to be operable to Modes 1, 2, 3, and 4, and changing the Auxiliary Building Ventilation System exhaust filter testing guidelines do not result in changes to the design or operation of these systems. Although the other changes proposed by this amendment could affect the operation of the CREVS and CCHE following a design basis radiological accident, none of these changes can initiate a new or different kind of accident since they are only related to system capabilities that provide protection from accidents that have already occurred. Therefore the proposed changes do not create the possibility of a new or different kind of accident from those previously analyzed

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

The proposed changes to the control complex cooling specification do not affect the ability of the system to maintain control complex temperatures within safety-related equipment operability limits when the equipment is required. The results of revised control room dose calculations indicate that the proposed changes to the CREVS specification, the CREVS filter testing criteria, and removal of the CREVS actuation signal on high radiation will not affect the ability of the CREVS and CCHE to maintain control room doses less than required limits during design basis radiological accidents. The revised dose calculations also indicate that the Auxiliary Building Ventilation System exhaust filters are not required in order to maintain public or control room doses less than required limits; therefore the proposed changes to the testing requirements for these filters cannot adversely affect public or control room doses.

Based on the above, the revised technical specifications meet the same intent as the currently approved specifications. Therefore, the proposed changes do not involve a significant reduction in the margin of safety.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT C

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Environmental Impact Evaluation

Environmental Impact Evaluation

10 CFR 51.22(c)(9) provides criteria for and identification of licensing and regulatory actions eligible for categorical exclusion from performing an environmental assessment. A proposed amendment to an operating license for a facility requires no environmental assessment if operation of the facility in accordance with the proposed amendment 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, or (3) result in a significant increase in individual or cumulative occupational radiation exposure.

FPC has reviewed this license amendment and has determined that it meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(c), no environmental impact statement or environmental assessment needs to be prepared in connection with the issuance of the proposed license amendment. The basis for this determination is as follows:

1. The proposed license amendment does not involve a significant hazards consideration as described previously in the evaluation.

2. As discussed in the no significant hazards evaluation, the changes proposed by this amendment do not result in a significant change or significant increase in the public dose consequences for CR-3 design basis radiological accidents. Approval of an alternative source term for CR-3 establishes a new licensing and design basis for assessment of accident consequences. It does not change actual accident sequences or progressions; only the regulatory assumptions regarding accidents will be affected. Subsequent changes to the design or operation of CR-3 will be evaluated against this new design basis in accordance with 10 CFR 50.59 to assess increases in consequences, including post-accident environmental releases. The 10 CFR 50.59 criteria are sufficiently stringent that any potential change in plant design that could have an adverse environmental impact in all likelihood could not be made by FPC without prior NRC review and approval. Every plant change that requires NRC review and approval under 10 CFR 50.59 requires a license amendment and, therefore, the preparation of an environmental assessment to determine whether the proposed change involves any significant environmental impact. Thus adoption of an alternative source term, by itself, will not result in plant changes that involve any significant increase in environmental impacts.

   The proposed changes affect the Control Room Emergency Ventilation System (CREVS), the Control Complex Habitability Envelope (CCHE), the Control Complex Cooling System, and the Auxiliary Building Ventilation Exhaust System. The CREVS, CCHE and Control Complex Cooling System do not interface with any plant system that is involved in the generation or processing of radioactive fluids. Although The Auxiliary Building Ventilation Exhaust System interfaces with the Waste Gas System, the proposed changes to this system are limited to filter testing guidelines. Therefore the proposed amendment will not result in a significant change in the types or increase in the amounts of any effluents that may be released off-site.

3. As discussed in the no significant hazards evaluation, the changes proposed by this amendment do not result in a significant increase in control room operator doses during design basis radiological accidents. In addition, the proposed changes do not require operator or other actions that could increase occupational radiation exposure. Therefore the proposed amendment will not result in a significant increase in individual or cumulative occupational radiation exposure.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT D

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Proposed Revised Improved Technical Specifications and Bases
Change Pages

Strikeout / Shadow Format

~~Strikeout Text~~	Indicates deleted text
Shadowed text	Indicates added text

~~3.3 INSTRUMENTATION~~

~~3.3.16 Control Room Isolation-High Radiation~~

~~LCO 3.3.16 One channel of Control Room Isolation-High Radiation shall be OPERABLE.~~

~~APPLICABILITY: MODES 1, 2, 3, 4,~~
~~During movement of irradiated fuel assemblies.~~

~~ACTIONS~~

~~CONDITION~~	~~REQUIRED ACTION~~	~~COMPLETION TIME~~
~~A. One channel inoperable in MODE 1, 2, 3, or 4.~~	~~A.1 Place an OPERABLE Control Room Emergency Ventilation System (CREVS) train in the emergency recirculation mode.~~	~~1 hour~~
~~B. Required Action and associated Completion Time of Condition A not met.~~	~~B.1 Be in MODE 3.~~	~~6 hours~~
	~~AND~~	
	~~B.2 Be in MODE 5.~~	~~36 hours~~
~~C. One channel inoperable during movement of irradiated fuel assemblies.~~	~~C.1 Place an OPERABLE CREVS train in the emergency recirculation mode.~~	~~Immediately~~
	~~OR~~	
	~~C.2 Suspend movement of irradiated fuel assemblies.~~	~~Immediately~~

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.16.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.16.2	-------------------NOTE------------------- When the Control Room Isolation-High Radiation instrumentation is placed in an inoperable status solely for performance of this Surveillance, entry into associated Conditions and Required Actions may be delayed for up to 3 hours. ---	
	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.16.3	Perform CHANNEL CALIBRATION with setpoint Allowable Value less than or equal to two times background.	18 months

B 3.3 INSTRUMENTATION

B 3.3.16 Control Room Isolation-High Radiation

BASES

BACKGROUND

The principal function of the Control Room Isolation-High Radiation is to provide an enclosed environment from which the plant can be operated following an uncontrolled release of radioactivity. The high radiation isolation function provides assurance that an isolation signal will be generated when conditions dictate. The radiation monitor is located in the control complex return duct. The control room isolation signal is provided by a single channel containing an iodine monitor with a scintillation detector and a gaseous monitor with a Geiger-Mueller detector. The iodine channel includes a particulate prefilter with a charcoal cartridge. If a radioactivity concentration above normal background level is detected on the iodine channel or if power is lost, the monitor will initiate a shutdown of the normal duty supply fans and normal duty return fans and will place the ventilation dampers in their recirculation mode.

Although, not included within the scope of Technical Specifications, the Control Complex is also isolated on an Engineered Safeguards Actuation System (ESAS) RB Pressure-High signal as well as elevated toxic gas levels.

APPLICABLE SAFETY ANALYSES

Following a LOCA, the high radiation function is credited with performing the initial Control Complex isolation function and beginning the emergency recirculation mode of operation. This isolation is necessary to limit doses to the Control Room operator to within 10 CFR 50, Appendix A, General Design Criteria (GDC) 19 limits, (Ref. 1). The limiting GDC 19 dose criteria is the 30 Rem limit to the thyroid. The high radiation isolation would also limits dose rates to the Control Room Operator in the event of a Fuel Handling Accident.

The Control Room Isolation-High Radiation satisfies Criterion 3 of the NRC Policy Statement.

(continued)

~~BASES (continued)~~

~~LCO~~ ~~One channel of Control Room Isolation-High Radiation is required to be OPERABLE to ensure 10 CFR 50, Appendix A, GDC 19 operator and 10 CFR 100 offsite dose limits are met for design basis transients and accidents. Only the iodine channel is addressed by this LCO. Operability of the instrumentation includes proper operation of the sample pump.~~

~~APPLICABILITY~~ ~~The capability to automatically isolate the Control Room on high radiation shall be OPERABLE whenever an accidental release of radioactivity is postulated. This includes MODES 1, 2, 3, 4, and during movement of irradiated fuel assemblies. If a radioactive release were to occur during any of these conditions, the Control Room would have to remain habitable to ensure reactor shutdown and core cooling is maintained.~~

~~ACTIONS~~ ~~A.1~~

~~Condition A applies to a failure of the Control Room Isolation-High Radiation Function in MODE 1, 2, 3, or 4.~~

~~With the Control Room Isolation-High Radiation instrumentation inoperable, the Control Room Emergency Ventilation System (CREVS) must be placed in a system configuration that minimizes the impact of the inoperable monitor. To ensure that the ventilation system has been placed in a state equivalent to that which occurs after the high radiation isolation has occurred, an OPERABLE train of the CREVS is placed in the emergency recirculation mode of operation. The 1 hour Completion Time is a sufficient amount of time in which to complete the Required Action.~~

~~B.1 and B.2~~

~~If the CREVS cannot be placed into the emergency recirculation mode or the monitor restored to OPERABLE status within 1 hour while in MODE 1, 2, 3, or 4, actions must be taken to minimize the plant's vulnerability to an accident that would lead to radiation releases. The plant~~

~~(continued)~~

BASES

ACTIONS

B.1 and B.2 (continued)

must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. These ACTIONS place the reactor and RCS in a low energy state reducing the stresses present in the RCS and allowing more time for operator action if habitation of the control room is precluded. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

C.1 and C.2

Required Action C.1 is the same as discussed above for Condition A, except for Completion Time. If the CREVS cannot be placed into the emergency recirculation mode while moving irradiated fuel assemblies, then Required Action C.2 specifies actions be taken to suspend activities that could lead to release of radioactivity following a fuel handling accident.

Required Action C.2 places the plant in a safe and stable configuration in which it is less likely to experience an accident that could result in a release of radioactivity. This condition must be maintained until the automatic isolation capability is returned to OPERABLE status or when manual action places one train of CREVS into the emergency recirculation mode. The immediate Completion Time is consistent with the urgency of the situation and assumes the high radiation function is the only automatic Control Room Isolation Function capable of responding to radiation release due to a fuel handling accident. The Completion Time does not preclude placing any fuel assembly into a safe position before ceasing any such movement.

Note that in certain circumstances, such as movement of irradiated fuel assemblies in the Spent Fuel Pool during power operation, Condition A, B and C may apply simultaneously in the event of a channel failure.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.16.1

This SR is the performance of a CHANNEL CHECK for the Control Room Isolation-High Radiation actuation instrumentation once every 12 hours. The CHANNEL CHECK is a comparison of the parameter indicated on the radiation monitoring instrumentation channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. Internal check sources may also be used to satisfy the CHANNEL CHECK requirement.

Acceptance criteria are determined by the plant staff and are presented in the Surveillance Procedures. The criteria are based on a combination of the channel instrument uncertainties. The 12 hour Frequency, about once every shift, is based on operating experience that demonstrates channel failure is an unlikely event. Additionally, control room alarms and annunciators are provided to alert the operator to various "trouble" conditions associated with the instrument.

SR 3.3.16.2

This SR is the performance of a CHANNEL FUNCTIONAL TEST once every 92 days to ensure that the channel is capable of performing its intended function. This test verifies the capability of the instrumentation to provide the automatic Control Room Isolation. The 92 day Frequency is based on the recommendations of NUREG-1366 (Ref. 2).

A Note has been added to this SR indicating the Required Actions of the Specification may be suspended for up to 3 hours while the channel is bypassed for surveillance testing. The Note allows channel bypass for testing without taking the Actions of the Specification although during this time period the instrumentation cannot actuate a control room isolation. The length of this allowance was developed based on a historic review of the average time required to historically perform this SR.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.16.3

This SR requires the performance of a CHANNEL CALIBRATION with a setpoint Allowable Value of less than or equal to two times the background count rate.

CHANNEL CALIBRATION is a complete check of the instrument string including and the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations to ensure that the channel remains OPERABLE between successive tests.

The 18 month Frequency is based on engineering judgment and industry-accepted practice.

REFERENCES

1. 10 CFR 50, GDC 19.

2. NUREG-1366, December 1992.

(continued)

3.7 PLANT SYSTEMS

3.7.12 Control Room Emergency Ventilation System (CREVS)

LCO 3.7.12 Two CREVS trains and the Control Complex Habitability Envelope (CCHE) shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.~~,~~
~~During movement of irradiated fuel assemblies.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B~~A~~. One CREVS train inoperable **for reasons other than Condition A.**	**B**~~A~~.1 Restore CREVS train to OPERABLE status.	7 days
A~~B~~. CCHE inoperable due to a breach or breaches in excess of the limit**.** ~~AND~~ ~~Less than or equal to 1 square foot in excess of the limit.~~	**A**~~B~~.1 Restore CCHE boundary.	~~7 days~~ **24 hours**
C. Required Action and associated Completion Time of Condition A or B not met**.** ~~in MODE 1, 2, 3 or 4.~~	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours

~~NOTE~~

~~NOTE~~

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME	
~~D. Required Action and associated Completion Time of Condition A or B not met during movement of irradiated fuel assemblies.~~	~~------------NOTE------------~~ ~~Place in emergency recirculation mode if automatic transfer to emergency recirculation mode is inoperable.~~ ----------------------------		NOTE NOTE
	~~D.1 Place OPERABLE CREVS train in emergency recirculation mode.~~	~~Immediately~~	NOTE
	~~OR~~		
	~~D.2 Suspend movement of Irradiat`ed fuel assemblies.~~	~~Immediately~~	NOTE
DE. Two CREVS trains inoperable **for reasons other than Condition A.** ~~or breaches exist in the CCHE that exceed Condition B during MODE 1, 2, 3, or 4.~~	DE.1 Enter LCO 3.0.3.	Immediately	NOTE
~~F. Two CREVS trains inoperable or breaches exist in the CCHE that exceed Condition B during movement of irradiated fuel assemblies.~~	~~F.1 Suspend movement of irradiated fuel assemblies.~~	~~Immediately~~	NOTE

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.12.1	Operate each CREVS train for ≥ 15 minutes.	31 days
SR 3.7.12.2	Perform required CREVS filter testing in accordance with the Ventilation Filter Testing Program.	In accordance with the Ventilation Filter Testing Program
SR 3.7.12.3	Verify each CREVS train actuates to the emergency recirculation mode on an actual or simulated actuation signal.	24 months
~~SR 3.7.12.4~~	~~Verify CCHE boundary leakage does not exceed allowable limits as measured by performance of an integrated leakage test.~~	~~24 months~~ ~~NOTE~~

3.7.18 PLANT SYSTEMS

3.7.18 Control Complex Cooling System

LCO 3.7.18 Two Control Complex Cooling trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.,
~~During movement of irradiated fuel assemblies.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more trains inoperable. AND At least 100% of the cooling capability of a single OPERABLE Control Complex Cooling train available.	A.1 Ensure adequate cooling capability from the Control Complex Cooling system in operation. AND A.2 Restore Control Complex Cooling trains(s) to OPERABLE status.	Immediately 7 days
~~B. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies.~~	~~B.1 Place available Control Complex Cooling System in operation.~~ ~~OR~~ ~~B.2 Suspend movement of irradiated fuel assemblies.~~	~~Immediately~~ ~~Immediately~~

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
BC. Required Action and associated Completion Time of Condition A not met. ~~during MODES 1, 2, 3, or 4.~~	BC.1	Be in Mode 3.	6 hours
	AND		
	BC.2	Be in Mode 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.18.1	Verify each chilled water pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.7.18.2	Verify the redundant capability of the Control Complex Cooling System to remove the assumed heat load.	24 months

B 3.7 PLANT SYSTEMS

B 3.7.12 Control Room Emergency Ventilation System (CREVS)

BASES

BACKGROUND

The principal function of the Control Room Emergency Ventilation System (CREVS) is to provide an enclosed environment from which the plant can be operated following an uncontrolled release of radioactivity or toxic gas.

The CREVS consists of two trains with much of the non-safety related equipment common to both trains and with two independent, redundant components supplied for major items of safety related equipment (Ref. 1). The major equipment consists of the normal duty filter banks, the emergency filters, the normal duty and emergency duty supply fans, and the return fans. The normal duty filters consist of one bank of glass fiber roughing filters. The emergency filters consist of a roughing filter similar to the normal filters, high efficiency particulate air (HEPA) filters, and activated charcoal adsorbers for removal of gaseous activity (principally iodine). The rest of the system, consisting of supply and return ductwork, dampers, and instrumentation, is not designed with redundant components. However, redundant dampers are provided for isolation of the ventilation system from the surrounding environment.

~~The ventilation exhaust duct is continuously tested by radiation monitor RM-A5, which has a range of 10^1 to 10^6 counts per minute. The monitor is set to alarm and initiate the emergency recirculation mode of operation when the radiation level reaches approximately two times the background count rate.~~

The Control Complex Habitability Envelope (CCHE) is the space within the Control Complex served by CREVS. This includes Control Complex floor elevations from 108 through 180 feet and the stair enclosure from elevation 95 to 198 feet. The elements which compromise the CCHE are walls, doors, a roof, floors, floor drains, penetration seals, and ventilation isolation dampers. Together the CCHE and CREVS provide an enclosed environment from which the plant can be operated following an uncontrolled release of radioactivity or toxic gas.

CREVS has a normal operation mode and recirculation modes. During normal operation, the system provides filtered, conditioned air to the control complex, including the controlled access area (CA) on the 95 foot elevation. When switched to the recirculation mode, isolation dampers close isolating the discharge to the controlled access area and isolating the outside air intake. In this mode the system recirculates filtered air through the CCHE.

(continued)

BASES

BACKGROUND (continued)

~~Design calculations determine the maximum allowed leakage into the CCHE below which control room operator dose and toxic gas concentrations remain within approved limits.~~

~~Integrated leak tests of the CCHE determine actual leakage. The difference between allowed and actual leakage is converted to an allowance for breach areas (in square inches) that may exist in the CCHE to accommodate normal operating and maintenance activities. Breaches in excess of the calculated area renders the CCHE incapable of performing its function, and therefore inoperable. Routine opening and closing of the CCHE doors for personnel passage and the movement of equipment is accounted for in the design calculations. A continuous leakage of 10 cubic feet per minute is assumed to account for this. Holding or blocking doors open for short periods of time does not constitute a breach of the CCHE as long as the doors could be closed upon notification of a radiological or toxic gas release.~~ ~~NOTE~~

~~CREVS has a normal operation mode and recirculation modes. During normal operation, the system provides filtered, conditioned air to the control complex, including the controlled access area (CA) on the 95 foot elevation. When switched to the recirculation mode, isolation dampers close isolating the discharge to the controlled access area and isolating the outside air intake. In this mode the system recirculates filtered air through the CCHE.~~

The control complex normal duty ventilation system is operated from the control room and runs continuously. During normal operation, the outside air intake damper is partially open, the atmospheric relief discharge damper is closed, the discharge to the CA is open, and the system return damper is throttled. This configuration allows a controlled amount of outside air to be admitted to the control complex. The design temperature maintained by the system is 75°F at a relative humidity of 50%.

(continued)

BASES

BACKGROUND (continued)

Three signals will cause the system to automatically switch to the recirculation modes of operation.

1. Engineered Safeguards Actuation System (ESAS) signal (high reactor building pressure).

2. High radiation signal from the return duct radiation monitor RM-A5.

3. Toxic gas signal (chlorine or sulfur dioxide)

The recirculation modes isolate the CCHE from outside air to ensure a habitable environment for the safe shutdown of the plant. In these modes of operation, the controlled access area is isolated from the CCHE.

Upon detection of ESAS or toxic gas signals, the system switches to the normal recirculation mode. In this mode, dampers for the outside air intake and the exhaust to the CA will automatically close, isolating the CCHE from outside air exchange, and the system return damper will open thus allowing air in the CCHE to be recirculated. Additionally, the CA fume hood exhaust fan, CA fume hood auxiliary supply fan, and CA exhaust fan are de-energized and their corresponding isolation dampers close. The return fan, normal filters, normal fan, and the cooling (or heating) coils remain in operation in a recirculating mode.

Upon detection of high radiation by RM-A5 the system switches to the emergency recirculation mode. In this mode, the dampers that isolate the CCHE from the surroundings will automatically close. The CA fume hood exhaust fan, CA fume hood auxiliary supply fan, CA exhaust fan, normal supply fan, and return fan are tripped and their corresponding isolation dampers close. Manual action is required to restart the return fan and place the emergency fans and filters in operation. The cooling (or heating) coils remain in operation.

(continued)

BASES

APPLICABLE SAFETY ANALYSIS

During emergency operations the design basis of the CREVS and the CCHE is to provide radiation protection to the control room operators. The limiting accident which may threaten the habitability of the control room (i.e., accidents resulting in release of airborne radioactivity) is the postulated ~~maximum hypothetical accident (MHA)~~ **large break LOCA**, which is assumed to occur while in MODE 1. The consequences of this event in MODE 1 envelope the results for MODES 2, 3, and 4, and results in the limiting radiological source term for the control room habitability evaluation (Ref. 2). ~~A fuel handling accident (FHA) may also result in a challenge to control room habitability, and may occur in any MODE. However, due to the severity of the MHA and the MODES in which the postulated MHA can occur, the FHA is the limiting radiological accident in MODES 5 and 6 only.~~ The CREVS and the CCHE ensures that the control room will remain habitable following all postulated design basis events, maintaining exposures to control room operators within the limits of GDC 19 of 10 CFR 50 Appendix A (Ref. 3).

The CREVS is not in the primary success path for any accident analysis. However, the Control Room Emergency Ventilation System meets Criterion 3 of the NRC Policy Statement since long term control room habitability is essential to mitigation of accidents resulting in atmospheric fission product release.

LCO

Two trains of the control room emergency ventilation system are required to be OPERABLE to ensure that at least one is available assuming a single failure disabling the other train. Failure to meet the LCO could result in the control room becoming uninhabitable in the unlikely event of an accident.

The required CREVS trains must be independent to the extent allowed by the design which provides redundant components for the major equipment as discussed in the BACKGROUND section of this bases. OPERABILITY of the CREVS requires the following as a minimum:

a. A Control Complex Emergency Duty Supply Fan is OPERABLE;

(continued)

BASES

LCO (continued)

b. A Control Complex Return Fan is OPERABLE;

c. HEPA filter and charcoal adsorber are not excessively restricting flow, and are capable of performing their filtration functions;

d. Ductwork and dampers are OPERABLE, and air circulation can be maintained; and

e. The CCHE is intact as discussed below.

The CCHE boundary including the integrity of the doors, walls, roof, floors, floor drains, penetration seals, and ventilation isolation dampers must be maintained within the assumptions of the design calculations. Breaches in the CCHE must be controlled to provide assurance that the CCHE remains capable of performing its function.

If the total open breach area in the CCHE exceeds the limit determined in approved design analyses (Reference 2), currently ~~35.5~~ **50** square inches, the CCHE is rendered inoperable and entry into LCO Condition **A**~~B~~ is required. ~~The upper bound of the breach area for the LCO is the sum of the breach area limit plus one square foot (144 square inches).~~ If the Required Action of LCO Condition **A**~~B~~ is not met within the respective Completion Time, then Condition C ~~or D, as applicable,~~ must be entered. ~~NOTE~~

Routine opening and closing of CCHE doors for personnel passage and movement of equipment is accounted for in the design calculations. A continuous leakage of 10 cubic feet per minute is assumed to account for this. Holding or blocking doors open for short periods of time does not constitute a breach of the CCHE as long as the doors could be closed upon notification of a radiological or toxic gas release.

The ability to maintain temperature in the Control Complex is addressed in Technical Specification 3.7.18.

APPLICABILITY

In MODES 1, 2, 3, and 4, the CREVS must be OPERABLE to ensure that the CCHE will remain habitable during and following a postulated accident. ~~During movement of irradiated fuel assemblies, the CREVS must be OPERABLE to cope with a release due to a fuel handling accident.~~

(continued)

BASES

ACTIONS

B~~A~~.1

With one CREVS train inoperable, action must be taken to restore the train to OPERABLE status within 7 days. In this Condition, the remaining OPERABLE CREVS train is adequate to perform the radiation protection function for control room personnel. However, the overall reliability is reduced because a failure in the OPERABLE CREVS train could result in loss of CREVS function. The 7 day Completion Time is based on the low probability of an accident occurring during this time period, and ability of the remaining train to provide the required capability.

A~~B~~.1

With the CCHE inoperable due to breaches in excess of approved design calculations, ~~but within the criteria stated,~~ operation may continue for ~~7 days~~ **24 hours**. Restoration of excess breaches is not limited to returning the opening to its pre-breached condition, but can also be accomplished using temporary sealing measures as described in plant procedures and/or work instructions.

Condition **A**~~B~~ will permit opening breaches in the CCHE to support maintenance and modification to the habitability envelope boundary. It also will establish an allowance for the discovery of breaches during routine operation, ~~NOTE~~ and provide the opportunity to repair the breach in a time frame consistent with the low safety significance of small breaches in the CCHE. **The 24 hour completion time is reasonable based on the low probability of a significant release occurring during this time and the use of compensatory measures to protect the control room operators from potential hazards such as radiation, toxic chemicals and smoke.**

~~Condition B also provides an opportunity, following an unsuccessful CCHE leak rate test, to determine the cause for excessive leakage, correct it, and perform a re-test. Excessive leakage measured during an integrated leak test can be converted to an equivalent breach size in accordance with approved design calculations. If the calculated breach size is less than or equal to 179.5 square inches then operation may continue while locating the source of the leakage and performing a re-test.~~

(continued)

BASES

ACTIONS (continued)

C.1 and C.2 NOTE

In MODE 1, 2, 3, or 4, if the inoperable CREVS train cannot be restored to OPERABLE status, or breaches in the CCHE which exceed allowable limits cannot be closed within the associated Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. NOTE

~~D.1 and D.2~~ NOTE

~~During movement of irradiated fuel assemblies, if the inoperable CREVS train cannot be restored to OPERABLE status, or breaches in the CCHE which exceed allowable limits, cannot be closed within the associated Completion Time, the OPERABLE CREVS train must immediately be placed in the emergency recirculation mode. This action ensures that the remaining train is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure will be readily detected.~~ NOTE

~~An alternative to Required Action D.1 is to immediately suspend activities that could release radioactivity and require isolation of the CCHE. This places the plant in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.~~ NOTE

~~Required Action D.1 and D.2 are modified by a Note indicating to place the system in the emergency mode if automatic transfer to emergency mode is inoperable.~~

~~E.1~~ **D.1** NOTE

If both CREVS trains are inoperable ~~or breaches in the CCHE exceed the limits of Condition B in MODE 1, 2, 3, or 4,~~ the CREVS may not be capable of performing the intended function and the plant is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

(continued)

BASES

ACTIONS (continued)

~~F.1~~ NOTE

~~During movement of irradiated fuel assemblies, when two CREVS trains are inoperable or breaches in the CCHE exceed the limits of Condition B, action must be taken immediately to suspend activities that could release radioactivity that could enter the CCHE. This places the plant in a condition that minimizes the accident risk. This does not preclude the movement of fuel to a safe position.~~ NOTE

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

Standby systems should be checked periodically to ensure that they function properly. Since the environment and normal operating conditions on this system are not severe, testing each train once every month adequately checks proper function of this system. Systems such as the CR-3 design without heaters need only be operated for ≥ 15 minutes to demonstrate the function of the system. The 31 day Frequency is based on the known reliability of the equipment and the two train redundancy available.

SR 3.7.12.2

This SR verifies that the required CREVS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The CREVS filter tests are in accordance with Regulatory Guide 1.52, (Ref. 4) as described in the VFTP Program description (FSAR, Section 9.7.4). The VFTP includes testing HEPA filter performance, charcoal absorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal. Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.12.3

This SR verifies that each CREVS train actuates to place the control complex into the emergency recirculation mode on an actual or simulated actuation signal. The Frequency of 24 months is consistent with the typical fuel cycle length.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~SR 3.7.12.4~~

~~This SR verifies the integrity of the CCHE and the assumed inleakage rates of potentially contaminated air. During the emergency mode of operation, the CCHE is designed to be a closed environment having limited air exchange with its surroundings. Performance of a periodic leak test verifies the continuing integrity of the CCHE. The Frequency of 24 months is consistent with the typical fuel cycle length.~~

~~NOTE~~

~~The design of the CCHE precludes performance of the commonly applied leak test characterized by pressurization to a nominal value and measurement of the make up air required to maintain pressurization. The test for CR-3 is performed by operating CREVS in the emergency recirculation mode with the Auxiliary Building Ventilation System operating to maintain a differential pressure between the CCHE and the Auxiliary Building. The Auxiliary Building will be at least 1/8 inch water gauge negative relative to the CCHE. Tracer gas will be used to determine the leakage rate. The acceptance criteria for the test is a leakage rate that would not result in control room personnel exceeding dose limits described in Reference 3 following the most limiting accident. A detailed description of the conditions for conduct of the test are provided in Reference 2.~~

REFERENCES

1. FSAR, Section 9.7.2.1.g.

2. ~~CR-3 Control Room Habitability Report, dated July 30, 1998.~~ **FPC Calculation N-00-0002.**

3. 10 CFR 50, Appendix A, GDC 19.

4. Regulatory Guide 1.52, Rev. 2, 1978.

B 3.7 PLANT SYSTEMS

B 3.7.18 Control Complex Cooling System

BASES

BACKGROUND

The Control Complex Cooling System provides temperature control for the control room and other portions of the Control Complex containing safety related equipment.

The Control Complex Cooling System consists of two redundant chillers, associated chilled water pumps, and parallel duct mounted air heat exchangers that can receive chilled water from either chilled water pump. A train consists of a chiller and associated chilled water pump as well as a duct mounted heat exchanger that provide cooling of recirculated control complex air. The design of the Control Complex Cooling System contains features that allow either train chiller and associated chilled water pump to provide cooling capability to either duct mounted heat exchanger. Redundant chillers and chilled water pumps are provided for suitable temperature conditions in the control complex for operating personnel and safety related control equipment. The Control Complex Cooling System maintains the nominal temperature between 70°F and 80°F.

A single chiller and associated chilled water pump will provide the required heat removal for either duct mounted heat exchanger. The Control Complex Cooling System operation to maintain control complex temperature is discussed in the FSAR, Section 9.7 (Ref. 1).

APPLICABLE SAFETY ANALYSIS

The Control Complex Cooling System consists of redundant, safety related components, with some common piping. The Control Complex Cooling System maintains the temperature between 70°F and 80°F. A single active failure of a Control Complex Cooling System component does not impair the ability of the system to perform as designed. The Control Complex Cooling System is designed in accordance with Seismic Category I requirements. The Control Complex Cooling System is capable of removing heat loads from the control room and other portions of the Control Complex containing safety related equipment, including consideration of equipment heat loads and

(continued)

BASES

APPLICABLE SAFETY ANALYSIS (continued)

personnel occupancy requirements, to ensure equipment OPERABILITY.

The Control Complex Cooling System satisfies Criterion 3 of the NRC Policy Statement.

LCO

Two redundant trains of the Control Complex Cooling System are required to be OPERABLE to ensure that at least one train is available, assuming a single failure disables one redundant component. A Control Complex Cooling train consists of a chiller and associated chilled water pump as well as a duct mounted heat exchanger that provides cooling of recirculated control complex air. All components of an OPERABLE train must be energized by the same train electrical bus. Total system failure could cause control complex equipment to exceed its operating temperature limits. In addition, the Control Complex Cooling System must be OPERABLE to the extent that air circulation can be maintained (See Specification 3.7.12).

APPLICABILITY

In MODES 1, 2, 3, and 4, the Control Complex Cooling System must be OPERABLE to ensure that the control complex temperature will not exceed equipment OPERABILITY requirements. ~~During movement of irradiated fuel assemblies the Control Complex Cooling System must be OPERABLE to cope with a release due to a fuel handling accident.~~

ACTIONS

A.1

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy and diversity of subsystems, the inoperability of one component in a train does not render the Control Complex Cooling System incapable of performing its safety function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the Control Complex Cooling System. The intent of this Condition is to maintain a combination of equipment such that the cooling capability equivalent to 100% of a single train remains available and in operation. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

(continued)

BASES

ACTIONS

A.1 (continued)

With one or more components inoperable such that the cooling capability equivalent to a single OPERABLE train is not available, the facility is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be immediately entered.

With one or more Control Complex Cooling trains inoperable and at least 100% cooling capability of a single OPERABLE train available, the inoperable components must be restored to OPERABLE status within 7 days. In this Condition, the remaining Control Complex Cooling System equipment is adequate to maintain the control complex temperature. Adequate cooling capability exists when the control complex air temperature is maintained within the limits for the contained equipment and components. However, the overall reliability is reduced because additional failures could result in a loss of Control Complex Cooling System function. The 7 day Completion Time is based on the low probability of an event occurring requiring the Control Complex Cooling System and the consideration that the remaining components can provide the required capabilities.

~~B.1 and B.2~~

~~During movement of irradiated fuel, if the required Action and Completion Times of Condition A can not be met, the Control Complex Cooling System must be placed in operation immediately. This action ensures that the remaining Control Complex Cooling System components are available, and that any active failure will be readily detected.~~

~~An alternative to Required Action B.1 is to immediately suspend activities that could release radioactivity that might require the isolation of the control room. This places the plant in a condition that minimizes accident risk. This does not preclude the movement of fuel to a safe position.~~

~~C.1 and C.2~~ **B.1 and B.2**

~~In MODE 1, 2, 3, or 4, i~~I If the inoperable Control Complex Cooling System component cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner without challenging unit systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.18.1

Verifying that each Control Complex Cooling chiller's developed head at the flow test point is greater than or equal to the required developed head ensures that chiller's performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by Section XI of the ASME Code (Ref. 3). This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of the SR is in accordance with the Inservice Testing Program.

SR 3.7.18.2

This SR verifies that the heat removal capability of the system is sufficient to meet design requirements. This SR consists of a combination of testing and calculations. A 24 month Frequency is appropriate, as significant degradation of the system is slow and is not expected over this time period.

REFERENCES

1. FSAR, Section 9.7.
2. Deleted.
3. ASME, Boiler and Pressure Vessel Code, Section XI.

5.6 Procedures, Programs and Manuals

5.6.2.10 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit steam generator tube degradation and low pressure turbine disc stress corrosion cracking. The program shall include:

a. Identification of a sampling schedule for the critical variables and control points for these variables;

b. Identification of the procedures used to measure the values of the critical variables;

c. Identification of process sampling points, which shall include monitoring the discharge of the condensate pumps for evidence of condenser in leakage;

d. Procedures for the recording and management of data;

e. Procedures defining corrective actions for all off control point chemistry conditions; and

f. A procedure identifying the authority responsible for the interpretation of the data and the sequence and timing of administrative events, which is required to initiate corrective action.

5.6.2.12 Ventilation Filter Testing Program (VFTP)

A program shall be established to implement the following required testing of the Control Room Emergency Ventilation System (CREVS) ~~and the Auxiliary Building Ventilation Exhaust System (ABVES)~~ per the requirements specified in Regulatory Guide 1.52, Revision 2, 1978, and/or as specified herein, and in accordance with ANSI N510-1975 and ASTM D 3803-89 (Re-approved 1995).

a. Demonstrate for each train of the CREVS that an inplace test of the high efficiency particulate air (HEPA) filters shows a penetration < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 2, 1978, and in accordance with ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

b. Demonstrate for each train of the CREVS that an inplace test of the carbon adsorber shows a system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 2, and ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

c. Demonstrate for each train of the CREVS that a laboratory test of a sample of the carbon adsorber, when obtained as described in Regulatory Guide 1.52, Revision 2, 1978, meets the laboratory testing criteria of ASTM D 3803-89 (Re-approved 1995) at a temperature of 30°C and relative humidity of 95% with methyl iodide penetration of less than ~~2.5%~~ **5.0%**.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.12 VFTP (continued)

d. Demonstrate for each train of CREVS that the pressure drop across the combined roughing filters, HEPA filters and the carbon adsorbers is $\leq \Delta P=4"$ water gauge when tested in accordance with Regulatory Guide 1.52, Revision 2, 1978, and ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

~~e. Demonstrate for each train of the ABVES that an inplace test of the HEPA filters shows a penetration < 1% when tested in accordance with ANSI N510-1975 at the system flowrate of between 35,253 and 43,087 cfm.~~

~~f. Demonstrate for each train of the ABVES that an inplace test of the carbon adsorber shows bypass < 1% when tested in accordance with ANSI N510-1975 at the system flowrate of between 35,253 and 43,087 cfm.~~

~~g. Demonstrate for each train of the ABVES that a laboratory test of a representative sample of the carbon adsorber, when obtained as described in Regulatory Guide 1.52, Revision 2, 1978, meets the laboratory testing criteria of ASTM D 3803-89 (Re-approved 1995) at the temperature of 30°C and relative humidity of 95% with methyl iodide penetration of less than 12.5%.~~

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the VFTP test frequencies.

5.6.2.13 Explosive Gas and Storage Tank Radioactivity Monitoring Program

This program provides controls for potentially explosive gas mixtures contained in the Radioactive Waste Disposal (WD) System, the quantity of radioactivity contained in gas storage tanks or fed into the offgas treatment system. The gaseous radioactivity quantities shall be determined following the methodology in Branch Technical Position (BTP) ETSB 11-5, "Postulated Radioactive Release due to Waste Gas System Leak or Failure". The liquid radwaste quantities shall be determined in accordance with Standard Review Plan, Section 15.7.3, "Postulated Radioactive Release due to Tank Failures".

The program shall include:

a. The limits for concentrations of hydrogen and oxygen in the Radioactive Waste Disposal (WD) System and a surveillance program to ensure the limits are maintained. Such limits

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.13 Explosive Gas and Storage Tank Radioactivity Monitoring Program (continued)

shall be appropriate to the system's design criteria, (i.e., whether or not the system is designed to withstand a hydrogen explosion).

b. A surveillance program to ensure that the quantity of radioactivity contained in each gas storage tank and fed into the offgas treatment system is less than the amount that would result in a whole body exposure of ≥ 0.5 rem to any individual in an unrestricted area, in the event of an uncontrolled release of the tanks' contents.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Explosive Gas and Storage Tank Radioactivity Monitoring Program surveillance frequencies.

5.6.2.14 Diesel Fuel Oil Testing Program

A diesel fuel oil testing program to implement required testing of both new fuel oil and stored fuel oil shall be established. The program shall include sampling and testing requirements, and acceptance criteria, in accordance with applicable ASTM Standards. The purpose of the program is to establish the following:

a. Acceptability of new fuel oil for use prior to addition to storage tanks by determining that the fuel oil has the following properties within limits of ASTM D 975 for Grade No. 2-D fuel oil:

   1. Kinematic Viscosity,

   2. Water and Sediment,

   3. Flash Point,

   4. Specific Gravity API;

b. Other properties of ASTM D 975 for Grade No. 2-D fuel oil are within limits within 92 days following sampling and addition of new fuel to storage tanks.

c. Total particulate contamination of stored fuel oil is < 10 mg/L when tested once per 92 days in accordance with ASTM D 2276-91 (gravimetric method).

5.6.2.15 Not Used

(continued)

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT E

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Proposed Revised Improved Technical Specifications and Bases
Change Pages

Revision Bar Format

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3.7 PLANT SYSTEMS

3.7.12 Control Room Emergency Ventilation System (CREVS)

LCO 3.7.12 Two CREVS trains and the Control Complex Habitability Envelope (CCHE) shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. CCHE inoperable due to a breach or breaches in excess of the limit.	A.1 Restore CCHE boundary.	24 hours
B. One CREVS train inoperable for reasons other than Condition A.	B.1 Restore CREVS train to OPERABLE status.	7 days
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 5.	6 hours 36 hours
D. Two CREVS trains inoperable for reasons other than Condition A.	D.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.12.1	Operate each CREVS train for ≥ 15 minutes.	31 days
SR 3.7.12.2	Perform required CREVS filter testing in accordance with the Ventilation Filter Testing Program.	In accordance with the Ventilation Filter Testing Program
SR 3.7.12.3	Verify each CREVS train actuates to the emergency recirculation mode on an actual or simulated actuation signal.	24 months

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3.7 PLANT SYSTEMS

3.7.18 Control Complex Cooling System

LCO 3.7.18 Two Control Complex Cooling trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more trains inoperable. <u>AND</u> At least 100% of the cooling capability of a single OPERABLE Control Complex Cooling train available.	A.1 Ensure adequate cooling capability from the Control Complex Cooling system in operation. <u>AND</u> A.2 Restore Control Complex Cooling trains(s) to OPERABLE status.	Immediately 7 days
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in Mode 3. <u>AND</u> B.2 Be in Mode 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.18.1	Verify each chilled water pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.7.18.2	Verify the redundant capability of the Control Complex Cooling System to remove the assumed heat load.	24 months

B 3.7 PLANT SYSTEMS

B 3.7.12 Control Room Emergency Ventilation System (CREVS)

BASES

BACKGROUND

The principal function of the Control Room Emergency Ventilation System (CREVS) is to provide an enclosed environment from which the plant can be operated following an uncontrolled release of radioactivity or toxic gas.

The CREVS consists of two trains with much of the non-safety related equipment common to both trains and with two independent, redundant components supplied for major items of safety related equipment (Ref. 1). The major equipment consists of the normal duty filter banks, the emergency filters, the normal duty and emergency duty supply fans, and the return fans. The normal duty filters consist of one bank of glass fiber roughing filters. The emergency filters consist of a roughing filter similar to the normal filters, high efficiency particulate air (HEPA) filters, and activated charcoal adsorbers for removal of gaseous activity (principally iodine). The rest of the system, consisting of supply and return ductwork, dampers, and instrumentation, is not designed with redundant components. However, redundant dampers are provided for isolation of the ventilation system from the surrounding environment.

The Control Complex Habitability Envelope (CCHE) is the space within the Control Complex served by CREVS. This includes Control Complex floor elevations from 108 through 180 feet and the stair enclosure from elevation 95 to 198 feet. The elements which compromise the CCHE are walls, doors, a roof, floors, floor drains, penetration seals, and ventilation isolation dampers. Together the CCHE and CREVS provide an enclosed environment from which the plant can be operated following an uncontrolled release of radioactivity or toxic gas.

CREVS has a normal operation mode and recirculation modes. During normal operation, the system provides filtered, conditioned air to the control complex, including the controlled access area (CA) on the 95 foot elevation. When switched to the recirculation mode, isolation dampers close isolating the discharge to the controlled access area and isolating the outside air intake. In this mode the system recirculates filtered air through the CCHE.

(continued)

BASES

BACKGROUND (continued)

The control complex normal duty ventilation system is operated from the control room and runs continuously. During normal operation, the outside air intake damper is partially open, the atmospheric relief discharge damper is closed, the discharge to the CA is open, and the system return damper is throttled. This configuration allows a controlled amount of outside air to be admitted to the control complex. The design temperature maintained by the system is 75°F at a relative humidity of 50%.

Three signals will cause the system to automatically switch to the recirculation modes of operation.

1. Engineered Safeguards Actuation System (ESAS) signal (high reactor building pressure).

2. High radiation signal from the return duct radiation monitor RM-A5.

3. Toxic gas signal (chlorine or sulfur dioxide)

The recirculation modes isolate the CCHE from outside air to ensure a habitable environment for the safe shutdown of the plant. In these modes of operation, the controlled access area is isolated from the CCHE.

Upon detection of ESAS or toxic gas signals, the system switches to the normal recirculation mode. In this mode, dampers for the outside air intake and the exhaust to the CA will automatically close, isolating the CCHE from outside air exchange, and the system return damper will open thus allowing air in the CCHE to be recirculated. Additionally, the CA fume hood exhaust fan, CA fume hood auxiliary supply fan, and CA exhaust fan are de-energized and their corresponding isolation dampers close. The return fan, normal filters, normal fan, and the cooling (or heating) coils remain in operation in a recirculating mode.

Upon detection of high radiation by RM-A5 the system switches to the emergency recirculation mode. In this mode, the dampers that isolate the CCHE from the surroundings will automatically close. The CA fume hood exhaust fan, CA fume hood auxiliary supply fan, CA exhaust fan, normal supply fan, and return fan are tripped and their corresponding isolation dampers close. Manual action is required to restart the return fan and place the emergency fans and filters in operation. The cooling (or heating) coils remain in operation.

(continued)

BASES

APPLICABLE SAFETY ANALYSIS

During emergency operations the design basis of the CREVS and the CCHE is to provide radiation protection to the control room operators. The limiting accident which may threaten the habitability of the control room (i.e., accidents resulting in release of airborne radioactivity) is the postulated large break LOCA, which is assumed to occur while in MODE 1. The consequences of this event in MODE 1 envelope the results for MODES 2, 3, and 4, and results in the limiting radiological source term for the control room habitability evaluation (Ref. 2). The CREVS and the CCHE ensures that the control room will remain habitable following all postulated design basis events, maintaining exposures to control room operators within the limits of GDC 19 of 10 CFR 50 Appendix A (Ref. 3).

The CREVS is not in the primary success path for any accident analysis. However, the Control Room Emergency Ventilation System meets Criterion 3 of the NRC Policy Statement since long term control room habitability is essential to mitigation of accidents resulting in atmospheric fission product release.

LCO

Two trains of the control room emergency ventilation system are required to be OPERABLE to ensure that at least one is available assuming a single failure disabling the other train. Failure to meet the LCO could result in the control room becoming uninhabitable in the unlikely event of an accident.

The required CREVS trains must be independent to the extent allowed by the design which provides redundant components for the major equipment as discussed in the BACKGROUND section of this bases. OPERABILITY of the CREVS requires the following as a minimum:

a. A Control Complex Emergency Duty Supply Fan is OPERABLE;

b. A Control Complex Return Fan is OPERABLE;

c. HEPA filter and charcoal adsorber are not excessively restricting flow, and are capable of performing their filtration functions;

d. Ductwork and dampers are OPERABLE, and air circulation can be maintained; and

(continued)

BASES

LCO (continued)

e. The CCHE is intact as discussed below.

The CCHE boundary including the integrity of the doors, walls, roof, floors, floor drains, penetration seals, and ventilation isolation dampers must be maintained within the assumptions of the design calculations. Breaches in the CCHE must be controlled to provide assurance that the CCHE remains capable of performing its function.

If the total open breach area in the CCHE exceeds the limit determined in approved design analyses (Reference 2), currently 50 square inches, the CCHE is rendered inoperable and entry into LCO Condition A is required. If the Required Action of LCO Condition A is not met within the respective Completion Time, then Condition C must be entered.

Routine opening and closing of CCHE doors for personnel passage and movement of equipment is accounted for in the design calculations. A continuous leakage of 10 cubic feet per minute is assumed to account for this. Holding or blocking doors open for short periods of time does not constitute a breach of the CCHE as long as the doors could be closed upon notification of a radiological or toxic gas release.

The ability to maintain temperature in the Control Complex is addressed in Technical Specification 3.7.18.

APPLICABILITY

In MODES 1, 2, 3, and 4, the CREVS must be OPERABLE to ensure that the CCHE will remain habitable during and following a postulated accident.

ACTIONS

A.1

With the CCHE inoperable due to breaches in excess of approved design calculations, operation may continue for 24 hours. Restoration of excess breaches is not limited to returning the opening to its pre-breached condition, but can also be accomplished using temporary sealing measures as described in plant procedures and/or work instructions.

(continued)

BASES

ACTIONS

A.1 (continued)

Condition A will permit opening breaches in the CCHE to support maintenance and modification to the habitability envelope boundary. It also will establish an allowance for the discovery of breaches during routine operation, and provide the opportunity to repair the breach in a time frame consistent with the low safety significance of small breaches in the CCHE. The 24 hour completion time is reasonable based on the low probability of a significant release occurring during this time and the use of compensatory measures to protect the control room operators from potential hazards such as radiation, toxic chemicals and smoke.

B.1

With one CREVS train inoperable, action must be taken to restore the train to OPERABLE status within 7 days. In this Condition, the remaining OPERABLE CREVS train is adequate to perform the radiation protection function for control room personnel. However, the overall reliability is reduced because a failure in the OPERABLE CREVS train could result in loss of CREVS function. The 7 day Completion Time is based on the low probability of an accident occurring during this time period, and ability of the remaining train to provide the required capability.

C.1 and C.2

In MODE 1, 2, 3, or 4, if the inoperable CREVS train cannot be restored to OPERABLE status, or breaches in the CCHE which exceed allowable limits cannot be closed within the associated Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

D.1

If both CREVS trains are inoperable the CREVS may not be capable of performing the intended function and the plant is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

Standby systems should be checked periodically to ensure that they function properly. Since the environment and normal operating conditions on this system are not severe, testing each train once every month adequately checks proper function of this system. Systems such as the CR-3 design without heaters need only be operated for ≥ 15 minutes to demonstrate the function of the system. The 31 day Frequency is based on the known reliability of the equipment and the two train redundancy available.

SR 3.7.12.2

This SR verifies that the required CREVS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The CREVS filter tests are in accordance with Regulatory Guide 1.52, (Ref. 4) as described in the VFTP Program description (FSAR, Section 9.7.4). The VFTP includes testing HEPA filter performance, charcoal absorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal. Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.12.3

This SR verifies that each CREVS train actuates to place the control complex into the emergency recirculation mode on an actual or simulated actuation signal. The Frequency of 24 months is consistent with the typical fuel cycle length.

REFERENCES

1. FSAR, Section 9.7.2.1.g.
2. FPC Calculation N-00-0002.
3. 10 CFR 50, Appendix A, GDC 19.
4. Regulatory Guide 1.52, Rev. 2, 1978.

B 3.7 PLANT SYSTEMS

B 3.7.18 Control Complex Cooling System

BASES

BACKGROUND

The Control Complex Cooling System provides temperature control for the control room and other portions of the Control Complex containing safety related equipment.

The Control Complex Cooling System consists of two redundant chillers, associated chilled water pumps, and parallel duct mounted air heat exchangers that can receive chilled water from either chilled water pump. A train consists of a chiller and associated chilled water pump as well as a duct mounted heat exchanger that provide cooling of recirculated control complex air. The design of the Control Complex Cooling System contains features that allow either train chiller and associated chilled water pump to provide cooling capability to either duct mounted heat exchanger. Redundant chillers and chilled water pumps are provided for suitable temperature conditions in the control complex for operating personnel and safety related control equipment. The Control Complex Cooling System maintains the nominal temperature between 70°F and 80°F.

A single chiller and associated chilled water pump will provide the required heat removal for either duct mounted heat exchanger. The Control Complex Cooling System operation to maintain control complex temperature is discussed in the FSAR, Section 9.7 (Ref. 1).

APPLICABLE SAFETY ANALYSIS

The Control Complex Cooling System consists of redundant, safety related components, with some common piping. The Control Complex Cooling System maintains the temperature between 70°F and 80°F. A single active failure of a Control Complex Cooling System component does not impair the ability of the system to perform as designed. The Control Complex Cooling System is designed in accordance with Seismic Category I requirements. The Control Complex Cooling System is capable of removing heat loads from the control room and other portions of the Control Complex containing safety related equipment, including consideration of equipment heat loads and personnel occupancy requirements, to ensure equipment OPERABILITY.

(continued)

BASES

APPLICABLE SAFETY ANALYSIS (continued)

The Control Complex Cooling System satisfies Criterion 3 of the NRC Policy Statement.

LCO

Two redundant trains of the Control Complex Cooling System are required to be OPERABLE to ensure that at least one train is available, assuming a single failure disables one redundant component. A Control Complex Cooling train consists of a chiller and associated chilled water pump as well as a duct mounted heat exchanger that provides cooling of recirculated control complex air. All components of an OPERABLE train must be energized by the same train electrical bus. Total system failure could cause control complex equipment to exceed its operating temperature limits. In addition, the Control Complex Cooling System must be OPERABLE to the extent that air circulation can be maintained (See Specification 3.7.12).

APPLICABILITY

In MODES 1, 2, 3, and 4, the Control Complex Cooling System must be OPERABLE to ensure that the control complex temperature will not exceed equipment OPERABILITY requirements.

ACTIONS

A.1

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy and diversity of subsystems, the inoperability of one component in a train does not render the Control Complex Cooling System incapable of performing its safety function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the Control Complex Cooling System. The intent of this Condition is to maintain a combination of equipment such that the cooling capability equivalent to 100% of a single train remains available and in operation. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

(continued)

BASES

ACTIONS

A.1 (continued)

With one or more components inoperable such that the cooling capability equivalent to a single OPERABLE train is not available, the facility is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be immediately entered.

With one or more Control Complex Cooling trains inoperable and at least 100% cooling capability of a single OPERABLE train available, the inoperable components must be restored to OPERABLE status within 7 days. In this Condition, the remaining Control Complex Cooling System equipment is adequate to maintain the control complex temperature. Adequate cooling capability exists when the control complex air temperature is maintained within the limits for the contained equipment and components. However, the overall reliability is reduced because additional failures could result in a loss of Control Complex Cooling System function. The 7 day Completion Time is based on the low probability of an event occurring requiring the Control Complex Cooling System and the consideration that the remaining components can provide the required capabilities.

B.1 and B.2

If the inoperable Control Complex Cooling System component cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner without challenging unit systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.18.1

Verifying that each Control Complex Cooling chiller's developed head at the flow test point is greater than or equal to the required developed head ensures that chiller's performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by Section XI of the ASME Code (Ref. 3). This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of the SR is in accordance with the Inservice Testing Program.

SR 3.7.18.2

This SR verifies that the heat removal capability of the system is sufficient to meet design requirements. This SR consists of a combination of testing and calculations. A 24 month Frequency is appropriate, as significant degradation of the system is slow and is not expected over this time period.

REFERENCES

1. FSAR, Section 9.7.

2. Deleted.

3. ASME, Boiler and Pressure Vessel Code, Section XI.

5.6 Procedures, Programs and Manuals

5.6.2.11 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit steam generator tube degradation and low pressure turbine disc stress corrosion cracking. The program shall include:

a. Identification of a sampling schedule for the critical variables and control points for these variables;

b. Identification of the procedures used to measure the values of the critical variables;

c. Identification of process sampling points, which shall include monitoring the discharge of the condensate pumps for evidence of condenser in leakage;

d. Procedures for the recording and management of data;

e. Procedures defining corrective actions for all off control point chemistry conditions; and

f. A procedure identifying the authority responsible for the interpretation of the data and the sequence and timing of administrative events, which is required to initiate corrective action.

5.6.2.12 Ventilation Filter Testing Program (VFTP)

A program shall be established to implement the following required testing of the Control Room Emergency Ventilation System (CREVS) per the requirements specified in Regulatory Guide 1.52, Revision 2, 1978, and/or as specified herein, and in accordance with ANSI N510-1975 and ASTM D 3803-89 (Re-approved 1995).

a. Demonstrate for each train of the CREVS that an inplace test of the high efficiency particulate air (HEPA) filters shows a penetration < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 2, 1978, and in accordance with ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

b. Demonstrate for each train of the CREVS that an inplace test of the carbon adsorber shows a system bypass < 0.05% when tested in accordance with Regulatory Guide 1.52, Revision 2, and ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

c. Demonstrate for each train of the CREVS that a laboratory test of a sample of the carbon adsorber, when obtained as described in Regulatory Guide 1.52, Revision 2, 1978, meets the laboratory testing criteria of ASTM D 3803-89 (Re-approved 1995) at a temperature of 30°C and relative humidity of 95% with methyl iodide penetration of less than 5.0%.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.12 VFTP (continued)

d. Demonstrate for each train of CREVS that the pressure drop across the combined roughing filters, HEPA filters and the carbon adsorbers is ≤ ΔP=4" water gauge when tested in accordance with Regulatory Guide 1.52, Revision 2, 1978, and ANSI N510-1975 at the system flowrate of between 37,800 and 47,850 cfm.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the VFTP test frequencies.

5.6.2.13 Explosive Gas and Storage Tank Radioactivity Monitoring Program

This program provides controls for potentially explosive gas mixtures contained in the Radioactive Waste Disposal (WD) System, the quantity of radioactivity contained in gas storage tanks or fed into the offgas treatment system. The gaseous radioactivity quantities shall be determined following the methodology in Branch Technical Position (BTP) ETSB 11-5, "Postulated Radioactive Release due to Waste Gas System Leak or Failure". The liquid radwaste quantities shall be determined in accordance with Standard Review Plan, Section 15.7.3, "Postulated Radioactive Release due to Tank Failures".

The program shall include:

a. The limits for concentrations of hydrogen and oxygen in the Radioactive Waste Disposal (WD) System and a surveillance program to ensure the limits are maintained. Such limits shall be appropriate to the system's design criteria, (i.e., whether or not the system is designed to withstand a hydrogen explosion).

b. A surveillance program to ensure that the quantity of radioactivity contained in each gas storage tank and fed into the offgas treatment system is less than the amount that would result in a whole body exposure of ≥ 0.5 rem to any individual in an unrestricted area, in the event of an uncontrolled release of the tanks' contents.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Explosive Gas and Storage Tank Radioactivity Monitoring Program surveillance frequencies.

(continued)

5.6 Procedures, Programs and Manuals

5.6.2.14 Diesel Fuel Oil Testing Program

A diesel fuel oil testing program to implement required testing of both new fuel oil and stored fuel oil shall be established. The program shall include sampling and testing requirements, and acceptance criteria, in accordance with applicable ASTM Standards. The purpose of the program is to establish the following:

a. Acceptability of new fuel oil for use prior to addition to storage tanks by determining that the fuel oil has the following properties within limits of ASTM D 975 for Grade No. 2-D fuel oil:

    1. Kinematic Viscosity,

    2. Water and Sediment,

    3. Flash Point,

    4. Specific Gravity API;

b. Other properties of ASTM D 975 for Grade No. 2-D fuel oil are within limits within 92 days following sampling and addition of new fuel to storage tanks.

c. Total particulate contamination of stored fuel oil is < 10 mg/L when tested once per 92 days in accordance with ASTM D 2276-91 (gravimetric method).

5.6.2.15 Not Used

(continued)

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

ATTACHMENT F

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Florida Power Corporation in this document. Any other actions discussed in the submittal represent intended or planned actions by Florida Power Corporation. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager, Nuclear Licensing of any questions regarding this document or any associated regulatory commitments.

Commitment	Due Date
FPC will inform the NRC in a supplement to this submittal when reduction of the toxic gas sources has been completed.	Upon completion of the reduction of the toxic gas sources
FPC will continue to apply current administrative controls for identifying, tracking, and closing CCHE breaches, and continue to perform required inspection and maintenance activities for CREVS dampers, CCHE doors, penetration seals, and floor drains to ensure margin is maintained between actual in-leakage and the 1000 cfm value assumed in the dose calculations.	Upon issuance of this requested License Amendment
Recognizing the importance of defense in depth afforded by automatic control room isolation on high radiation, CR-3 will continue to test and maintain this feature.	Upon issuance of this requested License Amendment

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX A

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

CR-3 Control Room Habitability Report

Control Room

Habitability Report

Florida Power Corporation

Crystal River – Unit 3

September 2000

Control Room Habitability Report
Florida Power Corporation
Crystal River 3

Table of Contents

I. Introduction and Summary

The Crystal River, Unit 3 (CR-3) Operating License contains a requirement to maintain control room habitability as specified in the post-Three Mile Island (TMI) requirements of NUREG-0737. Control Room Habitability analyses were performed during the 1980's to demonstrate compliance with NUREG-0737. System Readiness Reviews conducted in 1997 identified several issues that potentially impacted control room habitability. The primary issue identified was the inability of the Control Complex Habitability Envelope (CCHE) to maintain unfiltered inleakage to a value less than assumed in the 1980's Control Room Habitability analyses.

A number of modifications were made in 1997 to significantly improve the level of protection provided for the control room operator. For example, redundant bubble-tight dampers were installed in system connections that penetrate the boundary of the Control Complex. A more detailed discussion of all the improvements can be found in the 1998 version of the Control Room Habitability Report (submitted in letter 3F0798-15). After the modifications were completed, a 1997 tracer gas test was performed to determine the inleakage rate.

The unfiltered inleakage rate still exceeded the design basis value. The February 1998 startup was allowed with a JCO in effect. The JCO included compensatory actions, such as the maintenance of KI tablets for distribution to control room operators. The control room operator dose calculations were revised in 1998 to align inputs and assumptions with plant design and measured inleakage rates. Additionally, the control room dose was calculated for a number of accidents other than the LOCA. These other accidents included the Steam Generator Tube Rupture (SGTR), Letdown Line Rupture and Fuel Handling Accident. The LOCA remained the bounding accident.

Based on these revised habitability analyses, License Amendment Request #222 was submitted on July 30, 1998 (FPC Letter 3F0798-15). The 1998 version of the Control Room Habitability Report was attached to the LAR submittal. On August 23, 1999 (NRC Letter 3N0899-13), the NRC issued License Amendment 185 related to control room habitability. A number of the revised Technical Specification sections were approved for only one operating cycle (Cycle 12). Additionally, the NRC noted in its SER, that although the Technical Specification changes were approved, the Control Room Habitability Report was still under review. The NRC specified that the compensatory actions specified in the JCO must remain in place.

On October 28, 1999 (FPC Letter 3F1099-18), FPC withdrew the request for the NRC to review the 1998 Control Room Habitability Report. FPC noted that a subsequent LAR was anticipated to replace the ITS changes that were approved for one cycle. It was expected that this subsequent LAR would include a revised Control Room Habitability Report based on analyses using the Alternative Source Term.

The purpose of this 2000 version of the Control Room Habitability Report is to update the report to present the results of the revised control room habitability analyses performed using the Alternative Source Term (10CFR50.67 and Regulatory Guide 1.183). The report provides the technical justification for the License Amendment Request scheduled for submittal by 9/28/00 and will be attached to that submittal.

Upon NRC approval of the License Amendment Request, anticipated by the end of Cycle 12, the JCO will be closed.

This report will be a living document and will be referenced in the UFSAR. If any changes are made to the plant design or procedures that affect the assumptions or evaluations in this report, the report will be revised. Since this report will be referenced in the UFSAR, any changes to this report will require an Unreviewed Safety Question determination per 10CFR50.59, unless revised as part of a License Amendment Request.

II. Control Room Emergency Ventilation System Description

A simplified schematic of the CREVS is provided as Figure 1. The CREVS consists of two independent safety-related air recirculation trains that, in addition to the cooling capability, have the ability to divert 100% of the recirculation flow through an Emergency Filter Unit. Each Emergency Filter Unit contains, in the direction of flow, a roughing filter, a HEPA filter, 2-inch activated carbon filter bank, and a safety-related recirculation booster fan. The Emergency Filter Units do not include means to lower the humidity of the air as it enters the adsorber bank, such as electric heating coils. Heaters are not required since the system only operates in a recirculation mode. The emergency recirculation fans are powered by separate safety-related power sources. The CREVS processes and filters air from the top five levels of the control complex.

Upon detection of either high reactor building pressure or high radiation in normal Control Room ventilation ductwork, as detected by RMA-5, the redundant, bubble-tight boundary isolation dampers are automatically closed. The operation of the emergency fans and filters are manually initiated by the operator. The calculations conservatively assume 30 minutes for the time of manual initiation of the filters.

The redundant, bubble-tight boundary isolation dampers are also automatically closed as a result of a Loss of Offsite Power (LOOP). The operation of the CREVS during a LOOP is manually initiated by the operators. Although the diesel loading would allow starting of the CREVS well before 30 minutes, the operation of the CREVS is conservatively not credited for 30 minutes.

The CREVS provides environmental control for personnel comfort and equipment operation and protection of control room personnel during radiological and toxic gas events. It provides habitability via zone isolation with filtered recirculation. The control complex is not pressurized to limit inleakage. Leak tightness and filtration capability provide the necessary level of protection for the control room operator to ensure that exposure limits associated with DBAs and toxic gas events are not exceeded.

III. Control Complex Habitability Envelope (CCHE)

III.1 General Description

The CCHE is the physical barrier that separates the control room environment from the external environment. The integrity of the CCHE barriers (walls, doors, ceilings, floors, sealed penetrations, ventilation penetrations, etc.) directly affects the inleakage of radiation sources associated with Design Basis Accidents (DBAs).

The Control Complex is a six floor building located between the auxiliary building and the turbine building as shown in Figure 2. The CCHE is the top five floors of the Control Complex. The lower floor is isolated from the CCHE under accident conditions. The top floor of the CCHE contains the control complex ventilation equipment, thus it is all internal to the CCHE. The control room is one floor below the ventilation equipment room. The CCHE, along with CREVS are designed to protect the operator in case of a radiological or toxic gas release.

As is noted in the diagram in Figure 2, the only open surfaces to the environment are the upper levels of the east and west walls, which have no penetrations, and the roof. The north wall adjoins the turbine building and has a number of penetrations through the CCHE and the south wall adjoins the auxiliary building and contains a number of penetrations. Thus, the CCHE is not subject to significant inleakage due to wind induced effects. This is due both to the fact that it is fairly well surrounded by higher structures which should minimize wind loading and because the open surfaces contain a limited number of penetrations. Most inleakage would be expected to occur from penetrations in the turbine building wall due to negative pressure in the auxiliary building providing a motive force for flow from the turbine building through the CCHE and the into the auxiliary building. Inleakage rates are discussed below.

III.2 CCHE Inleakage Rates

The infiltration of unfiltered air into a control room boundary results from three paths: (1) through the zone boundary; (2) through the system components located outside of the emergency zone; and (3) through backflow at the zone boundary doors as a result of personnel access or egress.

With respect to component leakage, all of the CREVS components and ductwork at CR-3 are contained within the CCHE boundary and as such do not contribute as an inleakage source. With respect to backflow through the zone boundary doors, it has been assumed that an additional 10 scfm of infiltration is induced by the opening and closing of doors, as recommended by SRP 6.4. The inleakage through the zone boundary has been determined by testing.

Following the 1997 improvements to the CCHE boundary, the boundary performance was measured using tracer gas tests. The tests were performed by engineers from FPC and Lagus Applied Technology. The tracer gas test procedure was based on ASTM Standard E741-93, "Standard Test Method for Determining Air Change Rate in a Single Zone by Means of a Tracer Gas Dilution." The tests were accomplished using an electronegative gas, sulfur hexafluoride (SF6), as a tracer. Although not prescribed by regulatory guidance, application of tracer gas technology is recognized as a means to accurately measure building inleakage. By using tracer gas test methods, it is possible to measure inleakage under conditions which are representative of a specific postulated scenario. The 1997 test results gave a measured leak rate of 443 $\pm$ 20 cfm at a differential pressure across the CCHE of 0.171" water gauge.

The results of the 1997 tracer gas inleakage test measurements were used in the 1998 control room habitability dose calculations. Different inleakage rates were used for different dose calculations depending on the assumed ventilation alignments, wind speeds and potential differential pressure across the CCHE. The maximum differential pressure across the CCHE occurs when there is no Loss of Offsite Power. In this case, the Auxiliary Building Exhaust fans would remain on and the supply fans would trip on high radiation. This results in a negative pressure in the Auxiliary Building and hence a higher differential pressure across the CCHE of 0.2" water gauge. The measured results were extrapolated up to this higher differential pressure, resulting in a maximum potential inleakage rate of 513 cfm. The 10 cfm assumed inleakage from ingress/egress was added, giving a total maximum inleakage of 523 cfm. The value of 523 cfm was used in the applicable dose calculations. For the dose calculations for scenarios that involved a Loss of Offsite Power, lower inleakage rates were used based on extrapolation of the measured results to pressure differentials across the CCHE based on meteorological conditions.

Approximately 2 years later, in 1999, a subsequent CCHE tracer gas inleakage test was performed. The same methods as noted above were used. The test results were essentially identical. The 1999 measured leak rate was 450 $\pm$ 13 cfm at a differential pressure across the CCHE of 0.176" water gauge. This extrapolates to a leak rate at the maximum expected pressure differential of 0.2" water gauge of 503 cfm. Adding the 10 cfm from ingress/egress gives a maximum leak rate of 513 cfm. Revised dose calculations were unnecessary as the measured rates were within the assumed rates.

The Alternative Source Term dose calculations performed in 2000 for the proposed license amendment request used an unfiltered inleakage rate assumption of 1000 cfm under all conditions. This value was chosen to provide sufficient margin above the measured inleakage rate. The value is approximately 2 times the expected inleakage rate under the worst possible pressure differential conditions. It would provide even greater margin under other conditions, such as Loss of Offsite Power scenarios, where the pressure differential across the CCHE is less.

The use of 1000 cfm as the assumed inleakage rate provides part of the justification for the license amendment request to eliminate the requirement for subsequent tracer gas inleakage measurements. The deletion of this requirement is based on:

- 1000 cfm is twice the maximum expected leak rate based on previous tracer gas tests. This provides significant margin for CCHE boundary degradation before the dose calculation assumptions would be challenged.
- The 1999 test results were essentially equal to the 1997 results, thus demonstrating that the CCHE boundary is not degrading with time.
- The most likely sites for CCHE inleakage and boundary degradation (dampers and door seals) will continue to be inspected and maintained in good condition.

IV. Technical Specification Requirements

Improved Technical Specifications (ITS) Sections 3.7.12 and 5.6.2.12 specify operability and surveillance requirements for CREVS and the CCHE. Currently CREVS and the CCHE must be operable during Modes 1-4 and during movement of irradiated fuel assemblies. The proposed LAR will delete the operability requirement during movement of irradiated fuel based on the revised assessment of the Fuel Handling accident.

The Surveillance Requirements to demonstrate CREVS operability, include the following criteria:

- operating each CREVS train for at least 15 minutes each month
- satisfying the CREVS ventilation filter testing program
- verifying that each CREVS train actuates to the emergency recirculation mode on an actual or simulated actuation signal every 24 months.

The second criterion refers to the requirements of the ventilation filter test program defined in ITS Section 5.6.2.12. ITS Section 5.6.2.12 defines requirements pertaining to the Ventilation Filter Testing Program at CR-3 and requires that the CREVS filtration units meet minimum performance standards regarding penetration, bypass, and adsorption. The Alternative Source Term dose calculations are also being used to justify a reduction in the ITS specified adsorption efficiency of the CREVS charcoal filters.

Section 5.6.2.12 also contains requirements for the Auxiliary Building Exhaust filters. The Auxiliary Building filters were taken credit for in the 1998 control room dose assessments. The Alternative Source Term dose calculations take no credit for the Auxiliary Building filters for the dose to either the public or the control room. Therefore, the license amendment is requesting removal of the AB filter test requirements from the ITS.

Section 3.7.12 contains requirements related to the CCHE. One requirement specifies that the CCHE be declared inoperable if breaches in the boundary exceed predetermined limits. The license amendment request is requesting some modifications to the specific wording related to breaches. A surveillance requirement also specifies that an integrated CCHE leak test be performed once per 24 months. The use of a high inleakage rate assumption in the dose calculations, combined with the consistent results from the two tests already completed, is being used to justify the elimination of this test requirement.

V. Radiological Evaluations

In the 1998 Control Room Habitability Report, details were included on the assumptions and results for the control room dose assessments performed for the LOCA, the SGTR, the LLR and the FHA. In 1998, only the control room doses were being reanalyzed. For this 2000 license amendment request, CR3 is submitting a full implementation of the Alternative Source Term rule, 10CFR50.67. Therefore, dose analyses are required for not only the control room, but also for the public for each applicable FSAR Chapter 14 accident.

Appendices B through M have been included in the license amendment request package to fully describe the radiological evaluation input assumptions and results for each applicable accident. The NRC developed RADTRAD code was used to perform the control room radiological evaluations. The detailed inputs to RADTRAD are provided. Since RADTRAD calculates both the public dose and the control room dose as part of the same computer run, the inputs provided in Appendices B through M also apply to this control room habitability section. The information is not repeated here. (The control room dose assessment information will be incorporated into the controlled, living version of this Control Room Habitability Report maintained at Crystal River Unit 3). The control room dose was calculated for the LOCA, SGTR, LLR, FHA and Control Rod Ejection Accident. Note that the Control Rod Ejection has been added to the list of accidents evaluated for control room dose.

The results of these radiological analyses are as follows:

Control Room TEDE –
LOCA – 4.29 REM
SGTR – (pre-accident spike) – 1.19 REM

SGTR – (post-accident spike) – 0.365 REM
FHA – 4.43 REM – Note – takes no credit for CCHE or CREVS
LLR – (LOOP, pre-accident spike) – 0.895 REM
LLR – (LOOP, post-accident spike) – 0.06 REM
LLR – (no LOOP, pre-accident spike) – 3.24 REM
LLR – (no LOOP, post-accident spike) – 0.339 REM
CREA – (Containment release) – 0.56 REM
CREA – (Secondary side release) – 3.74 REM

All results are within the 5 REM TEDE criteria specified in 10CFR50.67. Note that the dose from a fuel handling accident is within the 5 REM limit taking no credit for the CCHE boundary, nor CREVS recirculation. Normal ventilation, with an unfiltered intake of 5700 cfm is assumed to continue for the course of the accident. Therefore, operability of CCHE and CREVS is unnecessary for moving irradiated fuel.

Also, none of the above analyses take credit for isolation of the normal ventilation based on a high radiation signal from the control complex ventilation radiation monitor (RMA-5). This provides justification for removal of the radiation monitor requirements of RMA-5 from the ITS. The monitor and its auto-isolation function will remain in service for defense in depth.

The Control Room Habitability analyses summarized in this license amendment supersede the analyses contained in previous submittals.

The analyses consider the concept of "breach margin." The breach margin is the area that can be opened in the CCHE envelope and still result in 30-day post accident MHA doses within the limits. The breaches are controlled and logged to ensure that the integrity of the CCHE is maintained within the limits through normal operation. The bounding analysis (LOCA) calculates an allowable breach area of 50 in^2 in addition to that area that would result in 1000 cfm inleakage.

VI. Hazardous Chemical Evaluation

CCHE integrity is also required to provide protection to the control room operator in the event of a toxic gas accident. Regulatory Guide 1.78 provides information and assumptions for assessing toxic gas accidents with regard to control room habitability. From this document comes the basic criteria that, in the event of a toxic gas accident, appropriate toxicity limits not be exceeded in the control room two minutes after initial detection in order to allow the operator adequate time to take action (i.e., don an air pack) prior to being overcome. The Regulatory Guide allows for detection to be accomplished by personal means (nasal detection) or with automatic detection equipment. CREVS isolation, if required, can be attained either by operator action or by an automatic signal from toxic gas detectors. At CR-3, procedures provide the appropriate instructions for the operator in the event of a toxic gas accident and for the use of air packs.

Based on previous evaluations, the locations and quantities of toxic gas storage sites at the Crystal River site that posed a potential liability to CR-3 control room habitability are listed below:

Toxic Gas container Size and Location

Toxic Gas	Helper Cooling Towers	CR-1/CR-2	CR-4/ CR-5
Chlorine -- Cl_2	17 tons	none	1 ton cylinders
Sulfur Dioxide --SO_2	50 tons	45 tons	1 ton cylinders

The most limiting source of toxic gas was an SO_2 tank at CR-1, which had been administratively limited to storage of 30 tons. Automatic detection and isolation was required as a result of that tank. That tank has recently been replaced with a system that uses solid pellets, which are converted to SO_2 as needed. The tank has been emptied of its contents and will no longer be used. As such, it is no longer the limiting source.

The next most limiting toxic gas source is the Helper Cooling Towers. Currently, there is no SO_2 or Cl_2 stored at this location and this is ensured by a CR-1 "Red Tag" clearance No. 1997-01543. Prior to releasing this clearance, administrative controls will be in place to limit the Helper Cooling Towers to 8 tons of Cl_2 and 30 tons of SO_2. FPC has used revised calculations to evaluate the lower quantities: 8 tons of Cl_2 and 30 tons of SO_2. This analysis combined the wind tunnel results from the CR-1 SO_2 tank model and traditional atmospheric dispersion mathematical modeling techniques to conclude that CREVS could remain in its normal alignment (i.e., no CCHE isolation required) without exceeding Control Room toxicity limits within 2 minutes of nasal detection if up to 9 tons of Cl_2 or 50 Tons of SO_2 were released. Thus, CCHE inleakage would be of no consequence given the new limits of 8 tons and 30 tons for Cl_2 and SO_2, respectively.

A revised calculation also analyzed the Cl_2 and SO_2 stored at the CR-4/CR-5 site. This calculation allows for a 4 ton Cl_2 release at the CR-4 and CR-5 cooling towers located 3600 feet from the CR-3 control complex intake. There are eight one ton cylinders, with four in service on a single header at a time. The assumed accident has one cylinder fail and the other three leak out though the common piping. With no automatic detection or isolation, the calculated control complex concentration 2 minutes after nasal detection is 7.5 ppm, well below the 15 ppm toxicity limit for this source. The one ton SO_2 cylinders were not analyzed due to the SO_2 at the Helper Cooling Towers being more limiting, both in terms of volume and dispersion. The amount at CR-4 and CR-5 is less (one ton versus fifty tons), farther away (3600 feet versus 3400 feet), and has a larger building wake value (3 versus 2). Since the calculation allows > 50 tons at the Helper Cooling Towers without automatic detection and isolation, then the CR-4 and CR-5 SO_2 amount will also not require automatic detection and isolation.

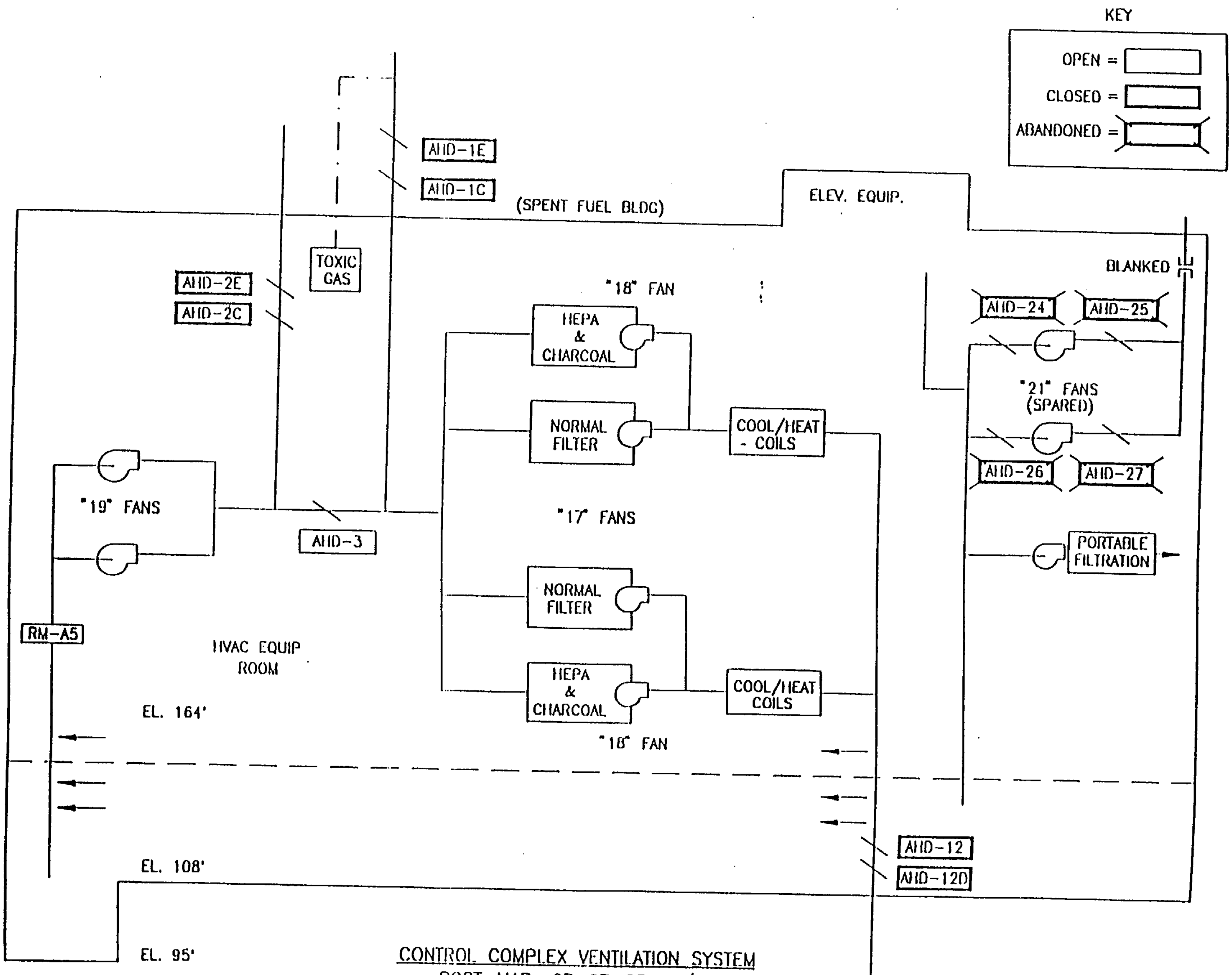
In regard to the transportation of these toxic gases, the only chemicals that are shipped at a frequency that requires evaluation (>10 truck shipments per year) is the shipment of chlorine cylinders to CR 4/5. An analysis of a transportation accident at the point of nearest approach to the CR3 control complex indicates that automatic isolation of chlorine intake by the chlorine gas detector is required to maintain the 2 minute post-detection concentration within the toxicity limits. This analysis assumed an inleakage rate following isolation consistent with the assumption of 1400 cfm inleakage at the maximum expected control complex pressure differential (an inleakage of 1107 cfm was assumed with the Auxiliary Building ventilation in its normal mode).

Based on the above, it is planned to remove the SO_2 detectors and auto-isolation functions. There are also plans to eliminate the liquid chlorine cylinders at CR 4/5 and replace them with solid chlorine pellets. With the cylinders eliminated, there would no longer be shipments of liquid chlorine, except perhaps a rare shipment to the helper cooling towers. Once the chlorine cylinders at CR4/5 are eliminated, the chlorine monitor and auto-isolation function could be eliminated. These changes are expected to occur prior to approval of the License Amendment Request. Supplemental information will be provided upon completion of these plans.

References

1. FPC Calculation No. M97-0109 R/1 (SL-9929-M-0008 R/1), Toxic Gas Analysis
2. FPC Calculation No. N-00-0001 – Public and Control Room Dose from a Fuel Handling Accident Using the Alternative Source Term
3. FPC Calculation No. N-00-0002 – Public and Control Room Dose from a LOCA Using the Alternative Source Term
4. FPC Calculation No. N-00-0003 – Public and Control Room Dose from a Letdown Line Rupture Using the Alternative Source Term
5. FPC Calculation No. N-00-0004 – Public and Control Room Dose from a Steam Generator Tube Rupture Using the Alternative Source Term
6. FPC Calculation No. N-00-0006 – Public and Control Room Dose from a Control Rod Ejection Accident Using the Alternative Source Term
7. FPC Calculation M-00-0002 – CR3 Control Room Chlorine Concentration for a Transportation Accident
8. Regulatory Guide 1.183 (DG1081) – Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, July 2000
9. Code of Federal Regulations 10CFR50.67
10. FPC Letter 3F0798-15, License Amendment Request #222, Revision 1 – Control Room Emergency Ventilation System and Ventilation Filter Test Program, July 30, 1998

11. NRC Letter 3N0899-13, Crystal River Unit 3 – Issuance of Amendment Regarding Control Room Emergency Ventilation System and Ventilation Filter Testing Program, August 23, 1999
12. FPC Letter 3F1099-18, Withdrawal of Request for Review of the Crystal River Unit 3 Control Room Habitability Report, October 28, 1999
13. FPC letter 3F0198-26, dated 01/14/98 Fm M.W. Rencheck (FPC) To NRC Doc. Control Desk
14. NRC Letter 3N0298-04, Crystal River Nuclear Generating Plant Unit 3 - Control Complex Habitability Envelope Justification for Continued Operation – Interim Assessment Results, February 3, 1998
15. Condition Resolution Report/Justification for Continued Operation 97-4355, Revision 7



CONTROL COMPLEX VENTILATION SYSTEM
POST-MARs 97-07-05-01/02
SHOWN IN THE RECIRCULATION LINE-UP

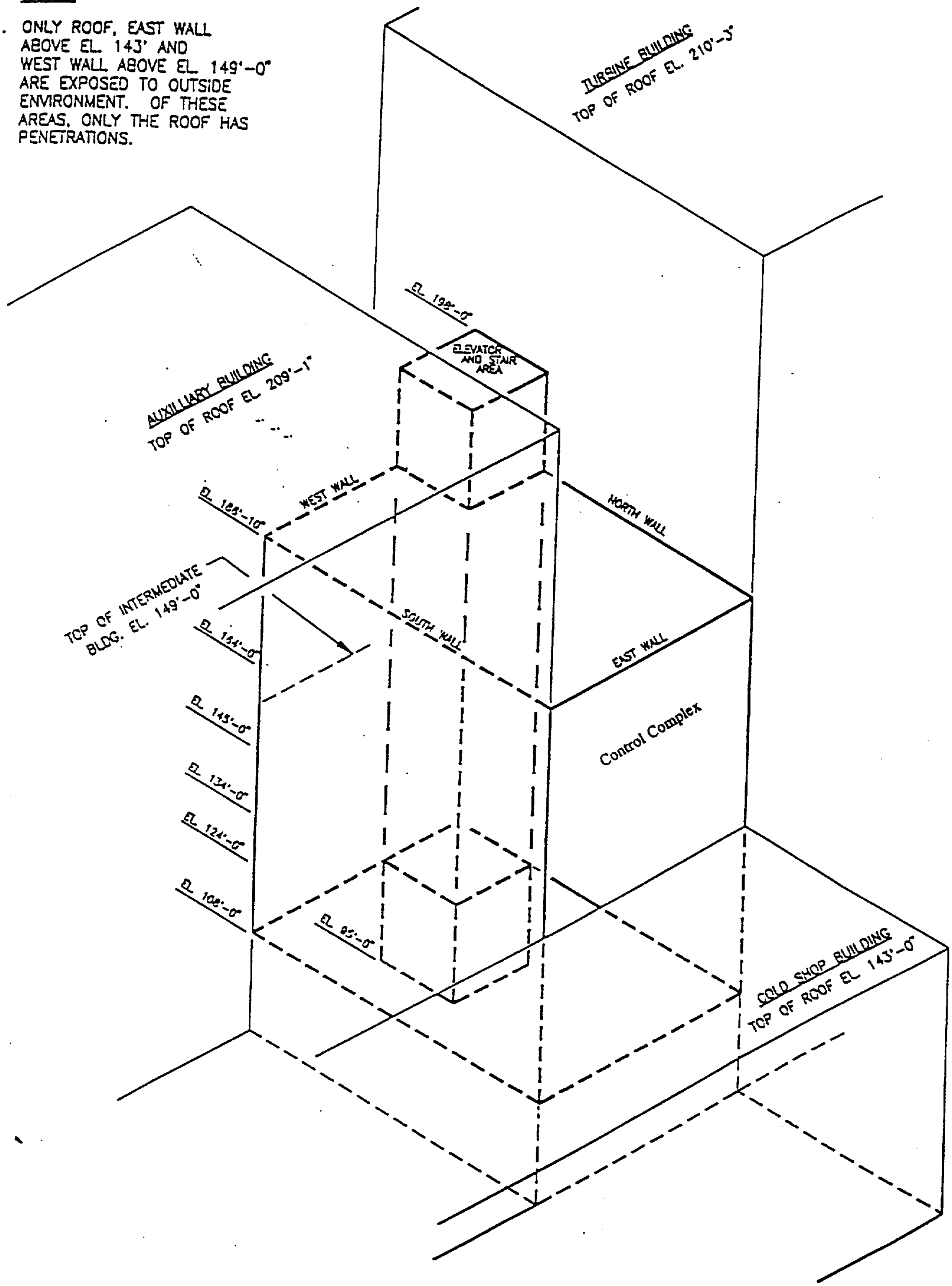
Figure 1

Control Room Habitability Report
Florida Power Corporation
Crystal River 3

Figure 2

NOTES:

1. ONLY ROOF, EAST WALL ABOVE EL. 143' AND WEST WALL ABOVE EL. 149'-0" ARE EXPOSED TO OUTSIDE ENVIRONMENT. OF THESE AREAS, ONLY THE ROOF HAS PENETRATIONS.



FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX B

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Summary of Radiological Analyses
For FSAR Chapter 14 Accidents

Summary of Radiological Analyses for FSAR Chapter 14 Accidents

Each of the Design Basis Accidents in Chapter 14 that had a quantified calculation of the dose consequences was recalculated using the Alternative Source Term where applicable. All dose results are expressed in terms of TEDE for comparison with the limits of 10CFR50.67. Unless noted, the accident consequences were calculated to both the Control Room Operator and the public at the Exclusion Area Boundary (EAB) and the Low Population Zone (LPZ). The primary method used for these analyses was the NRC developed code, RADTRAD, Version 3.02.

The following is a summary of the scenario, analysis and results for each of the accidents. The detailed inputs to the calculation and their bases are provided in a format consistent with the order in which they are entered into the RADTRAD input files. This input information is provided as individual Appendices in this submittal.

1. Main Steam Line Break – FSAR Section 14.2.2.1

   Scenario – For the purpose of radiological analysis, this accident is assumed to involve the rupture of a main steam line outside containment, but upstream of the MSIV's. The release consists of complete loss of the secondary coolant plus additional feedwater from the affected generator, secondary coolant from the unaffected generator, and a continuing primary to secondary leak in the affected generator of 1 gpm for 85 hours. The reactor coolant activity is based on steady state operation with 1% degraded fuel cladding. No spiking is assumed. This concentration is higher than allowed by Technical Specifications. There is no calculated fuel damage as a result of the accident.

   Analysis - There are no changes to the plant design or procedures associated with this license amendment request that would affect the current dose assessment. There are no aspects of the source term specified in Regulatory Guide 1.183 that would affect the existing dose calculation, as there is no fuel damage associated with this accident. The only aspect of the current Chapter 14 analysis affected by 10CFR50.67 and CR-3's intent to apply a Full Application of the Alternative Source term is the requirement to express the dose results of the existing calculation in terms of TEDE. This is required to demonstrate compliance with the limits of 10CFR50.67. Therefore, a new RADTRAD analysis for this accident was not required. A calculation was performed using the dose conversion factors in RADTRAD to convert the current dose results to TEDE results. Appendix C provides the inputs used in the current analysis and the conversion to TEDE results.

   Results:

   EAB TEDE = 0.0047 REM (0-2 hr is worst 2 hr period)
   LPZ TEDE = 0.0031 REM

The releases for this accident are significantly less than for a Steam Generator Tube Rupture (SGTR). Therefore, a control room dose assessment was not performed for this accident, as it would be bounded by the SGTR.

2. Steam Generator Tube Rupture – FSAR Section 14.2.2.2

Scenarios - There are two scenarios analyzed for the SGTR. They are the licensing basis analysis for public dose and the informational Standard Review Plan analysis performed for control room habitability.

The licensing basis scenario for public dose assumes no single failure and no Loss of Offsite Power (LOOP). Without a LOOP, the condenser remains available and iodine releases are significantly reduced. No iodine spike cases are analyzed. Significant conservatism is applied to the assumed release from the primary side, as discussed below.

In response to a request for additional information from the NRC related to control room habitability, in 1998, CR-3 analyzed the control room dose for a SGTR scenario consistent with the guidelines of the Standard Review Plan (Iodine spiking, LOOP, single failure).

The assumed licensing basis scenario is:

T=0 – Tube rupture. The primary to secondary break flow is conservatively calculated to be 60.5 lbm/sec (includes an existing 1 gpm primary to secondary leak) and is assumed to continue for the entire 8 hours of the event.

T= 8 min – the reactor trips. Until this time, all releases are via the condenser. With the reactor/turbine trip, a fraction of the steam is released via the atmospheric dumps and main steam safeties. The fraction of steam that is released directly to atmosphere from 8 minutes to 9 minutes is 0.55.

T= 9 minutes – steam flow is such that the dumps and safeties are closed. All releases for the remainder of the accident are via the condenser. The assumed reduction of iodine in the condenser is a factor of 10,000. In regard to noble gas releases, the release path doesn't matter. All noble gases released from the primary side are assumed to be instantaneously released to the environment.

T= 8 hours – the plant has been cooled to the point where both steam generators are isolated and heat removal is via the Decay Heat system. This terminates the release.

The reactor coolant activity for the licensing basis scenario is based on steady state operation with 1% degraded fuel cladding. No spiking is assumed. This concentration is higher than allowed by Technical Specifications. Releases of secondary side activity are not included in the calculation due to their insignificance compared to the primary side releases.

The control room dose SRP-like analysis considers a LOOP, the most-limiting single failure, and both a pre-existing iodine spike at the maximum value allowed in the Technical Specification (60 μCi/gm dose equivalent I-131) and an iodine spike 500 times the equilibrium release rate coincident with the operation value of 1 μCi/gm dose equivalent I-131. Credit is taken for some non-safety-related components, specifically, the analysis credits the use of the ADVs for cooldown, and the use of the PORV for depressurization.

The sequence of events for the SRP-like SGTR analysis, including control room assumptions, is as follows:
T = 0 - Tube Rupture
T = 8 min. - Rx trip, LOOP, loss of condenser, isolation of CCHE with LOOP
T = 38 min. - CR ventilation on recirculation 30 min. after LOOP
T = 53 min. - Operators initiate cooldown with ADV's – ADV fails on unaffected generator
T = 55 min. - Initiate RCS depressurization with PORV's
T = 78 min. - Manually open failed ADV
T = 108 min. - Isolate affected OTSG
T = 8 hrs - Terminate release from unaffected generator

The analysis conservatively considered a LOOP coincident with the reactor trip. The limiting single failure is the failure of the Atmospheric Dump Valve (ADV) on the unaffected steam generator to automatically open in response to the post-trip pressure control signal. This forces the operator to cool down using the affected generator's ADV until the unaffected steam generator's ADV can be opened. This results in an extended cooldown time and hence time until the affected generator can be isolated.

Analysis - For the Chapter 14 licensing basis assessment, there are no changes to the plant design or procedures associated with the planned Alternative Source Term license amendment request that would affect the current dose assessment. There are no aspects of the source term specified in Reg. Guide 1.183 that would affect the existing dose calculation, as there is no fuel damage associated with this accident. The only aspect of the current Chapter 14 analysis affected by 10CFR50.67 and CR-3's intent to apply a Full Application of the Alternative Source term is the requirement to express the dose results of the existing calculation in terms of TEDE dose. This is required to demonstrate compliance with the limits of 10CFR50.67. A calculation was performed using the dose conversion factors in RADTRAD to convert the current dose results to TEDE results. Appendix D provides the inputs used in the current analysis and the conversion to TEDE results.

For the SRP-like SGTR analysis of control room dose, there are changes associated with the proposed license amendment that will affect the calculation of control room dose. Therefore, a reanalysis of the control room dose using RADTRAD has been performed. For informational purposes, the public dose results will also be presented for the SRP-like scenario. Appendix E presents the RADTRAD inputs and their bases.

Results:

Chapter 14 Design Basis Assumptions
EAB TEDE – 0.139 REM (0-2 hr is worst 2 hour period)
LPZ TEDE – 0.0455 REM

SRP Assumptions
EAB TEDE -Pre-accident spike – 5.98 REM
EAB TEDE -Post-accident spike – 2.40 REM
LPZ TEDE - Pre-accident spike – 0.523 REM
LPZ TEDE - Post-accident spike – 0.210 REM
Control Room TEDE -Pre-accident spike – 1.19 REM
Control Room TEDE -Post-accident spike – 0.365 REM

3. Fuel Handling Accident – FSAR Section 14.2.2.3

Scenario - The gap activity is conservatively assumed to be released from all fuel pins in one fuel assembly. The gap fractions from Regulatory Guide 1.183 are used. A reduction factor for iodine is applied for removal by the water in the reactor cavity or spent fuel pool. No credit is taken for either building isolation or release pathway filters. As such, the calculation of a FHA in the spent fuel pool area will be exactly the same as for an accident in the Reactor Building. Hence, only one calculation is performed. All the activity is conservatively assumed to be released within the first few minutes. The control complex is assumed to be in the normal ventilation mode. No credit is taken for automatic isolation by the control room ventilation radiation monitor (RM-A5) or for manual isolation by the operator. No credit is taken for control complex recirculation filters. If the radiation monitor or operator did isolate the control complex and place the ventilation in filtered recirculation, the doses would be less than the results of this calculation.

Analysis – The doses were calculated using RADTRAD. Appendix F presents the RADTRAD inputs and their bases.

Results:

EAB TEDE (0-2 hr is worst 2 hour period) - 0.83 REM
LPZ TEDE - 0.073 REM
Control Room TEDE - 4.43 REM

4. Control Rod Ejection Accident – FSAR Section 14.2.2.4.

Scenario - There are two cases analyzed for the Control Rod Ejection (CRE). The first case assumes that all the activity released from the failed fuel is released directly to the containment and then leaks from the containment to the environment. The second case assumes that all the activity released from the fuel is dispersed in the reactor coolant and then is released to the environment via primary to secondary leakage.

Thermal hydraulic calculations determined that 14% of the fuel is assumed to experience clad damage (FTI 51-1172602-00). (This was very conservatively determined by assuming that any core area experiencing DNB resulted in clad damage). No fuel was calculated to experience fuel melt. Gap activity is assumed to be released from this 14% of the fuel. The gap activity is taken from DG-1081 (Note – final RG 1.183 reduced the fraction assumed to be in the gap compared to DG-1081, therefore, this assessment is conservative and was not revised). Normal coolant activity is insignificant compared to the activity from the 14% of the fuel that fails and hence the normal coolant activity is not included in the calculation.

For the first case, all the activity released from the fuel is instantaneously dispersed to the containment. There is no credit taken for removal by sprays. No immediate plateout is assumed. The only removal mechanisms assumed are natural deposition for the aerosol iodine and decay for all nuclides. The containment is assumed to leak at the Technical Specification leak rate limit for 24 hours and at one half that limit for the remaining 29 days.

For the second case, all the activity released from the fuel is instantaneously dispersed in the reactor coolant. The reactor coolant is assumed to leak at 150 gpd in each steam generator (300 gpd total). All activity released to the secondary side is assumed to be immediately released to the environment. It is assumed that there is a loss of offsite power and hence the condenser is not available. There is no credit assumed for any partitioning factor or removal of iodine or other nuclides in the secondary side. It is also conservatively assumed that the plant continues to cool down by steaming through the steam generators for 14 days prior to going on the Decay Heat System.

Analysis – The doses were calculated using RADTRAD. Appendix G presents the RADTRAD inputs and their bases for the containment release scenario. Appendix H presents the RADTRAD inputs and their bases for the secondary side release scenario.

Results:

Containment Release
EAB TEDE – 0.737 REM (0-2hr is worst 2 hours)
LPZ TEDE – 0.210 REM
Control Room TEDE – 0.560 REM

Secondary Side Release
EAB TEDE – 1.50 REM (0-2hr is worst 2 hours)
LPZ TEDE – 0.773 REM
Control Room TEDE – 3.74 REM

5. LOCA – FSAR Section 14.2.2.5

Scenario/Analysis - There are a number of different contributors to the LOCA dose assessment. They are:

- The dose from leakage of recirculated ECCS water, including an assumed 50 gpm leak for 30 minutes at 24 hours into the event. This source is considered for both the public and control room operator. Appendix I presents the input assumptions for this analysis. The calculations are performed using the NRC Code RADTRAD.
- The dose from leakage of containment atmosphere. This source is considered for both the public and control room operator. Appendix J presents the input assumptions for this analysis. The calculations are performed using the NRC Code RADTRAD.
- The dose from an assumed containment purge at 14 days into the accident for hydrogen control. This source is considered for both the public and control room operator. Appendix K presents the input assumptions for this analysis. The calculations are performed using the NRC Code RADTRAD
- Direct doses from containment shine, charcoal filters in the Control Complex and the plume outside the control room. These direct doses are considered in the control room dose analysis and are discussed below.

Additionally, the LOCA dose is the bounding dose for CCHE/CREVS operability. Therefore, the margin between the LOCA dose and the 10CFR50.67 limit of 5 REM TEDE will be used to establish the new breach margin for the CCHE. This analysis is discussed below.

The control room dose from sources outside the control room will all be direct gamma dose and hence will be a Deep Dose Equivalent (DDE). Therefore, the calculated dose can be added directly to the TEDE from activity inside the control room to get a total TEDE.

The dose due to the plume outside the control room was calculated in M-97-0110, Rev 4 to be 0.01 REM. Based on the reduced magnitude and delayed timing of the AST compared to the TID-14844 source term, the plume dose rate will be less for the AST. Assumptions such as the containment leak rate have not been changed that would affect this conclusion. It is therefore conservative to assume that the direct dose in the control room from the plume shine from outside the control room is the same as calculated in M-97-0110, or 0.01 REM.

The dose from containment shine was calculated in M-97-0110 to be 0.03 REM. Since the plume whole body dose from containment leakage is directly related to the containment airborne concentration, the above logic is also applicable to this source. The TID contribution from containment shine will be greater than the AST contribution. Therefore, it is conservative to use the dose of 0.03 REM as calculated in M-97-0110 for this AST analysis.

The dose from the control complex charcoal filters was calculated in M-97-0110 to be 0.026 REM. In this case, a number of changes have been made to assumptions that affect the amount of iodines and particulates taken into the control complex (e.g.- control complex inleakage rate). The changes are such that the integrated activity taken into the control complex is greater for the AST analysis. Therefore, it is not conservative to use the dose from M-97-0110. An approximate measure of the integrated activity in the control complex over 30 days, and hence eventually on the control complex filters, can be determined by evaluating the 30 day thyroid dose. For the TID analysis in M-97-0110, the 30 day operator thyroid dose is approximately 19 REM. For the AST analysis, the thyroid dose is approximately 110 REM, or approximately 6 times greater. Other factors, such as the effects of other particulates besides iodine can also have an effect. However, the calculation of direct dose from the filters in M-97-0110 is very conservative as it only used a concrete thickness of 1 foot between the filters on the 164' level of the control complex and the control room on the 145' level. The actual shielding thickness is a minimum of 2 feet of concrete. This extra foot of concrete would reduce the dose by at least a factor of 10. This factor of 10 would more than compensate for the effects of other nuclides or other minor differences. Therefore, the direct dose from the filters for the AST case will conservatively be estimated as 6 x 0.026 REM = 0.16 REM.

Controlled breaches are allowed to be opened in the Control Complex Habitability Envelope to a size that would ensure that the dose remains within the 5 REM TEDE acceptance criterion. The margin to this acceptance criterion based on the results below is 5.0 - 4.29 = 0.71 REM.

RADTRAD runs were made varying the control complex inleakage until a total dose of 5 REM was achieved. These calculations determined that an additional 400 cfm from controlled breaches would be acceptable. Calculation M-97-0137, Rev. 4 presented information on the inleakage rate as a function of breach size. Page 23 of that calculation concludes that at the maximum delta p expected across the CCHE boundary (0.2 " w.g.), there is 8.02 cfm of inleakage per in^2 of opening.

Therefore, the 400 cfm allowed breach inleakage corresponds to a breach size of: 400/8.02 = 50 in^2.

Results:

EAB TEDE – 7.59 REM (0.8 to 2.8 hrs is worst 2 hour period)
LPZ TEDE = 1.12 REM
Control Room TEDE = 4.29 REM
Control Room Breach Margin = 50 in^2

6. Letdown Line Rupture – FSAR Section 14.2.2.6

Scenario - At time zero, the letdown line outside containment is postulated to break releasing primary coolant in the Auxiliary Building. For the first six minutes, control room personnel try to keep the reactor at full power. During this time period, the control room is still assumed to be in normal makeup, with 5700 cfm of outside air. No credit is taken for the automatic radiation monitor isolation. No credit is taken for the Auxiliary Building filters in reducing the release to the environment.

At approximately six minutes, the reactor trips. At this time, there are two scenarios analyzed. The first assumes that with the reactor trip, simultaneously, there is a Loss Of Offsite Power (LOOP). As a result of the LOOP, control room ventilation trips resulting in no makeup or recirculation of the air within the control room. Because there is a LOOP, the Auxiliary Building Ventilation System loses power, however, this does not factor into the dose scenarios as no credit had been assumed for the Auxiliary Building filters. At this time, unfiltered inleakage into the control room begins.

The second scenario assumes that with the reactor trip at approximately 6 minutes, there is no simultaneous LOOP. Therefore, the control room ventilation continues to operate with a normal makeup of 5700 cfm. The Auxiliary Building ventilation would continue to operate, however, this does not factor into the dose scenarios as no credit had been assumed for the Auxiliary Building filters.

The accident continues with these conditions until 19.5 minutes. At this time, control room personnel recognize and isolate the letdown line break ending the release.

For the scenario with the LOOP, it was assumed that the control room recirculation filters are started 30 minutes after the LOOP; therefore, at 36 minutes into the accident, the control room filtered recirculation is started. From this time, all conditions remain the same until the end of the dose calculation scenario (30 days). For the scenario without the LOOP, the control room is assumed to operate in the normal ventilation mode (5700 cfm intake, no recirculation filters) until the end of the dose calculation period (30 days).

The release rate calculations evaluated two scenarios in accordance with Standard Review Plan 15.6.2. The two scenarios are the accident initiated spike and the pre-accident spike cases. Therefore, there are a total of four scenarios:

Case 1 – LOOP / Pre-accident spike
Case 2 – LOOP / Post-accident spike
Case 3 – No LOOP / Pre-accident spike
Case 4 – No LOOP / Post-accident spike

The activity release rate into the auxiliary building was calculated by FTI and presented in FTI Document 86-1266335-00, "CR-3 Letdown Line Break SRP Activities." The activity release rates are based on the following:

- The thermal hydraulic calculations of M-96-0043 for the break flow rates.
- For the post-accident spike case - an equilibrium reactor coolant concentration of noble gases and iodines corresponding to the Technical Specification limit of 1 μCi/gm Dose Equivalent I-131, followed by a spike factor of 500 in the steady state iodine release rate from the fuel.
- For the pre-accident spike case – a reactor coolant iodine concentration corresponding to the Technical Specification short-term concentration limit of 60

μCi/gm Dose Equivalent I-131 and a noble gas concentration corresponding to the 1 μCi/gm Dose Equivalent I-131 limit.

- An assumed carryover fraction from the RCS liquid to the Auxiliary Building atmosphere of 100% of the noble gases and 10% of the iodines.

Analysis – The analysis was performed with RADTRAD. Appendix L presents the input assumptions and their bases.

Results:

EAB TEDE (0-2 hr is worst 2 hour period)
Pre-accident spike – 0.614 REM
Post-accident spike – 0.078 REM

LPZ TEDE
Pre-accident spike – 0.054 REM
Post-accident spike – 0.0068 REM

Control Room TEDE – LOOP – CR Isolation/Filtration
Pre-accident spike – 0.895 REM
Post-accident spike – 0.060 REM

Control Room TEDE – no LOOP – no CR Isolation/Filtration
Pre-accident spike – 3.24 REM
Post-accident spike – 0.339 REM

7. Waste Gas Decay Tank Rupture – FSAR Section 14.2.2.8

Scenario - The entire contents of all three waste gas decay tanks is assumed to be released. Each tank is assumed to be at its maximum allowed activity as specified in the Offsite Dose Calculation Manual. This is a very conservative assumption, as the activity in two tanks would have significantly decayed while the third tank was being filled. The activity released from the tanks is assumed to be released to the environment instantaneously. There is no credit for mitigation features such as filters.

Analysis – The dose to the public was analyzed using RADTRAD. The input assumptions and their bases are provided in Appendix M. The releases from this accident are small compared to other accidents, so the control room dose is not analyzed.

Results:

EAB TEDE – 0.125 REM (0-2 hr is worst 2 hr period)
LPZ TEDE – 0.011 REM

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CRYSTAL RIVER UNIT 3

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APPENDIX C

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Main Steam Line Break Inputs/Analysis

Main Steam Line Break
Inputs/Analysis

The doses for the MSLB were not reanalyzed with RADTRAD. The results of the current dose calculation were adjusted to TEDE results.

1. Table 1 presents most of the input assumptions and their basis from the existing dose assessment.

2. The first Excel spreadsheet is Attachment 1 from the existing calculation and presents nuclide specific assumptions such as RCS concentration and dose conversion factors. This spreadsheet was used to calculate the whole body and thyroid dose. The calculations on this spreadsheet are:

   Column (F) = (B) x (C) x (D) x (E)
   Column (H) = (B) x (G) x (D) x (E)
   Column (J) = (B) x (I) x (D) x (E)
   Column (L) = (B) x (K) x (D) x (E)
   Column (T) = (F) x (M) x (Q) x (R)
   Column (U) = (F) x (M) x (S)
   Column (V) = (F) x (N) x (Q) x (R)
   Column (W) = (F) x (N) x (S)
   Column (X) = (H) x (N) x (Q) x (R)
   Column (Y) = (H) x (N) x (S)
   Column (Z) = (J) x (O) x (Q) x (R)
   Column (AA) = (J) x (O) x (S)
   Column (AB) = (L) x (P) x (Q) x (R)
   Column (AC) = (L) x (P) x (S)

3. The second Excel spreadsheet is from the new assessment that converts the results to TEDE results. The calculations on this spreadsheet are:

   Column (I) = (G) x (H)
   Column (J) = (I) ÷ (F)
   Column (K) = (B) x (H) ÷ (J)
   Column (L) = (K) + (C)
   Column (M) = (D) x (H) ÷ (J)
   Column (N) = (M) + (E)

List of Design Inputs/ Assumptions for
Main Steam Line Break Dose Calculations

Input/Assumption	Basis
1. Core Power Level: 2568 MWt	1. Potential Uprated Power Bounds Licensed Power of 2544 MWt
2. Core Power Level used for Nuclide Inventory 1.02*2568 = 2619 MWt	2. Conservative 2% measurement uncertainty
3. Reactor Coolant Concentration See Attachment 1 for nuclide specific Activities in μCi/gm	3. Calculation M-98-0109 Based on operation with 1% degraded fuel clad. No fuel damage resulting from MSLB
4. Volume of primary and secondary releases Primary 0-2 hrs - 802 lbm 2-8 hrs - 2791.44 lbm 8-24 hrs - 7443.85 lbm 24-96 hrs - 28379.68 lbm Secondary 0-2 hrs - 200866 lbm	4. T/H Calculation 32-1266196-00
5. Atmospheric Dispersion (X/Q) EAB (0-2 hr) - 1.6 E-4 sec/m^3 LPZ (0-8 hr) - 1.4 E-5 sec/m^3 LPZ (8-24 hr) - 1.5 E-6 sec/m^3 LPZ (24-96 hr) - 7.7 E-7 sec/m^3	5. NUS-1753 - also summarized in Table 2-18 of the FSAR
6. Breathing Rate - 3.47E-4 m^3/sec	6. TID-14844
7. Dose Conversion Factors See Attachment 1 for Specific Values	7. ICRP-30 for thyroid TACT-5 Code for whole body RADTRAD for TEDE conversion
8. Secondary Side Concentration 4.5 E-4 μCi/gm	8. Technical Specifications Section 3.7.16

Attachment 1
Main Steam Line Break
Public Dose

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
Nuclide	RCS Conc	Vol. RCS	Factor	Factor	Primary	Vol. RCS	Primary	Vol RCS	Primary	Vol RCS
	uCi/gm	leak (lbm)	gm/lbm	Ci/uCi	Ci released	leak (lbm)	Ci released	leak (lbm)	Ci released	leak (lbm)
		0-2 hr			0-2 hr	2 hr- 8 hr	2 hr - 8 hr	8 hr - 24 hr	8 hr - 24 hr	24 hr - 96 hr
I131	5.18E+00	8.02E+02	4.54E+02	1.00E-06	1.89	2791.40	6.56	7443.85	17.51	28379.68
I132	1.99E+00	8.02E+02	4.54E+02	1.00E-06	0.72	2791.40	2.52	7443.85	6.73	28379.68
I133	6.20E+00	8.02E+02	4.54E+02	1.00E-06	2.26	2791.40	7.86	7443.85	20.95	28379.68
I134	6.90E-01	8.02E+02	4.54E+02	1.00E-06	0.25	2791.40	0.87	7443.85	2.33	28379.68
I135	2.53E+00	8.02E+02	4.54E+02	1.00E-06	0.92	2791.40	3.21	7443.85	8.55	28379.68
Kr83m	4.58E-01	8.02E+02	4.54E+02	1.00E-06	0.17	2791.40	0.58	7443.85	1.55	28379.68
Kr85	1.95E+01	8.02E+02	4.54E+02	1.00E-06	7.10	2791.40	24.71	7443.85	65.90	28379.68
Kr85m	2.26E+00	8.02E+02	4.54E+02	1.00E-06	0.82	2791.40	2.86	7443.85	7.64	28379.68
Kr87	1.17E+00	8.02E+02	4.54E+02	1.00E-06	0.43	2791.40	1.48	7443.85	3.95	28379.68
Kr88	3.62E+00	8.02E+02	4.54E+02	1.00E-06	1.32	2791.40	4.59	7443.85	12.23	28379.68
Xe131m	2.52E+00	8.02E+02	4.54E+02	1.00E-06	0.92	2791.40	3.19	7443.85	8.52	28379.68
Xe133m	4.22E+00	8.02E+02	4.54E+02	1.00E-06	1.54	2791.40	5.35	7443.85	14.26	28379.68
Xe133	4.00E+02	8.02E+02	4.54E+02	1.00E-06	145.64	2791.40	506.92	7443.85	1351.80	28379.68
Xe135m	4.28E-01	8.02E+02	4.54E+02	1.00E-06	0.16	2791.40	0.54	7443.85	1.45	28379.68
Xe135	1.13E+01	8.02E+02	4.54E+02	1.00E-06	4.11	2791.40	14.32	7443.85	38.19	28379.68
Xe138	6.92E-01	8.02E+02	4.54E+02	1.00E-06	0.25	2791.40	0.88	7443.85	2.34	28379.68
TOTAL										

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Attachment 1
Main Steam Line Break
Public Dose

(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)
Primary	X/Q-EAB	X/Q-LPZ	X/Q-LPZ	X/Q-LPZ	BR	Thy DCF	WB DCF	EAB Thy	EAB-WB	LPZ-Thy	LPZ-WB
Ci released	sec/m3	sec/m3	sec/m3	sec/m3	m3/sec	REM/Ci	REM m3/sec Ci	REM	REM	REM	REM
24 hr - 96 hr	0-2 hr	0-8 hr	8-24 hr	24-96 hr						0-2 hr	0-2 hr
66.74	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	1.10E+06	5.59E-02	0.115	1.69E-05	1.01E-02	1.48E-06
25.64	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	6.30E+03	3.55E-01	0.000	4.12E-05	2.22E-05	3.60E-06
79.88	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	1.80E+05	9.11E-02	0.023	3.29E-05	1.97E-03	2.88E-06
8.89	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	1.10E+03	4.11E-01	0.000	1.65E-05	1.34E-06	1.45E-06
32.60	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	3.10E+04	2.49E-01	0.002	3.67E-05	1.39E-04	3.21E-06
5.90	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	1.27E-05	0	3.39E-10	0.00E+00	2.97E-11
251.25	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	3.31E-04	0	3.76E-07	0.00E+00	3.29E-08
29.12	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	2.31E-02	0	3.04E-06	0.00E+00	2.66E-07
15.07	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	1.33E-01	0	9.07E-06	0.00E+00	7.93E-07
46.64	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	3.38E-01	0	7.13E-05	0.00E+00	6.24E-06
32.47	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	1.25E-03	0	1.84E-07	0.00E+00	1.61E-08
54.37	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	4.29E-03	0	1.05E-06	0.00E+00	9.23E-08
5153.75	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	4.96E-03	0	1.16E-04	0.00E+00	1.01E-05
5.51	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	6.37E-02	0	1.59E-06	0.00E+00	1.39E-07
145.59	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	3.59E-02	0	2.36E-05	0.00E+00	2.07E-06
8.92	0.00016	0.000014	1.50E-06	7.70E-07	0.000347	0	1.87E-01	0	7.54E-06	0.00E+00	6.60E-07
								0.140	3.77E-04	1.22E-02	3.30E-05

Attachment 1
Main Steam Line Break
Public Dose

(X)	(Y)	(Z)	(AA)	(AB)	(AC)	(X)	
LPZ-Thy	LPZ-WB	LPZ-Thy	LPZ-WB	LPZ-Thy	LPZ-WB	Nuclide	
REM	REM	REM	REM	REM	REM		
2 - 8 hr	2 - 8 hr	8 - 24 hr	8 - 24 hr	24 - 96 hr	24 - 96 hr		
3.51E-02	5.14E-06	1.00E-02	1.47E-06	1.96E-02	2.87E-06	I131	
7.72E-05	1.25E-05	2.21E-05	3.58E-06	4.32E-05	7.01E-06	I132	
6.87E-03	1.00E-05	1.96E-03	2.86E-06	3.84E-03	5.60E-06	I133	
4.67E-06	5.03E-06	1.34E-06	1.44E-06	2.61E-06	2.81E-06	I134	
4.83E-04	1.12E-05	1.38E-04	3.19E-06	2.70E-04	6.25E-06	I135	
0.00E+00	1.03E-10	0.00E+00	2.95E-11	0.00E+00	5.77E-11	Kr83m	
0.00E+00	1.15E-07	0.00E+00	3.27E-08	0.00E+00	6.40E-08	Kr85	
0.00E+00	9.26E-07	0.00E+00	2.65E-07	0.00E+00	5.18E-07	Kr85m	
0.00E+00	2.76E-06	0.00E+00	7.89E-07	0.00E+00	1.54E-06	Kr87	
0.00E+00	2.17E-05	0.00E+00	6.20E-06	0.00E+00	1.21E-05	Kr88	
0.00E+00	5.59E-08	0.00E+00	1.60E-08	0.00E+00	3.13E-08	Xe131m	
0.00E+00	3.21E-07	0.00E+00	9.18E-08	0.00E+00	1.80E-07	Xe133m	
0.00E+00	3.52E-05	0.00E+00	1.01E-05	0.00E+00	1.97E-05	Xe133	
0.00E+00	4.84E-07	0.00E+00	1.38E-07	0.00E+00	2.70E-07	Xe135m	
0.00E+00	7.20E-06	0.00E+00	2.06E-06	0.00E+00	4.02E-06	Xe135	
0.00E+00	2.30E-06	0.00E+00	6.56E-07	0.00E+00	1.28E-06	Xe138	
4.25E-02	1.15E-04	1.21E-02	3.28E-05	2.38E-02	6.43E-05		TOTAL

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MSLB Public Dose
TEDE Conversion

	A	B	C	D	E	F	G	H	I	J
1	Nuclide	EAB Thy	EAB WB	LPZ Thy	LPZ WB	RADTRAD	RADTRAD	Thy CEDE	Thy CEDE	Ratio
2		REM	REM	REM	REM	CEDE Inhal	Thy Inhal	Equiv Fac	DoseFactor	Thy CEDE to
3						Dose Factor	Dose Factor			Tot CEDE
4										
5	I131	1.15E-01	1.69E-05	7.48E-02	1.10E-05	8.89E-09	2.92E-07	0.03	8.76E-09	9.85E-01
6	I132	2.53E-04	4.12E-05	1.65E-04	2.67E-05	1.03E-10	1.74E-09	0.03	5.22E-11	5.07E-01
7	I133	2.26E-02	3.29E-05	1.46E-02	2.14E-05	1.58E-09	4.86E-08	0.03	1.46E-09	9.23E-01
8	I134	1.53E-05	1.65E-05	9.96E-06	1.07E-05	3.55E-11	2.88E-10	0.03	8.64E-12	2.43E-01
9	I135	1.59E-03	3.67E-05	1.03E-03	2.38E-05	3.32E-10	8.46E-09	0.03	2.54E-10	7.64E-01
10										
11	Kr83m	0	3.39E-10	0.00E+00	2.20E-10	0	0	0	0.00E+00	0.00E+00
12	Kr85	0	3.76E-07	0.00E+00	2.44E-07	0	0	0	0.00E+00	0.00E+00
13	Kr85m	0	3.04E-06	0.00E+00	1.97E-06	0	0	0	0.00E+00	0.00E+00
14	Kr87	0	9.07E-06	0.00E+00	5.89E-06	0	0	0	0.00E+00	0.00E+00
15	Kr88	0	7.13E-05	0.00E+00	4.63E-05	0	0	0	0.00E+00	0.00E+00
16										
17	Xe131m	0	1.84E-07	0.00E+00	1.19E-07	0	0	0	0.00E+00	0.00E+00
18	Xe133m	0	1.05E-06	0.00E+00	6.85E-07	0	0	0	0.00E+00	0.00E+00
19	Xe133	0	1.16E-04	0.00E+00	7.51E-05	0	0	0	0.00E+00	0.00E+00
20	Xe135m	0	1.59E-06	0.00E+00	1.03E-06	0	0	0	0.00E+00	0.00E+00
21	Xe135	0	2.36E-05	0.00E+00	1.53E-05	0	0	0	0.00E+00	0.00E+00
22	Xe138	0	7.54E-06	0.00E+00	4.90E-06	0	0	0	0.00E+00	0.00E+00
23										
24	TOTAL	1.40E-01	3.77E-04	9.07E-02	2.45E-04					

	K	L	M	N
1	EAB CEDE	EAB TEDE	LPZ CEDE	LPZ TEDE
2	Dose-REM	REM	Dose-REM	REM
3				
4				
5	3.51E-03	3.52E-03	2.28E-03	2.29E-03
6	1.50E-05	5.62E-05	9.74E-06	3.65E-05
7	7.33E-04	7.66E-04	4.76E-04	4.98E-04
8	1.89E-06	1.84E-05	1.23E-06	1.20E-05
9	6.22E-05	9.89E-05	4.04E-05	6.42E-05
10				
11	0.00E+00	3.39E-10	0.00E+00	2.20E-10
12	0.00E+00	3.76E-07	0.00E+00	2.44E-07
13	0.00E+00	3.04E-06	0.00E+00	1.97E-06
14	0.00E+00	9.07E-06	0.00E+00	5.89E-06
15	0.00E+00	7.13E-05	0.00E+00	4.63E-05
16				
17	0.00E+00	1.84E-07	0.00E+00	1.19E-07
18	0.00E+00	1.05E-06	0.00E+00	6.85E-07
19	0.00E+00	1.16E-04	0.00E+00	7.51E-05
20	0.00E+00	1.59E-06	0.00E+00	1.03E-06
21	0.00E+00	2.36E-05	0.00E+00	1.53E-05
22	0.00E+00	7.54E-06	0.00E+00	4.90E-06
23				
24	4.32E-03	4.70E-03	2.80E-03	3.05E-03

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX D

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Steam Generator Tube Rupture
Licensing Basis Case Inputs/Analysis

List of Design Inputs/ Assumptions for
Steam Generator Tube Rupture Dose Calculations
Licensing Basis Public Dose Case

Input/Assumption	Basis
1. Reactor Coolant Concentration See Attachment 1 for nuclide specific activities in μCi/gm	1. Calculation M-98-0109 Based on operation with 1% degraded fuel clad
2. Primary to secondary break flow 60.38 lbm/sec	2. Calculation 51-1172572-00
3. Existing primary to secondary leak 1 gpm	3. SRP 15.6.3 Conservative compared to Technical Specification limit
4. Release Path Via condenser - 1 minute from ADV/safety	4. Licensing Basis - FSAR Ch 14
5. Fraction from dump/safeties, 8-9 min 0.55	5. B&W 32-1174762-00
6. Time of reactor trip 8 min.	6. B&W 51-1172572-00
7. Time to isolate break/leak flow 8 hours	7. Conservative assumption
8. Iodine DF in condenser 10,000	8. B&W 51-1172572-00
9. Other Removal Mechanisms Radioactive Decay - no credit Iodine removal in OTSG - no credit	9. Conservative assumption
10. Atmospheric Dispersion (X/Q) EAB (0-2 hr) - 1.6 E-4 sec/m^3 LPZ (0-8 hr) - 1.4 E-5 sec/m^3	10. NUS-1753 - also summarized in Table 2-18 of the FSAR
11. Breathing Rate 3.47 E-4 m^3/sec	11. TID-14844
12. Dose Conversion Factors See Attachment 1 for Specific Values	12. ICRP-30 for thyroid TACT-5 Code for whole body RADTRAD for TEDE conversion

LAR #262
Appendix D

Steam Generator Tube Rupture
Public Dose – Licensing Basis Case
Inputs/Analysis

The doses for the SGTR – Licensing Basis case were not reanalyzed with RADTRAD. The results of the current dose calculation were adjusted to TEDE results.

1. The first Table presents most of the input assumptions and their basis from the existing dose assessment.

2. The first Excel spreadsheet is Attachment 1 from the existing calculation and presents nuclide specific assumptions such as RCS concentration and dose conversion factors. This spreadsheet was used to calculate the whole body and thyroid dose. The calculations on this spreadsheet are:

   Column (H) = (B) x (C) x (D) x (E) x (F) x (G)
   Column (K) = (B) x (C) x (D) x (E) x (I) x (J)
   Column (L) = (H) + (K)
   Column (R) = (L) x (M) x (O) x (P)
   Column (S) = (L) x (M) x (Q)
   Column (U) = (B) x (C) x (D) x (E) x (G) x (T)
   Column (V) = (K) + (U)
   Column (W) = (V) x (N) x (O) x (P)
   Column (X) = (V) x (N) x (Q)

3. The second Excel spreadsheet is from the new assessment that converts the results to TEDE results. The calculations on this spreadsheet are:

   Column (I) = (G) x (H)
   Column (J) = (I) ÷ (F)
   Column (K) = (B) x (H) ÷ (J)
   Column (L) = (K) + (C)
   Column (M) = (D) x (H) ÷ (J)
   Column (N) = (M) + (E)

Attachment 1
OTSG Tube Rupture
Public Dose

(A) Nuclide	(B) RCS Conc uCi/gm	(C) RCS leak lb/sec	(D) Conversion gm/lb	(E) Conversion Ci/uCi	(F) 2 hr time sec	(G) Condenser DF	(H) Ci rel cond 0-2hr	(I) Dump rel - sec	(J) Fraction dump	(K) Ci rel dump-1min	(L) Total Ci 0-2hr	(M) X/Q-EAB sec/m3 0-2 hr
I131	5.18E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E-04	0.10	60.00	0.55	4.70	4.80	0.00016
I132	1.99E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E-04	0.04	60.00	0.55	1.80	1.84	0.00016
I133	6.20E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E-04	0.12	60.00	0.55	5.62	5.74	0.00016
I134	6.90E-01	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E-04	0.01	60.00	0.55	0.63	0.64	0.00016
I135	2.53E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E-04	0.05	60.00	0.55	2.29	2.34	0.00016
Kr83m	4.58E-01	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	90.58	60.00	0.55	0.42	90.99	0.00016
Kr85	1.95E+01	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	3856.37	60.00	0.55	17.68	3874.04	0.00016
Kr85m	2.26E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	446.94	60.00	0.55	2.05	448.99	0.00016
Kr87	1.17E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	231.38	60.00	0.55	1.06	232.44	0.00016
Kr88	3.62E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	715.90	60.00	0.55	3.28	719.18	0.00016
Xe131m	2.52E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	498.36	60.00	0.55	2.28	500.65	0.00016
Xe133m	4.22E+00	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	834.56	60.00	0.55	3.83	838.38	0.00016
Xe133	4.00E+02	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	79104.96	60.00	0.55	362.56	79467.52	0.00016
Xe135m	4.28E-01	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	84.64	60.00	0.55	0.39	85.03	0.00016
Xe135	1.13E+01	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	2234.72	60.00	0.55	10.24	2244.96	0.00016
Xe138	6.92E-01	6.05E+01	4.54E+02	1.00E-06	7.20E+03	1.00E+00	136.85	60.00	0.55	0.63	137.48	0.00016
TOTAL												

Attachment 1
OTSG Tube Rupture
Public Dose

(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)
X/Q-LPZ	BR	Thy DCF	WB DCF	EAB Thy	EAB-WB	8 hr time	Ci released	Total Ci	LPZ-Thy	LPZ-WB	Nuclide
sec/m3	m3/sec	REM/Ci	REM m3/sec Ci	REM	REM	sec	Cond 0-8hr	0-8 hr	REM	REM	
0-8 hr									0-8 hr	0-8 hr	
0.000014	0.000347	1.10E+06	5.59E-02	0.293	4.29E-05	2.88E+04	4.10E-01	5.10E+00	2.73E-02	4.00E-06	I131
0.000014	0.000347	6.30E+03	3.55E-01	0.001	1.05E-04	2.88E+04	1.57E-01	1.96E+00	6.00E-05	9.75E-06	I132
0.000014	0.000347	1.80E+05	9.11E-02	0.057	8.37E-05	2.88E+04	4.90E-01	6.11E+00	5.34E-03	7.79E-06	I133
0.000014	0.000347	1.10E+03	4.11E-01	0.000	4.20E-05	2.88E+04	5.46E-02	6.80E-01	3.63E-06	3.91E-06	I134
0.000014	0.000347	3.10E+04	2.49E-01	0.004	9.34E-05	2.88E+04	2.00E-01	2.49E+00	3.75E-04	8.69E-06	I135
0.000014	0.000347	0	1.27E-05	0.000	1.85E-07	2.88E+04	3.62E+02	3.63E+02	0.00E+00	6.45E-08	Kr83m
0.000014	0.000347	0	3.31E-04	0.000	2.05E-04	2.88E+04	1.54E+04	1.54E+04	0.00E+00	7.16E-05	Kr85
0.000014	0.000347	0	2.31E-02	0.000	1.66E-03	2.88E+04	1.79E+03	1.79E+03	0.00E+00	5.79E-04	Kr85m
0.000014	0.000347	0	1.33E-01	0.000	4.95E-03	2.88E+04	9.26E+02	9.27E+02	0.00E+00	1.73E-03	Kr87
0.000014	0.000347	0	3.38E-01	0.000	3.89E-02	2.88E+04	2.86E+03	2.87E+03	0.00E+00	1.36E-02	Kr88
0.000014	0.000347	0	1.25E-03	0.000	1.00E-04	2.88E+04	1.99E+03	2.00E+03	0.00E+00	3.49E-05	Xe131m
0.000014	0.000347	0	4.29E-03	0.000	5.75E-04	2.88E+04	3.34E+03	3.34E+03	0.00E+00	2.01E-04	Xe133m
0.000014	0.000347	0	4.96E-03	0.000	6.31E-02	2.88E+04	3.16E+05	3.17E+05	0.00E+00	2.20E-02	Xe133
0.000014	0.000347	0	6.37E-02	0.000	8.67E-04	2.88E+04	3.39E+02	3.39E+02	0.00E+00	3.02E-04	Xe135m
0.000014	0.000347	0	3.59E-02	0.000	1.29E-02	2.88E+04	8.94E+03	8.95E+03	0.00E+00	4.50E-03	Xe135
0.000014	0.000347	0	1.87E-01	0.000	4.11E-03	2.88E+04	5.47E+02	5.48E+02	0.00E+00	1.43E-03	Xe138
				0.355	0.128				3.31E-02	4.44E-02	Total

	A	B	C	D	E	F	G	H	I	J
1	Nuclide	EAB Thy	EAB WB	LPZ Thy	LPZ WB	RADTRAD	RADTRAD	Thy CEDE	Thy CEDE	Ratio
2		REM	REM	REM	REM	CEDE Inhal	Thy Inhal	Equiv Fac	DoseFactor	Thy CEDE to
3						Dose Factor	Dose Factor			Tot CEDE
4										
5	I131	2.93E-01	4.29E-05	2.73E-02	4.00E-06	8.89E-09	2.92E-07	0.03	8.76E-09	9.85E-01
6	I132	6.45E-04	1.05E-04	6.00E-05	9.75E-06	1.03E-10	1.74E-09	0.03	5.22E-11	5.07E-01
7	I133	5.74E-02	8.37E-05	5.34E-03	7.79E-06	1.58E-09	4.86E-08	0.03	1.46E-09	9.23E-01
8	I134	3.90E-05	4.20E-05	3.63E-06	3.91E-06	3.55E-11	2.88E-10	0.03	8.64E-12	2.43E-01
9	I135	4.03E-03	9.34E-05	3.75E-04	8.69E-06	3.32E-10	8.46E-09	0.03	2.54E-10	7.64E-01
10										
11	Kr83m	0	1.85E-07	0.00E+00	6.45E-08	0	0	0	0.00E+00	0.00E+00
12	Kr85	0	2.05E-04	0.00E+00	7.16E-05	0	0	0	0.00E+00	0.00E+00
13	Kr85m	0	1.66E-03	0.00E+00	5.79E-04	0	0	0	0.00E+00	0.00E+00
14	Kr87	0	4.95E-03	0.00E+00	1.73E-03	0	0	0	0.00E+00	0.00E+00
15	Kr88	0	3.89E-02	0.00E+00	1.36E-02	0	0	0	0.00E+00	0.00E+00
16										
17	Xe131m	0	1.00E-04	0.00E+00	3.49E-05	0	0	0	0.00E+00	0.00E+00
18	Xe133m	0	5.75E-04	0.00E+00	2.01E-04	0	0	0	0.00E+00	0.00E+00
19	Xe133	0	6.31E-02	0.00E+00	2.20E-02	0	0	0	0.00E+00	0.00E+00
20	Xe135m	0	8.67E-04	0.00E+00	3.02E-04	0	0	0	0.00E+00	0.00E+00
21	Xe135	0	1.29E-02	0.00E+00	4.50E-03	0	0	0	0.00E+00	0.00E+00
22	Xe138	0	4.11E-03	0.00E+00	1.43E-03	0	0	0	0.00E+00	0.00E+00
23										
24	TOTAL	3.55E-01	1.28E-01	3.31E-02	4.44E-02					

	K	L	M	N
1	EAB CEDE	EAB TEDE	LPZ CEDE	LPZ TEDE
2	Dose-REM	REM	Dose-REM	REM
3				
4				
5	8.92E-03	8.96E-03	8.31E-04	8.35E-04
6	3.82E-05	1.43E-04	3.55E-06	1.33E-05
7	1.87E-03	1.95E-03	1.74E-04	1.81E-04
8	4.81E-06	4.68E-05	4.48E-07	4.36E-06
9	1.58E-04	2.52E-04	1.47E-05	2.34E-05
10				
11	0.00E+00	1.85E-07	0.00E+00	6.45E-08
12	0.00E+00	2.05E-04	0.00E+00	7.16E-05
13	0.00E+00	1.66E-03	0.00E+00	5.79E-04
14	0.00E+00	4.95E-03	0.00E+00	1.73E-03
15	0.00E+00	3.89E-02	0.00E+00	1.36E-02
16				
17	0.00E+00	1.00E-04	0.00E+00	3.49E-05
18	0.00E+00	5.75E-04	0.00E+00	2.01E-04
19	0.00E+00	6.31E-02	0.00E+00	2.20E-02
20	0.00E+00	8.67E-04	0.00E+00	3.02E-04
21	0.00E+00	1.29E-02	0.00E+00	4.50E-03
22	0.00E+00	4.11E-03	0.00E+00	1.43E-03
23				
24	1.10E-02	1.39E-01	1.02E-03	4.55E-02

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX E

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Steam Generator Tube Rupture
Standard Review Plan Case Inputs/Analysis

RADTRAD Inputs
For Steam Generator Tube Rupture
SRP Analysis
Public and Control Room Dose

There were 8 RATRAD runs:

Case 1 - Pre-accident spike – Time Steps 1-4
Case 2 – Post-accident spike – Time Steps 1-4

Most of the inputs remain the same for all 8 runs. The primary changes were to the nuclide files in both the curies available for release and the time of the release. The following presents each RADTRAD input parameter. Differences between runs are noted. If no differences are noted, the input was the same for all 8 runs.

All of the runs will involve modification to the assumed core inventories built into the RADTRAD nuclide libraries, with the use of an assumed power level of 1 MWt. A separate run will be required for each time step, due to the manner in which RADTRAD uses decay (explained further below under Source Term). The results of each time step will then have to be summed to get the total dose. This is the standard method to be used to model the control room dose for accidents where the release input is based on the known release in curies of each nuclide as a function of time. The releases are based on the assumed reactor coolant activity. The TID libraries from RADTRAD will be used as those libraries contain more of the noble gas nuclides than the NUREG-1465 libraries. The NUREG-1465 libraries are not required as there is no fuel failure at the time of the accident and no particulate activity is assumed to be released.

The following are the RADTRAD inputs:

A. Compartments

1. Secondary Side – the releases from the tube rupture will be into the Secondary Side.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 1 ft^3 – This is an arbitrary low value, which will be combined with an arbitrary high flow rate to ensure all the activity is released within seconds.
c. Source term fraction – 1 – This value is based on the fact that the nuclide and release fraction libraries will be adjusted such that the core contains a curie inventory equal to the curies released to the secondary side from Attachment 2.
d. Compartment features – none selected.

2. Environment

a. Compartment type – Environment - This defeats all other input parameters.

3. Control Room

a. Compartment type – Control Room
b. Volume - 3.649E+05 ft^3 – (Design Input Transmittal DIT-CR-0044) Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. Hence, RADTRAD will provide conservative results for the Deep Dose Equivalent (DDE) from noble gas submersion. This could be adjusted by hand in the calculation, however, for this calculation, the DDE is such a small fraction of the TEDE dose, that the net effect would be negligible. Therefore no finite cloud correction factor adjustment is performed in this calculation.
c. Compartment Features – Recirculating Filters is turned on.
d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing per Technical Specification 5.6.2.12.
e. Recirculating Filters – Filter efficiencies
   Time 0– all filter efficiencies are 0% as emergency recirculation through filters is not required and is not automatically initiated.
   At Time = 0.63 hours – filter efficiency for all iodine chemical forms is assumed to be 90% as the operator is assumed to manually lineup the emergency filters at 30 minutes after the LOOP, which occurs at 8 minutes. The total time of 38 min = 0.63 hrs. These efficiencies apply until the end of the accident at 30 days. (Although an efficiency of 95% could be assumed for the particulate iodine filter, the value of 90 was chosen to be consistent with the other chemical forms so that the specification of the fraction of each chemical form is unimportant.) The value of 90% is based on the proposed change to ITS 5.6.2.12.

B. Transfer Pathways

1. Leak to environment

a. From Compartment 1 – Secondary Side
b. To Compartment 2 – Environment
c. Transfer mechanism – "Filter" selected –No credit for filters is taken. "Filter" is chosen for ease of input as the Filter panel allows flow inputs in cfm.
d. Filter Efficiency Panel – Flow rate – 10000 cfm – This is an arbitrary value, which combined with the secondary side volume of 1 ft3 entered above, will ensure all activity is released within seconds.
e. Filter Efficiency Panel – The filter efficiency is assumed to be 0% for the course of the accident as no credit is taken for filters for any of the cases.
f. Active Pathway – Yes

2. Unfiltered inflow

a. From Compartment 2 – Environment
b. To Compartment 3 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate –For the first 0.13 hrs, normal ventilation remains on and the intake flow is 5700 cfm. At 0.13 hrs, with the LOOP, the normal ventilation fans are lost and only inleakage exists. The inleakage is assumed to be 1000 cfm, consistent with the proposed License Amendment. The value of 1000 cfm is approximately 2 times the maximum expected inleakage based on previous tracer gas inleakage tests. The value of 1000 cfm is assumed to last from 0.13 hours to 30 days.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway - Yes

3. Exhaust

a. From Compartment 3 – Control Room
b. To Compartment 2 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.
d. Filter Efficiency Panel –The flow rates as a function of time are set equal to the intake flow rates, 5700cfm from 0 to 0.13 hrs, and 1000 cfm from 0.13 hrs to the end of the accident.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust.
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as only the maximum 2 hour dose will be used. The value is left at the 0-2hr X/Q value to ensure the maximum release period occurs with the maximum X/Q.

d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate for the public (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as only the maximum 2 hour dose will be used. The value is left at the 0-2hr breathing rate value to ensure the maximum release period occurs with the maximum breathing rate.

2. Low Population Zone

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.40E-05 sec/m^3 for the period 0 to 8 hours, 1.50E-06 sec/m^3 for the preiod 8 hours to 24 hours, 7.7E-07 sec/m^3 for the period 24 hours to 96 hours and 4.5E-07 sec/m^3 for the period 96 hours to 30 days. These are the LPZ accident X/Q's for CR3 (NUS-1753).
d. Breathing Rate – 3.47E-04 m^3/sec for the period 0 to 8 hours, 1.75E-04 m^3/sec for the period 8 hours to 24 hours and 2.32E-04 m^3/sec for the period 24 hours to 30 days– these are the Reg. Guide specified breathing rates (Reg. Guide 1.4).

3. Control Room

a. In Compartment 3 – Control Room
b. Breathing Rate Default – not checked
c. X/Q – 9.0E-04 sec/m^3 – this is the 0-8 hr accident X/Q for the CR3 control complex (Letter 3F0588-10). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates at 8 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the specified breathing rate in Murphy and Campe. This value is entered from time 0 to the end of the accident.
e. Occupancy Factor – 1.0 for 0-24 hours, 0.6 for 24 to 96 hours and 0.4 for 96 hours to 30 days. These are the occupancy factors specified by Murphy and Campe.

D. Source Term

Discussion – The thermal hydraulic calculation for the SRP SGTR also calculated the curies released of each nuclide as a function of time. The RADTRAD source term panels require a selection of either Decay or No Decay. If Decay is selected, the activity of each nuclide, whether in the core or some other location, will be decayed with time. Therefore, if the releases from the T/H calculation were entered into RADTRAD as the inventory available for release, and it was released over time, then the initial inventory would decay before all activity was released and the total release would be less than calculated in the T/H analysis. If No Decay were selected, then the total activity released would be consistent with the T/H analysis, however, decay would not be taken credit for as a removal mechanism from the control room. This is an important dose reduction mechanism, especially for noble gases. Therefore, the calculated dose would be higher than necessary. If Decay was selected and all the activity for a given time step was released at the beginning of the time step to ensure no decay was applied to the release, then the dose would be higher than necessary as all of the activity would result in control room doses over the entire time period, rather than a gradual buildup over time. The solution for entering a given curie release into RADTRAD is to run each time step separately. The releases will occur in the middle of the time step and the curies entered for core inventory will be taken from the T/H calculation, but adjusted up to account for decay to the middle of the time step. Decay will be selected in RADTRAD. This method has been demonstrated to work in the RADTRAD code verification report by comparison with existing calculation results. The reasons it works is because: 1) The curie release rates during the periods of highest release were relatively consistent, 2) the time steps chosen were such that there were no changes in plant related scenario inputs (e.g. – CREVS recirc) that would affect dose consequences (other than factors that affect curie release rates which were accounted for by ensuring the release rates during the period were relatively consistent) and 3) most of the dose is due to nuclides with half-lives much greater than the release periods.

1. Nuclide Inventory

a. "User Inventory" is checked.
b. Plant Power –1 MWt – The values of the curies released from the T/H calculation (adjusted for decay to the middle of the time period) will be input in the .nif file in the location for each nuclide that gives the Ci/MWt. The code will multiply this value by the specified power level in MWt. Hence MWt must be 1 for this scenario.
c. NIF File – Eight .nif files will be required. One is required for each of the four release periods chosen. The releases for the pre-accident spike case are different from the post-accident spike case. Therefore, there will be data for four time steps for 2 spike cases, or a total of 8 .nif input files.
The eight files were created by taking the file "tid_def.nif" and modifying the Ci/MWt value for each nuclide. The adjusted curies released for each of the time periods and spike cases are provided in the attached two tables. These curies will be entered in the Ci/MWt location for each nuclide in the .nif file.
d. Decay and No Daughter products is selected. This matches the standard industry dose method. Decay must be selected as discussed above.
e. Iodine Chemical Fractions – TID is selected. This automatically enters values into the boxes for each chemical form. They are not edited. The chemical form is not important for this analysis, as the filter removal is equal for all forms.

2. Release Fractions and Timing

a. User RFT file is selected. Four .rft files will be required. They will be named sgtrts1_def.rft, sgtrts2_def.rft, sgtrts3_def.rft, and sgtrts4_def.rft for the four time steps respectively. These files were created by taking the TID_def.rft file and changing the release durations and fractions. The release durations were chosen to be consistent with the above approach of having the release occur in the middle of the four time periods. The first duration is to the middle of the specified time period, so the duration is entered as 0.065 hrs in sgtrts1_def.rft, 0.38 hrs in sgtrts2_def.rft, 1.21 hrs in sgtrts3_def.rft and 4.9 hrs in sgtrts4_def.rft. The fractional activity released during this period is a nominal 1E-5 for both the iodines and noble gases, to avoid having a zero release period and potential code errors. The second duration is a nominal 1E-5 hrs, so that the entire adjusted curie inventory is released within 1 second. The fractional release during this period is 0.9999 for both the iodines and noble gases. All other values are 0.

b. Delay (hours) - 0 hrs –Standard assumption.
c. Decay and No Daughter products – automatically set the same as the previous panel
d. Iodine chemical fractions – automatically set the same as the previous panel

3. Dose Conversion Factors

a. TID 14844 is selected. This automatically selects the file to be used as tid14.inp. The TID files are being used as they contain more of the noble gas nuclides than the NUREG-1465 files.
b. Decay and No Daughter products – automatically set the same as the previous panel
c. Iodine chemical fractions - automatically set the same as the previous panel

SGTR-Pre-Accident Spike
Adjusted Curie Releases

0-0.13 hr Adj.Ci Rel.	0.13-0.63 hr Adj. Ci Rel.	0.63-1.8 hr Adj. Ci Rel.	1.8-8.0 hr Adj. Ci Rel.	Nuclide
3.794E+00	5.077E+02	2.040E+03	2.032E+00	I131
1.487E+00	2.184E+02	1.124E+03	3.367E+00	I132
4.562E+00	6.161E+02	2.537E+03	2.821E+00	I133
5.306E-01	9.034E+01	6.856E+02	1.162E+01	I134
1.864E+00	2.574E+02	1.125E+03	1.631E+00	I135
2.941E+00	9.612E+00	1.768E+01	1.605E-02	Xe131m
5.029E+00	1.649E+01	3.060E+01	2.890E-02	Xe133m
4.737E+02	1.549E+03	2.857E+03	2.624E+00	Xe133
6.132E-01	4.788E+00	8.768E+01	2.227E+03	Xe135m
1.175E+01	3.930E+01	7.684E+01	9.163E-02	Xe135
5.582E-01	2.058E+00	5.198E+00	1.941E-02	Kr83m
2.723E+00	9.333E+00	1.947E+01	3.095E-02	Kr85m
1.441E+00	5.563E+00	1.589E+01	1.026E-01	Kr87
4.387E+00	1.548E+01	3.490E+01	7.840E-02	Kr88

SGTR -Post -accident Spike
Adjusted Curie Releases

0-0.13 hr Adj.Ci Rel.	0.13-0.63 hr Adj. Ci Rel.	0.63-1.8 hr Adj. Ci Rel.	1.8-8.0 hr Adj. Ci Rel.	Nuclide
1.540E-01	6.862E+01	6.996E+02	1.897E+00	I131
2.959E-01	2.012E+02	2.819E+03	2.361E+01	I132
2.558E-01	1.308E+02	1.410E+03	4.319E+00	I133
2.467E-01	2.024E+02	4.209E+03	2.000E+02	I134
1.748E-01	1.027E+02	1.204E+03	4.853E+00	I135
2.941E+00	9.612E+00	1.768E+01	1.605E-02	Xe131m
5.029E+00	1.649E+01	3.060E+01	2.890E-02	Xe133m
4.737E+02	1.549E+03	2.857E+03	2.624E+00	Xe133
6.132E-01	4.788E+00	8.768E+01	2.227E+03	Xe135m
1.175E+01	3.930E+01	7.684E+01	9.163E-02	Xe135
5.582E-01	2.058E+00	5.198E+00	1.941E-02	Kr83m
2.723E+00	9.333E+00	1.947E+01	3.095E-02	Kr85m
1.441E+00	5.563E+00	1.589E+01	1.026E-01	Kr87
4.387E+00	1.548E+01	3.490E+01	7.840E-02	Kr88

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX F

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Fuel Handling Accident RADTRAD Inputs

RADTRAD Inputs
for the
Fuel Handling Accident

The following are the RADTRAD code inputs:

A. Compartments

1. Containment – Although called the containment, since the scenario for the FHA in containment or in the SFP at CR3 is the same, this compartment represents the containment or the spent fuel pool area.

a. Compartment type – Other – since it is not the environment or control room.

b. Volume – 1 ft^3 – This is an arbitrary low value, which will be combined with an arbitrary high flow rate to ensure all the activity is released within a few minutes. This will ensure that all activity is released within the 2 hour X/Q period.

c. Source term fraction – 1.02 E-02 – This value is based on the following:
Number of fuel pins that fail – all pins in one assembly – conservative, non-mechanistic assumption – NRC SER 5/6/80
Number of assemblies in the core – 177 – Tech Spec 4.2.1
Peaking factor of failed assembly – 1.8 – Cycle 12 reload report
Therefore fraction of core inventory = 1/177 x 1.8 = 1.02 E-02
Note that this fraction will not represent the actual fraction in the "containment" air as it does not account for the fact that only the fuel gap activity is released and does not account for the iodine removal by the spent fuel pool or reactor cavity water. These two factors do not apply equally to all nuclides and hence can not be incorporated into a generic factor such as this one. Adjustments for these other factors will be incorporated into inputs discussed below.

d. Compartment features – none selected.

2. Environment

Compartment type – Environment - This defeats all other input parameters.

3. Control Room

a. Compartment type – Control Room

b. Volume - 3.649E+05 ft^3 – Basis – S&L Design Input Transmittal DIT-CR-0044, "Control Complex Volume, 10/1/97. Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used, as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. Since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. This could be adjusted by hand in the calculation, but was not due to the small contribution to TEDE from the noble gas submersion for this accident.

c. Compartment Features – None selected. Although the CR3 control complex contains emergency recirculation filters, no credit is being taken for these filters in this calculation. This will justify the ability to move fuel during mode 6 without an operable CCHE or CREVS system.

B. Transfer Pathways

1. Leak to environment

a. From Compartment 1 – Containment
b. To Compartment 2 – Environment
c. Transfer mechanism – "Filter" selected – Although both the containment ventilation and the spent fuel pool ventilation is released through HEPA and charcoal filters, no credit is taken for these filter systems. The reason filters is selected is because this is the place in the code where credit will be taken for the DF for iodine afforded by the water above the fuel in the reactor cavity or spent fuel pool.
d. Filter Efficiency Panel – Flow rate – 300 cfm – This is an arbitrary value, which combined with the containment volume of 1 ft3 entered above, will ensure all activity is released within the first few minutes. The 300 cfm flow rate is assumed to last for 2 hours at which time it is changed to zero as all activity has been released.
e. Filter Efficiency Panel – Filter efficiency is entered as 99% for all chemical forms of iodine for the 0 to 2 hour period. This 99% accounts for an effective DF of 100 for the combined iodine species in the water above the fuel. Note that Regulatory Guide 1.183 specifies different water removal efficiencies for the different chemical forms, which when combined with the assumed percentage mix of the species, results in an overall effective DF of 200. Since CR3 does not assume different filter efficiencies for the different chemical forms for the control room recirculation filters, the chemical form percentages are not important. Thus, it is easier to apply an overall effective DF.
The decontamination factors in the guidelines are based on experimentally determined factors as presented in WCAP-7518-L. The experiments were performed at various internal rod pressures. The conclusions were based on a maximum of 1200 psig, which was bounding in 1970. The experiments were also done at various water depths, but the conclusions were written for a depth of 23 feet, which was the depth of water above the stored fuel in a typical fuel pool. The measured DF under these conditions was significantly greater than 100. The industry has recognized that with 23 feet of water above the stored fuel, there may not be 23 feet of water above the dropped damaged fuel, as it would likely be lying on top of the storage racks. Additionally, with today's extended burnup cores, the internal rod pressures can exceed 1200 psig. The experimental data in the WCAP allows for extrapolation to

higher pressures and reduced water levels. A Framatome analysis of the allowable iodine DF for high burnup cores and water depths of 21 feet concludes that a total effective DF of 100 is still conservative and acceptable. The effective DF of 200 in Regulatory Guide 1.183 will not be used since the water level above a damaged assembly lying on the racks at CR3 can be between 21 and 23 feet.

f. Active Pathway – Yes

2. Unfiltered inflow

a. From Compartment 2 – Environment
b. To Compartment 3 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – It is assumed that normal ventilation remains in service for the course of the accident. Therefore, the flow rate is 5700 cfm from T=0 to 30 days. Letter 3F0587-11 provides the specification of 5700 cfm for use as the control room normal intake flow. Modifications performed to CREVS since that time have reduced the actual flow. Flow testing performed per MP-217 on 8/6/99 measured an intake flow of 4192 cfm. This is well within the 5700 cfm. The higher the assumed flow, the more conservative the results.
e. Filter efficiencies – 0% - as noted above this is unfiltered intake or inleakage.
f. Active Pathway - Yes

3. Exhaust

a. From Compartment 3 – Control Room
b. To Compartment 2 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – The exhaust rate is assumed equal to the intake rate. Therefore, the exhaust rate is 5700 cfm for the entire course of the accident.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust.
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 2 – Environment

b. Breathing Rate Default – not checked
c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates at 2 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate. (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates at 2 hours.

2. Low Population Zone

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.40E-05 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates at 2 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates at 2 hours.

3. Control Room
a. In Compartment 3 – Control Room
b. Breathing Rate Default – not checked
c. X/Q – 9.0E-04 sec/m^3 – this is the 0-8 hr accident X/Q for the CR3 control complex. (Letter 3F0588-10). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates at 2 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the specified breathing rate from Murphy and Campe. This value is entered from time 0 to the end of the accident.
e. Occupancy Factor – 1.0 for the first 24 hours, 0.6 for the subsequent 72 hours and then 0.4 for the remainder of the accident. These are the standard values from Murphy and Campe.

D. Source Term

1. Nuclide Inventory

a. User Inventory is checked.
b. Plant Power – 2619 MWt – this is the potential licensed power plus 2% for instrument uncertainty.
c. NIF file – The file to be used is "Pwr_1183.nif". This file was created by starting with the PWR default inventory file in RADTRAD, "pwr_def.nif", and modifying the Ci/MWt for I-131 and Kr-85. The value for I-131 is increased from the default value of 0.254E5 Ci/MWt to 1.6 times the default value, or 0.406E5 Ci/MWt. The value for Kr-85 is increased from the default value of 0.196E3 Ci/MWt to 2 times the default value, or 0.392E3 Ci/MWt. These adjustments are necessary since 5% will be the assumed fraction of core inventory released from the fuel experiencing clad damage. However, Table 3 of Regulatory Guide 1.183 specifies that the gap fraction for I-131 is 8% and for Kr-85 is 10%. Since the fraction released can not be specified on a

nuclide basis, the equivalent curies released can be adjusted by adjusting the core inventory by the appropriate factor for these two nuclides.

d. Decay and No Daughter products is selected. This matches previous methods.
e. Iodine Chemical Fractions – as noted above, the chemical form is not important for this analysis as all removal factors are equivalent. Therefore, "1465" is checked, which automatically enters the NUREG-1465 fractions.

2. Release Fractions and Timing

a. User RFT file is selected. The file to be selected is fha1183_def.rft. This is a file created by taking the PWR_def.rft file and changing the duration to one time step of 0.1E-05 hr to represent an instantaneous release from the fuel. The fractional release for noble gases for the first time step was specified as a release fraction of 0.05 to account for the fact that only 5% of the noble gases are in the gap. (Kr-85 was adjusted to 10% by modifying the core inventory). The fractional release for iodines for the first time step was specified as a release fraction of 0.05 to account for the fact that only 5% of the iodines are in the gap. (I-131 was adjusted to 8% by modifying the core inventory). Note that the percentage release for all other nuclides is assumed to be zero. Regulatory Guide 1.183 specifies that the gap activity of cesiums and rubidiums should be assumed to be released from the fuel. However, the guidance also states that an infinite DF for particulates in the water over the damaged assembly should be used. Therefore, there would be no cesiums or rubidiums in the air over the pool. Hence, the fraction released for these species is set to zero. The fractional release of all nuclides was changed to zero for all subsequent time steps since there is only one release period.
b. Delay (hours) – This is set to 72 hrs – This is the minimum assumed decay time before fuel can be moved, or heavy loads moved over the fuel. The minimum time for moving fuel allowed by current procedures (FP-203) is 150 hours based on heat load limitations. This could be reduced with revised thermal-hydraulic calculations, but could not be made less than 72 hours.
c. Decay and No Daughter products – automatically set the same as the previous panel
d. Iodine chemical fractions - automatically set the same as the previous panel

3. Dose Conversion Factors

a. MACCS-60 – FGR 11 & 12 is selected. This automatically selects the file to be used. These are dose factors to be used with the AST source term. They are the same factors used for TID; there are just more nuclides in the library.
b. Decay and No Daughter products – automatically set the same as the previous panel.
c. Iodine chemical fractions - automatically set the same as the previous panel.

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CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX G

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Control Rod Ejection Accident
Containment Release RADTRAD Inputs

RADTRAD Inputs
for the
Control Rod Ejection Accident
Containment Releases

A. Compartments

1. Containment –This run is calculating the dose from the assumed releases into the containment. A separate run is made for releases via the secondary side.

    a. Compartment type – Other – since it is not the environment or control room.
    b. Volume – 2.0 E6 ft^3 – This is the free air volume of the containment per calculation M-98-0010, Rev. 0
    c. Source term fraction – 1 – The fraction of core inventory released into the containment will be accounted for in the release fraction table. Therefore, this value is 1 as this run assumes all activity is released to the containment.
    d. Compartment features – Natural Deposition is selected. No credit for sprays is taken in the CRE, as the spray activation setpoint may not be reached. Credit can be taken for natural deposition per DG-1081, Appendix H.
    e. Natural Deposition Panel – "Powers Containment" option is selected. In Appendix A of DG-1081, it states that the Power's model (NUREG/CR-6189) is an acceptable model for deposition.
    f. Powers Aerosol Panel – The 10% uncertainty model is chosen. This is the most conservative choice and hence would be acceptable. PWR design basis accident is also chosen.
    g. Elemental iodine panel – no credit is taken for elemental iodine deposition – conservative assumption. Therefore, all values are 0.

2. Environment

    a. Compartment type – Environment - This defeats all other input parameters.

3. Control Room

    a. Compartment type – Control Room
    b. Volume - 3.649E+05 ft^3 – Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. This could be adjusted by hand in the calculation, however, for this analysis the TEDE contribution from the noble gas submersion is so small that no adjustment was made.
    c. Compartment Features – Recirculating Filters is turned on.

d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing in the Technical Specifications.
e. Recirculating Filters – Filter efficiencies
Time 0 – all filter efficiencies are 0% as emergency recirculation through filters is not automatically initiated.
Time = 0.5 hours – filter efficiency for iodine chemical forms is assumed to be 95% for aerosols and 90% for elemental and organic iodine. These are the values justified per the revised test acceptance criteria in the License Amendment Request. The operator is assumed to manually lineup the emergency filters at 30 minutes. These efficiencies apply until the end of the accident at 30 days.

B. Transfer Pathways

1. Leak to environment

a. From Compartment 1 – Containment
b. To Compartment 2 – Environment
c. Transfer mechanism – "Air Leakage" selected – Although containment leakage may be filtered, it can not be assured, hence all leakage is assumed to be unfiltered air leakage. The air leakage panel allows input in terms of %/day, consistent with the units for the Containment leak rate limit.
d. Air Leakage Panel – The leak rate is 0.25%/day for 0 to 24 hours and one-half of that, or 0.125%/day for 24 to 720 hours. The 0.25%/day is the ITS limit. The value is reduced by one-half at 24 hours per DG-1081.
e. Active Pathway – Yes

2. Unfiltered inflow

a. From Compartment 2 – Environment
b. To Compartment 3 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on being approximately 2 times the worst case tracer gas measurement results. The control complex would isolate on RB isolation prior to plume arrival. Therefore, the only intake will be the assumed inleakage. The use of 1000 cfm will be justified in the proposed license amendment request.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway - Yes

3. Exhaust

   a. From Compartment 3 – Control Room
   b. To Compartment 2 – Environment
   c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.
   d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on tracer gas measurements. The exhaust rate is assumed equal to the intake rate.
   e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust.
   f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

   a. In Compartment 2 – Environment
   b. Breathing Rate Default – not checked
   c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753) This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as only the maximum 2 hour dose will be used. The value is left at the 0-2hr X/Q value to ensure the maximum release period occurs with the maximum X/Q.
   d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate for the public (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as only the maximum 2 hour dose will be used. The value is left at the 0-2hr breathing rate value to ensure the maximum release period occurs with the maximum breathing rate.

2. Low Population Zone

   a. In Compartment 2 – Environment
   b. Breathing Rate Default – not checked
   c. X/Q – 1.40E-05 sec/m^3 for the period 0 to 8 hours, 1.50E-06 sec/m^3 for the period 8 hours to 24 hours, 7.7E-07 sec/m^3 for the period 24 hours to 96 hours and 4.5E-07 sec/m^3 for the period 96 hours to 30 days. These are the LPZ accident X/Q's for CR3 (NUS-1753).
   d. Breathing Rate – 3.47E-04 m^3/sec for the period 0 to 8 hours, 1.75E-04 m^3/sec for the period 8 hours to 24 hours and 2.32E-04 m^3/sec for the period 24 hours

to 30 days– these are the Reg. Guide specified breathing rates (Reg. Guide 1.4).

3. Control Room

   a. In Compartment 3 – Control Room
   b. Breathing Rate Default – not checked
   c. X/Q – 9.0E-04 sec/m^3 for the 0-8 hr time period, 5.31E-04 sec/m^3 for the 8 to 24 hour period, 3.38E-04 sec/m^3 for the 24-96 hour period, and 1.49E-04 sec/m^3 for the 96-720 hour period. These are the accident X/Q's for the CR3 control complex from Letter 3F0588-10. They are not adjusted for occupancy time as the occupancy times will be entered separately.
   d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate. This value is entered from time 0 to the end of the accident.
   e. Occupancy Factor – 1.0 for the first 24 hours, 0.6 for the subsequent 72 hours and then 0.4 for the remainder of the accident. These are the standard values from Murphy and Campe.

D. Source Term

1. Nuclide Inventory

   a. "User Inventory" is checked.
   b. Plant Power – 2619 MWt – this is the potential licensed power plus 2% for instrument uncertainty.
   c. NIF file – The file to be used is "pwr_cre.nif". This file was created by starting with the PWR default inventory file in RADTRAD, "pwr_def.nif", and modifying the Ci/MWt for I-131 and Kr-85. The value for I-131 is increased from the default value of 0.254E5 Ci/MWt to 1.2 times the default value, or 0.3048E5 Ci/MWt. The value for Kr-85 is increased from the default value of 0.196E3 Ci/MWt to 1.5 times the default value, or 0.294E3 Ci/MWt. These adjustments are necessary since 10% will be the assumed fraction of core inventory released from the fuel experiencing clad damage. However, Table 3 of DG-1081 specifies that the gap fraction for I-131 is 12% and for Kr-85 is 15%. Since the fraction released can not be specified on a nuclide basis, the equivalent curies released can be adjusted by adjusting the core inventory by the appropriate factor for these two nuclides.
   d. Decay and No Daughter products is selected. This matches standard methods.
   e. Iodine Chemical Fractions – AST is selected. This automatically enters values of 0.95 for aerosol, 0.0485 for elemental, and 0.0015 for organic. They are not edited as this is consistent with the mix specified in DG-1081.

2. Release Fractions and Timing

   a. User RFT file is selected. The file to be selected is cre_def.rft. This file has the following values:

Duration = 0.1E-05 hrs. Unlike the delayed source term for a LOCA, the clad damage in this case is due to the reactivity excursion with the rod ejection. Therefore, all the activity is assumed to be released instantaneously. The value of 0.1E-05 is a nominal value to ensure all activity is released to the containment within 1 second.
Fraction of noble gases, iodines and cesiums released during first time interval = 0.14E-01. This value is based on:
0.14 is the fraction of fuel assumed to experience clad damage (FTI 51-1172602-00)
0.10 is the assumed fraction of core inventory in the gap for these three nuclide groups per Table 3 of DG-1081. The combined fraction is 0.014.
All other values in the rft file are 0 as there are no additional releases over time and no other nuclides assumed to be in the gap. There is no calculated fuel melt for this event at CR-3.

b. Delay(hours) – 0. Release will occur at the time of rod ejection.
c. Decay and No Daughter products – automatically set the same as the previous panel
d. Iodine chemical fractions - automatically set the same as the previous panel

3. Dose Conversion Factors

   a. MACSS 60 (FGR 11& 12) is selected. This automatically selects the file to be used as fgr11&12.inp. This is the default dose factor file to be used with the AST source term.
   b. Decay and No Daughter products – automatically set the same as the previous panel
   c. Iodine chemical fractions - automatically set the same as the previous panel

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX H

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Control Rod Ejection Accident
Secondary Side Release RADTRAD Inputs

RADTRAD Inputs
for the
Control Rod Ejection Accident
Secondary Side Releases

A. Compartments

1. Reactor coolant –This run is calculating the dose from the assumed releases into the reactor coolant and then to the secondary side via primary to secondary leakage. A separate run is made for releases via primary containment leakage. The first compartment selected is the Reactor Coolant as that is where the activity released from the fuel is dispersed. There is no compartment required for the secondary side as the calculation conservatively assumes that all activity released from the primary side to the secondary side is immediately released to the environment, with no removal mechanisms.

    a. Compartment type – Other – since it is not the environment or control room.
    b. Volume – 8162 ft^3 – This is the reactor coolant cold volume per FTI Document 86-1266341-00. The cold volume is used since the samples for primary to secondary leakage determination are cold water samples.
    c. Source term fraction – 1 – The fraction of core inventory released into the reactor coolant will be accounted for in the release fraction table. Therefore, this value is 1 as this run assumes all activity is released to the coolant.
    d. Compartment features – None selected. There are no removal mechanisms assumed in either the primary or secondary sides.

2. Environment

    a. Compartment type – Environment - This defeats all other input parameters.

3. Control Room

    a. Compartment type – Control Room
    b. Volume - 3.649E+05 ft^3 – Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. This could be adjusted by hand in the calculation, however, for this analysis the TEDE contribution from the noble gas submersion is so small that no adjustment was made.
    c. Compartment Features – Recirculating Filters is turned on.

d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing in the Technical Specifications.
e. Recirculating Filters – Filter efficiencies
   Time 0 – all filter efficiencies are 0% as emergency recirculation through filters is not automatically initiated.
   Time = 0.5 hours – filter efficiency for iodine chemical forms is assumed to be 95% for aerosols and 90% for elemental and organic iodine. These are the values justified per the revised test acceptance criteria in the License Amendment Request. The operator is assumed to manually lineup the emergency filters at 30 minutes. These efficiencies apply until the end of the accident at 30 days.

B. Transfer Pathways

1. Leak to environment

   a. From Compartment 1 – Reactor Coolant
   b. To Compartment 2 – Environment
   c. Transfer mechanism – "Air Leakage" selected – although this is water and not air, the input units are %/day and hence the medium is not important.
   d. Air Leakage Panel – The leak rate is 0.5%/day for the first 14 days, or 336 hours. The rate is then changed to 0 for the remainder of the accident. This value is based on the following:
      The Technical Specification limit for primary to secondary leakage is 150 gpd. Since there are 2 steam generators, there could be a total of 300 gpd. The total RCS cold volume is:
      8162 ft^3 x 7.48 gal/ft^3 = 61,000 gal
      The percentage of the RCS cold volume represented by 300 gpd is:
      (300 gpd/61000g) x 100% = 0.5%/day
      It was conservatively assumed that this secondary side release path exists for 14 days prior to isolating the steam generators and switching to the Decay Heat System.
   e. Active Pathway – Yes

2. Unfiltered inflow

   a. From Compartment 2 – Environment
   b. To Compartment 3 – Control Room
   c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.

d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on being approximately 2 times the worst case tracer gas measurement results. The control complex would isolate on the loss of offsite power prior to arrival of any plume with significant activity (prior to the LOOP the condenser would be available and the iodine releases would be insignificant). Therefore, the LOOP is assumed to occur at T=0 to maximize releases. Therefore, the only intake will be the assumed inleakage. The use of 1000 cfm will be justified in the proposed license amendment request.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway - Yes

3. Exhaust

a. From Compartment 3 – Control Room
b. To Compartment 2 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on tracer gas measurements. The exhaust rate is assumed equal to the intake rate.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust.
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753) This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as only the maximum 2 hour dose will be used. The value is left at the 0-2hr X/Q value to ensure the maximum release period occurs with the maximum X/Q.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate for the public (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as only the maximum 2 hour dose will be used. The value is left at the 0-2hr breathing rate value to ensure the maximum release period occurs with the maximum breathing rate.

2. Low Population Zone

   a. In Compartment 2 – Environment
   b. Breathing Rate Default – not checked
   c. X/Q – 1.40E-05 sec/m^3 for the period 0 to 8 hours, 1.50E-06 sec/m^3 for the period 8 hours to 24 hours, 7.7E-07 sec/m^3 for the period 24 hours to 96 hours and 4.5E-07 sec/m^3 for the period 96 hours to 30 days. These are the LPZ accident X/Q's for CR3 (NUS-1753).
   d. Breathing Rate – 3.47E-04 m^3/sec for the period 0 to 8 hours, 1.75E-04 m^3/sec for the period 8 hours to 24 hours and 2.32E-04 m^3/sec for the period 24 hours to 30 days– these are the Reg. Guide specified breathing rates (Reg. Guide 1.4).

3. Control Room

   a. In Compartment 3 – Control Room
   b. Breathing Rate Default – not checked
   c. X/Q – 9.0E-04 sec/m^3 for the 0-8 hr time period, 5.31E-04 sec/m^3 for the 8 to 24 hour period, 3.38E-04 sec/m^3 for the 24-96 hour period, and 1.49E-04 sec/m^3 for the 96-720 hour period. These are the accident X/Q's for the CR3 control complex from Letter 3F0588-10. They are not adjusted for occupancy time as the occupancy times will be entered separately.
   d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate. This value is entered from time 0 to the end of the accident.
   e. Occupancy Factor – 1.0 for the first 24 hours, 0.6 for the subsequent 72 hours and then 0.4 for the remainder of the accident. These are the standard values from Murphy and Campe.

D. Source Term

1. Nuclide Inventory

   a. "User Inventory" is checked.
   b. Plant Power – 2619 MWt – this is the potential licensed power plus 2% for instrument uncertainty.
   c. NIF file – The file to be used is "pwr_cre.nif". This file was created by starting with the PWR default inventory file in RADTRAD, "pwr_def.nif", and modifying the Ci/MWt for I-131 and Kr-85. The value for I-131 is increased from the default value of 0.254E5 Ci/MWt to 1.2 times the default value, or 0.3048E5 Ci/MWt. The value for Kr-85 is increased from the default value of 0.196E3 Ci/MWt to 1.5 times the default value, or 0.294E3 Ci/MWt. These adjustments are necessary since 10% will be the assumed fraction of core inventory released from the fuel experiencing clad damage. However, Table 3 of DG-1081 specifies that the gap fraction for I-131 is 12% and for Kr-85 is 15%. Since the fraction released can not be specified on a nuclide

basis, the equivalent curies released can be adjusted by adjusting the core inventory by the appropriate factor for these two nuclides.

d. Decay and No Daughter products is selected. This matches standard methods.
e. Iodine Chemical Fractions – The values entered are 0 for Aerosol, 0.97 for Elemental and 0.03 for Organic. These are based on DG-1081, Appendix H.

2. Release Fractions and Timing

   a. User RFT file is selected. The file to be selected is cre_def.rft. This file has the following values:
      Duration = 0.1E-05 hrs. Unlike the delayed source term for a LOCA, the clad damage in this case is due to the reactivity excursion with the rod ejection. Therefore, all the activity is assumed to be released instantaneously. The value of 0.1E-05 is a nominal value to ensure all activity is released to the coolant within 1 second.
      Fraction of noble gases, iodines and cesiums released during first time interval = 0.14E-01. This value is based on:
      0.14 is the fraction of fuel assumed to experience clad damage (FTI Document 51-1172602-00)
      0.10 is the assumed fraction of core inventory in the gap for these three nuclide groups per Table 3 of DG-1081. The combined fraction is 0.014.
      All other values in the rft file are 0 as there are no additional releases over time and no other nuclides assumed to be in the gap. There is no calculated fuel melt for this event at CR-3.
   b. Delay (hours) – 0. Release will occur at the time of rod ejection.
   c. Decay and No Daughter products – automatically set the same as the previous panel
   d. Iodine chemical fractions - automatically set the same as the previous panel

3. Dose Conversion Factors

   a. MACSS 60 (FGR 11& 12) is selected. This automatically selects the file to be used as fgr11&12.inp. This is the default dose factor file to be used with the AST source term.
   b. Decay and No Daughter products – automatically set the same as the previous panel
   c. Iodine chemical fractions - automatically set the same as the previous panel

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX I

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

LOCA ECCS Leakage RADTRAD Inputs

RADTRAD Code Inputs for the LOCA
ECCS Leakage

This run includes both the continuous ECCS leakage and the assumed 30 minute release of 50 gpm at 24 hours specified in DG-1081. Containment leakage is addressed in a separate RADTRAD run.

A. Compartments

1. Sump

   a. Compartment type – Other – since it is not the environment or control room.
   b. Volume – 4.537E4 ft^3 – this is the minimum possible volume of recirculated sump water from Calculation M-95-0007, "BWST Level for Adequate RB Inventory". The actual value entered in this input parameter will not figure in the calculation as the release rate will be input in %/day. However, this value will be used in determining the %/day.
   c. Source term fraction – 1.0 – Per DG-1081 all of the activity released from the core is released to the sump for this analysis.
   d. Compartment features – None selected as there are no removal mechanisms.

2. Auxiliary Building – the ECCS systems would leak into the Auxiliary Building.

   a. Compartment type – Other – since it is not the environment or control room.
   b. Volume – 1 ft^3 – since no holdup is being assumed in the AB, an arbitrary low volume is used, which when combined with an arbitrary high release rate of 1000 cfm below results in the assumption that all activity leaking from the sump water is immediately released to the environment.
   c. Source term fraction – 0 – The activity released from the core is released to the sump water. There will be a transfer rate to the AB.
   d. Compartment features – Nothing is selected since there is no credit for any removal mechanisms. (Flash fraction will be addressed in a subsequent input parameter).

3. Environment

   Compartment type – Environment - This defeats all other input parameters.

4. Control Room

   a. Compartment type - Control Room
   b. Volume - 3.649E+05 ft^3 – Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). Basis – S&L Design Input Transmittal DIT-CR-0044, "Control Complex

Volume" 10/1/97. This value must be used as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. This could be adjusted by hand in the calculation, but will not be for this analysis due to the small contribution from submersion DDE.

c. Compartment Features – Recirculating Filters is turned on.
d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing in the Technical Specifications.
e. Recirculating Filters – Filter efficiencies
   Time 0– all filter efficiencies are 0% as emergency recirculation through filters is not required and is not automatically initiated.
   Time = 0.5 hours – filter efficiency is assumed to be 95% for aerosols and 90% for elemental and organic iodine, as the operator is assumed to manually lineup the emergency filters at 30 minutes. (AP-250) These efficiencies apply until the end of the accident at 30 days. These efficiencies are based on the revised test criteria being submitted in the LAR.

B. Transfer Pathways

1. Sump to Auxiliary Building.

   a. From Compartment 1 – Sump
   b. To Compartment 2 – Auxiliary Building
   c. Transfer mechanism – Air Leakage – even though it's water, this is the best choice. The units are percent/day and it is really an indication of the fraction of the radionuclide activity transferred per day. Hence the medium doesn't matter.
   d. Air Leakage Tab – Edit Rates - Leakage Rate is determined as follows: Continuous leakage – proposed leakage test acceptance criteria – 0.02 gal/min. Calculation assumed leakage = two times surveillance acceptance criteria, or 0.04 gal/min. Converting to percent per day for code input, using the sump volume of 45,370 ft^3 we get:

   (0.04 gal/min x 0.134 ft^3/gal x 1440 min/day x100%)/ 45,370 ft^3 = 0.017 %/day

   This value is entered from T=0 to T=24 hours and then from 24.5 hrs to the end of the accident. From 24 to 24.5 hrs, an additional leak of 50-gpm must be assumed per DG-1081. Therefore, for this time period, the %/day will be:

   (50.04 gal/min x 0.134 ft^3/gal x 1440 min/day x100%)/ 45,370 ft^3 = 21.28 %/day

2. Auxiliary Building to Environment

   a. From Compartment 2 – Auxiliary Building
   b. To Compartment 3 – Environment

c. Transfer mechanism – Filter is checked. There will be no credit taken for the auxiliary building filters. However, this is the location in the code where credit will be taken for the flash fraction of 10%.
d. Filter Tab – Edit Efficiencies. A flow of 1000 cfm is entered. As noted above, this is an arbitrary value, which when combined with the low building volume assumed, ensures an immediate release of all airborne iodine. A filter efficiency of 90% is entered for all forms of iodine. This is based upon incorporation of the flash fraction of 10% (M-97-0137).

3. Filtered Inflow

a. From Compartment 3 – Environment
b. To Compartment 4 – Control Room
c. Transfer mechanism- Filter
d. Filter Tab – Edit Efficiencies – All values are entered as 0. This transfer pathway was established for the previous LOCA analyses, which had a filtered inleakage component. No filtered inleakage is assumed in this analysis. The pathway was left in the model for consistency, but has no effect since 0 flows are assumed. The code does not allow deletion of the pathway once established.

4. Unfiltered inflow

a. From Compartment 3 – Environment
b. To Compartment 4 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – The value is approximately two times the maximum expected inleakage based on tracer gas measurements. Since the control complex isolates with high RB pressure before the plume arrives, the only input is the inleakage.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway – Yes

5. Exhaust

a. From Compartment 4 – Control Room
b. To Compartment 3 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be

assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.

d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on a two factor margin above tracer gas measurements. The exhaust rate is assumed equal to the intake rate.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

   a. In Compartment 3 – Environment
   b. Breathing Rate Default – not checked
   c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753) This value is entered from time 0 to the end of the accident to ensure the worst meteorology occurs simultaneous with the worst release. Note – for this ECCS leak evaluation, the worst dose will obviously be from 22.5 to 24.5 hours because of the assumed 50 gpm leak at 24 hours. The calculated dose for that time period will not be used for the EAB dose. It can be assumed that the population at the EAB would have been evacuated by 24 hours. Under Control Options we will ask the code to print the EAB dose for this case for a number of time periods between 0 and 3 hours as that is the time period over which the worst two hours from containment leakage will occur.
   d. Breathing Rate – 3.47E-04 m^3/sec - This is the Reg. Guide specified breathing rate for 0 to 8 hours. (Reg. Guide 1.4) Only the 0-8 hr value is used for the EAB dose to ensure the maximum breathing rate coincides with the maximum two hour release period.

2. Low Population Zone

   a. In Compartment 3 – Environment
   b. Breathing Rate Default – not checked
   c. X/Q – 1.40E-05 sec/m^3 for 0 to 8 hours, 1.50E-06 sec/m^3 for 8 to 24 hours, 7.70E-07 sec/m^3 for 24 to 96 hours and 4.50E-07 sec/m^3 for 96 to 720 hours– these are the accident X/Q's at the LPZ for CR3 (NUS-1753).
   d. Breathing Rate – 3.47E-04 m^3/sec for 0 to 8 hours, 1.75E-04 m^3/sec for 8 to 24 hours and 2.32E-04 m^3/sec for 24 to 720 hours– these are the Reg. Guide specified breathing rates (Reg. Guide 1.4).

3. Control Room

   a. In Compartment 4 – Control Room
   b. Breathing Rate Default – not checked
   c. X/Q – 9.0E-04 sec/m^3 for the 0-8 hr period, 5.31E-04 for 8 hrs to 24 hrs, 3.38E-04 for 24 hrs to 96 hrs, and 1.49E-04 for 96 hrs to 720 hrs. These are the accident

X/Q's for the CR3 control complex based on an FPC letter 3F0588-10 and Murphy and Campe.

d. Breathing Rate – 3.47E-04 m^3/sec – this is the Murphy and Campe specified breathing rate. This value is entered from time 0 to the end of the accident.
e. Occupancy Factor – 1.0 for the first 24 hours, 0.6 for the subsequent 72 hours and 0.4 for the remainder of the accident. These are the occupancy factors from Murphy and Campe.

D. Source Term

1. Nuclide Inventory

   a. Default PWR is checked.
   b. Plant Power – 2619 MWt – this is the potential licensed power plus 2% for instrument uncertainty.
   c. NIF file – this is automatically entered by the code when Default PWR is selected. The file used is "pwr_def.nif". It is not edited.
   d. Decay and No Daughter products is selected. This is the standard method used.
   e. Iodine Chemical Fractions – 0% aerosol, 97% elemental and 3% organic. These are the fractions specified in DG-1081.

2. Release Fractions and Timing

   a. User RFT button is checked.
   b. Delay (hours) – 0 hrs – This is the standard industry assumption. Although ECCS sump recirculation would not start for many minutes post-LOCA, it is conservatively assumed to exist from T=0.
   c. RFT file – the file that has been created for ECCS leakage is "eccsast.rft". This file specifies release fractions only for iodines based on DG-1081, Appendix A. The file specifies a release fraction of 0.05 for the first period, which has a duration of 0.5 hours, and a release fraction of 0.35 for the second time period, which has a duration of 1.3 hours. These values are from Tables 2 and 4 of DG-1081.
   d. Decay and No Daughter products – automatically set the same as the previous panel
   e. Iodine chemical fractions – automatically set the same as the previous panel

3. Dose Conversion Factors

   a. MACCS 60 (FGR 11&12) is selected. This automatically selects the file to be used as fgr11&12.inp. These are dose factors to be used with the PWR alternative source term.
   b. Decay and No Daughter products – automatically set the same as the previous panel.
   c. Iodine chemical fractions – automatically set the same as the previous panel.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX J

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

LOCA Containment Leakage RADTRAD Inputs

RADTRAD Code Inputs for the LOCA
Containment Leakage

This run is for the containment leakage contribution to the LOCA dose. ECCS leakage is addressed in a separate RADTRAD run.

A. Compartments

1. Sprayed Region - the containment is divided into two nodes, the sprayed region and the unsprayed region.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 1.304E6 ft^3 – Based on calculation I-86-0001, Rev 0, "Containment Sprayed/Unsprayed Volumes 2/6/86 - the sprayed volume constitutes 65.2% of the containment free air volume. This value is 65.2% of the containment volume of 2E6 ft^3. (M-98-0010, Rev. 0 provides the containment volume)
c. Source term fraction – 0.652 – The activity released from the core is assumed to be homogeneously mixed in the containment atmosphere. Therefore, the fraction in the sprayed region is equal to the fraction of the volume sprayed.
d. Compartment features – "Sprays" selected since this is the sprayed region. "Natural deposition" is not selected. Natural deposition does not significantly affect the results and hence is not assumed.
e. Sprays Tab – "User Defined Coefficients is checked. The intent is to use the spray removal coefficients as calculated in I-86-0002.
f. User Defined Coefficient Tab - All removal factors are 0 until 0.0344 hrs. This corresponds to 124 seconds, which is the time at which sprays are delivering full flow. At 0.0344 hrs, the Aerosol removal coefficient is 1.98 hr^{-1} and the elemental removal coefficient is 19.81 hr^{-1}. This is based on Calculation I-86-0002 for a minimum spray flow (injection or recirculation mode) of 1000 gal/min.

   In accordance with NRC guidance (SRP 6.5.2 – Ref. 21), the elemental spray removal coefficient should be terminated when the elemental iodine DF is 200. A special RADTRAD run was made with all elemental iodine to determine the time to a 200 factor reduction using the iodine removal coefficients and mixing rates consistent with this calculation. The elemental removal coefficient is changed to 0 when a DF of 200 is achieved at 4.5 hours.

   In accordance with NRC guidance (SRP 6.5.2 – Ref. 21), the particulate spray removal coefficient should be reduced by a factor of 10 when the particulate iodine DF is 50. A special RADTRAD run was made with all particulate iodine to determine the time to a 50 factor reduction using the iodine removal coefficients and mixing rates consistent with this calculation. The particulate removal coefficient is changed to 0.198 at 5.7 hours.

   Organic iodine removal factors are assumed to be 0 at all times.

2. Unsprayed region – the containment is divided into two nodes, the sprayed region and the unsprayed region.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 6.96E5 ft^3 – Based on calculations, the unsprayed volume constitutes 34.8% of the containment free air volume. (I-86-001, Rev. 0) This value is 34.8% of the containment volume of 2E6 ft^3.
c. Source term fraction – 0.348 – The activity released from the core is assumed to be homogeneously mixed in the containment atmosphere. Therefore, the fraction in the unsprayed region is equal to the fraction of the volume unsprayed.
d. Compartment features – Nothing is selected since this is the unsprayed region. No deposition removal factors are used.

3. Environment

Compartment type – Environment - This defeats all other input parameters.

4. Control room

a. Compartment type - Control Room
b. Volume - 3.649E+05 ft^3 – Basis – S&L Design Input Transmittal DIT-CR-0044, "Control Complex Volume 10/1/97. Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. This can be adjusted by hand in the calculation.
c. Compartment Features – Recirculating Filters is turned on.
d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing in the Technical Specifications.
e. Recirculating Filters – Filter efficiencies

   Time 0– all filter efficiencies are 0% as emergency recirculation through filters is not required and is not automatically initiated.

   Time = 0.5 hours – filter efficiency is assumed to be 95% for aerosols and 90% for elemental and organic iodine, as the operator is assumed to manually lineup the emergency filters at 30 minutes. (AP-250) These efficiencies apply until the end of the accident at 30 days. These efficiencies are based on the revised test criteria being submitted in the LAR.

B. Transfer Pathways

1. Sprayed Region to Unsprayed Region

a. From Compartment 1 – Sprayed region

b. To Compartment 2 – Unsprayed region
c. Transfer mechanism – Air Leakage
d. Air Leakage Tab – Edit Rates - Leakage Rate is 2562%/day from T=0 to end of accident. This is based on 2 turnovers of the Unsprayed volume per hour. (SRP 6.5.2) This gives:

   6.96E5 ft^3 x 2/hr x 24 hr/day x 100% / 1.304E6 ft^3= 2562%/day

2. Unsprayed Region to Sprayed Region

a. From Compartment 2 – Unsprayed region
b. To Compartment 1 – Sprayed region
c. Transfer mechanism – Air Leakage
d. Air Leakage Tab – Edit Rates - Leakage Rate is 4800%/day from T=0 to end of accident. This is based on the Standard Review Plan assumption of 2 turnovers of the Unsprayed volume per hour. This gives:

   6.96E5 ft^3 x 2/hr x 24 hr/day x 100% / 6.96E5 ft^3= 4800%/day

3. Sprayed Region to Environment

a. From Compartment 1 – Sprayed region
b. To Compartment 3 – Environment
c. Transfer mechanism – Air Leakage
d. Air Leakage Tab – Edit Rates - Leakage Rate is 0.25%/day from T=0 to 24 hours. Then it is 0.125%/day from 24 hours to the end of the accident (720 hours). This is based on the Technical Specification Containment leak rate limit of 0.25%/day and the DG-1081 assumption that the leakage is one half of the limit after 24 hours. Containment leakage is assumed to come from the unsprayed and sprayed region at the same percentage rate.

4. Unsprayed Region to Environment

a. From Compartment 2 – Unsprayed region
b. To Compartment 3 – Environment
c. Transfer mechanism – Air Leakage
d. Air Leakage Tab – Edit Rates - Leakage Rate is 0.25%/day from T=0 to 24 hours. Then it is 0.125%/day from 24 hours to the end of the accident (720 hours). This is based on the Technical Specification Containment leak rate limit of 0.25%/day and the DG-1081 assumption that the leakage is one half of the limit after 24 hours. Containment leakage is assumed to come from the unsprayed and sprayed region at the same percentage rate.

5. Filtered Inflow

a. From Compartment 3 – Environment
b. To Compartment 4 – Control Room
c. Transfer mechanism- Filter

d. Filter Tab – Edit Efficiencies – All values are entered as 0. This transfer pathway was established for the previous LOCA analyses, which had a filtered inleakage component. No filtered inleakage is assumed in this analysis. The pathway was left in the model for consistency, but has no effect since 0 flows are assumed. The code does not allow deletion of the pathway once established.

6. Unfiltered inflow

a. From Compartment 3 – Environment
b. To Compartment 4 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – The value is approximately two times the maximum expected inleakage based on tracer gas measurements. Since the control complex isolates with high RB pressure before the plume arrives, the only input is the inleakage.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway – Yes

7. Exhaust

a. From Compartment 4 – Control Room
b. To Compartment 3 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.
d. Filter Efficiency Panel – Flow rate - 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on a two factor margin above tracer gas measurements. The exhaust rate is assumed equal to the intake rate.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 3 – Environment
b. Breathing Rate Default – not checked

c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753) This value is entered from time 0 to the end of the accident. Although only a 2 hour EAB dose is calculated, per the new acceptance criteria of 10CFR50.67, it must be the worst 2 hour period. By keeping the X/Q at the 0-2 hr X/Q value, it ensures the bounding release period matches up with the bounding meteorology.

d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate for the EAB. (Reg. Guide 1.4) This value is entered from time 0 to the end of the accident, again to ensure the bounding breathing rate matches up with the bounding 2 hour release period.

2. Low Population Zone

a. In Compartment 3 – Environment

b. Breathing Rate Default – not checked

c. X/Q – 1.40E-05 sec/m^3 for 0 to 8 hours, 1.50E-06 sec/m^3 for 8 to 24 hours, 7.70E-07 sec/m^3 for 24 to 96 hours and 4.50E-07 sec/m^3 for 96 to 720 hours– these are the accident X/Q's at the LPZ for CR3. (NUS-1753)

d. Breathing Rate – 3.47E-04 m^3/sec for 0 to 8 hours, 1.75E-04 m^3/sec for 8 to 24 hours and 2.32E-04 m^3/sec for 24 to 720 hours– these are the Reg. Guide specified breathing rates for the LPZ. (Reg. Guide 1.4)

3. Control Room

a. In Compartment 4 – Control Room
b. Breathing Rate Default – not checked
c. X/Q – 9.0E-04 sec/m^3 for the 0-8 hr period, 5.31E-04 for 8 hrs to 24 hrs, 3.38E-04 for 24 hrs to 96 hrs, and 1.49E-04 for 96 hrs to 720 hrs. These are the accident X/Q's for the CR3 control complex based on FPC Letter 3F0588-10 and Murphy and Campe.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Murphy and Campe specified breathing rate. This value is entered from time 0 to the end of the accident.
e. Occupancy Factor – 1.0 for the first 24 hours, 0.6 for the subsequent 72 hours and 0.4 for the remainder of the accident. These are the occupancy factors from Murphy and Campe.

D. Source Term

1. Nuclide Inventory

a. Default PWR is checked.
b. Plant Power – 2619 MWt – this is the potential licensed power plus 2% for instrument uncertainty.
c. NIF file – this is automatically entered as PWR_def.nif by the code when Default PWR is selected. It is not edited.

d. Decay and No Daughter products is selected. This matches the standard method used.
e. Iodine Chemical Fractions –When default PWR is chosen above, this automatically enters values into the boxes for each chemical form. The standard PWR assumption is that 4.85% is elemental, 95% is particulate and 0.15% is organic.

2. Release Fractions and Timing

a. PWR-DBA button is checked.
b. Delay (hours) – 0 hrs – This is the standard industry assumption. The delay in the timing of the release is built into the PWR-DBA library.
c. RFT file – this is automatically entered as pwr_dba.rft when the PWR-DBA button is selected. It is not edited.
d. Decay and No Daughter products – automatically set the same as the previous panel
e. Iodine chemical fractions – automatically set the same as the previous panel

3. Dose Conversion Factors

a. MACCS60/FGR 11&12 is selected. This automatically selects the file to be used as fgr11&12.inp. These are dose factors to be used with the TID source term.
b. Decay and No Daughter products – automatically set the same as the previous panel.
c. Iodine chemical fractions – automatically set the same as the previous panel.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX K

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

LOCA Hydrogen Purge RADTRAD Inputs

RADTRAD Code Inputs for the LOCA
Hydrogen Purge

This run is for the containment hydrogen purge contribution to the LOCA dose. Since the purge will occur many days into the accident, it will not contribute to the 2 hour EAB dose. Therefore, only the dose to the LPZ and control room is calculated.

A. Compartments

1. Sprayed Region - the containment is divided into two nodes, the sprayed region and the unsprayed region.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 1.304E6 ft^3 – Based on calculation I-86-0001, Rev 0, "Containment Sprayed/Unsprayed Volumes 2/6/86 - the sprayed volume constitutes 65.2% of the containment free air volume. This value is 65.2% of the containment volume of 2E6 ft^3. (M-98-0010, Rev. 0 provides the containment volume)
c. Source term fraction – 0.652 – The activity released from the core is assumed to be homogeneously mixed in the containment atmosphere. Therefore, the fraction in the sprayed region is equal to the fraction of the volume sprayed.
d. Compartment features – "Sprays" selected since this is the sprayed region. "Natural deposition" is not selected. Natural deposition does not significantly affect the results and hence is not assumed.
e. Sprays Tab – "User Defined Coefficients is checked. The intent is to use the spray removal coefficients as calculated in I-86-0002.
f. User Defined Coefficient Tab - All removal factors are 0 until 0.0344 hrs. This corresponds to 124 seconds, which is the time at which sprays are delivering full flow. At 0.0344 hrs, the Aerosol removal coefficient is 1.98 hr^{-1} and the elemental removal coefficient is 19.81 hr^{-1}. This is based on Calculation I-86-0002 for a minimum spray flow (injection or recirculation mode) of 1000 gal/min.

   In accordance with NRC guidance (SRP 6.5.2), the elemental spray removal coefficient should be terminated when the elemental iodine DF is 200. A special RADTRAD run was made with all elemental iodine to determine the time to a 200 factor reduction using the iodine removal coefficients and mixing rates consistent with this calculation. The elemental removal coefficient is changed to 0 at 4.5 hours.

   In accordance with NRC guidance (SRP 6.5.2 – Ref. 21), the particulate spray removal coefficient should be reduced by a factor of 10 when the particulate iodine DF is 50. A special RADTRAD run was made with all particulate iodine to determine the time to a 50 factor reduction using the iodine removal coefficients and mixing rates consistent with this calculation. The particulate removal coefficient is changed to 0.198 at 5.7 hours.

   Organic iodine removal factors are assumed to be 0 at all times.

2. Unsprayed region – the containment is divided into two nodes, the sprayed region and the unsprayed region.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 6.96E5 ft^3 – Based on calculations, the unsprayed volume constitutes 34.8% of the containment free air volume. (I-86-001, Rev. 0) This value is 34.8% of the containment volume of 2E6 ft^3.
c. Source term fraction – 0.348 – The activity released from the core is assumed to be homogeneously mixed in the containment atmosphere. Therefore, the fraction in the unsprayed region is equal to the fraction of the volume unsprayed.
d. Compartment features – Nothing is selected since this is the unsprayed region. No deposition removal factors are used.

3. Environment

Compartment type – Environment - This defeats all other input parameters.

4. Control room

a. Compartment type - Control Room
b. Volume - 3.649E+05 ft^3 – Basis – S&L Design Input Transmittal DIT-CR-0044, "Control Complex Volume 10/1/97. Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used, as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. This can be adjusted by hand in the calculation.
c. Compartment Features – Recirculating Filters is turned on.
d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing in the Technical Specifications.
e. Recirculating Filters – Filter efficiencies

    Time 0– all filter efficiencies are 0% as emergency recirculation through filters is not required and is not automatically initiated.

    Time = 0.5 hours – filter efficiency is assumed to be 95% for aerosols and 90% for elemental and organic iodine, as the operator is assumed to manually lineup the emergency filters at 30 minutes. (AP-250) These efficiencies apply until the end of the accident at 30 days. These efficiencies are based on the revised test criteria being submitted in the LAR.

B. Transfer Pathways

1. Sprayed Region to Unsprayed Region

a. From Compartment 1 – Sprayed region

b. To Compartment 2 – Unsprayed region
c. Transfer mechanism – Air Leakage
d. Air Leakage Tab – Edit Rates - Leakage Rate is 2562%/day from T=0 to end of accident. This is based on 2 turnovers of the Unsprayed volume per hour. (SRP 6.5.2) This gives:

$6.96E5\ ft^3 \times 2/hr \times 24\ hr/day \times 100\% / 1.304E6\ ft^3 = 2562\%/day$

2. Unsprayed Region to Sprayed Region

a. From Compartment 2 – Unsprayed region
b. To Compartment 1 – Sprayed region
c. Transfer mechanism – Air Leakage
d. Air Leakage Tab – Edit Rates - Leakage Rate is 4800%/day from T=0 to end of accident. This is based on the Standard Review Plan assumption of 2 turnovers of the Unsprayed volume per hour. This gives:

$6.96E5\ ft^3 \times 2/hr \times 24\ hr/day \times 100\% / 6.96E5\ ft^3 = 4800\%/day$

3. Sprayed Region to Environment

a. From Compartment 1 – Sprayed Region
b. To Compartment 3 – Environment
c. Transfer Mechanism – Filter
d. Filter Tab – Edit Rates – The release rate at T=0 is 0. At T= 336 hrs, the release rate is 65.2 cfm. This rate is continued until 720 hours. Based on Calculation M-85-1004, Rev. 3, "Hydrogen Generation", 9/2/98 a hydrogen purge could occur as early as 14.8 days. It was conservatively assumed the purge begins at 14.0 days, or 336 hours. The required purge rate per M-85-1004, Rev. 3 will be in the range of 50 cfm at 14.8 days. Considering instrument uncertainty for the purge flow meter, the actual purge flow could be approximately 60 cfm. Conservatively, this calculation assumes a purge flow of 100 cfm is established and continues for the remainder of the accident. The fraction of the 100 cfm from the sprayed region is assumed to be the same as the fractional volume of the containment, or 0.652. Therefore, the flow from the sprayed region is assumed to be 65.2 cfm. The purge is through the RB filters which are tested to 95 % efficiency. Therefore, an efficiency of 90% is assumed.

4. Unsprayed Region to Environment

a. From Compartment 2 – Unsprayed region
b. To Compartment 3 – Environment
c. Transfer mechanism – Filter
d. Filter Tab – Edit Rates - The release rate at T=0 is 0. At T= 336 hrs, the release rate is 34.8 cfm. This rate is continued until 720 hours. Based on Calculation M-85-1004, Rev. 3, "Hydrogen Generation", 9/2/98 a hydrogen purge could occur as early as 14.8 days. It was conservatively assumed the purge begins at 14.0 days, or 336 hours. The required purge rate per M-85-1004, Rev. 3 will be in the range of 50 cfm at 14.8 days.

Considering instrument uncertainty for the purge flow meter, the actual purge flow could be approximately 60 cfm. Conservatively, this calculation assumes a purge flow of 100 cfm is established and continues for the remainder of the accident. The fraction of the 100 cfm from the unsprayed region is assumed to be the same as the fractional volume of the containment, or 0.348. Therefore, the flow from the unsprayed region is assumed to be 34.8 cfm. The purge is through the RB filters which are tested to 95 % efficiency. Therefore, an efficiency of 90% is assumed.

5. Filtered Inflow

a. From Compartment 3 – Environment
b. To Compartment 4 – Control Room
c. Transfer mechanism- Filter
d. Filter Tab – Edit Efficiencies – All values are entered as 0. This transfer pathway was established for the previous LOCA analyses, which had a filtered inleakage component. No filtered inleakage is assumed in this analysis. The pathway was left in the model for consistency, but has no effect since 0 flows are assumed. The code does not allow deletion of the pathway once established.

6. Unfiltered inflow

a. From Compartment 3 – Environment
b. To Compartment 4 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – The value is approximately two times the maximum expected inleakage based on tracer gas measurements. Since the control complex isolates with high RB pressure before the plume arrives, the only input is the inleakage.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway – Yes

7. Exhaust

a. From Compartment 4 – Control Room
b. To Compartment 3 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to

the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.

d. Filter Efficiency Panel – Flow rate - 1000 cfm – this is the assumed inleakage rate for the entire course of the accident – based on a two factor margin above tracer gas measurements. The exhaust rate is assumed equal to the intake rate.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 3 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 0. This value is entered from time 0 to the end of the accident. The hydrogen purge will not occur during the worst two hour period at the EAB (0.8 to 2.8 hours). Therefore, no contribution from the hydrogen purge will be added to the EAB dose. Hence, 0 was used as the X/Q.
d. Breathing Rate – 0. This value is entered from time 0 to the end of the accident. The hydrogen purge will not occur during the worst two hour period at the EAB (0.8 to 2.8 hours). Therefore, no contribution from the hydrogen purge will be added to the EAB dose. Hence, 0 was used as the breathing rate.

2. Low Population Zone

a. In Compartment 3 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.40E-05 sec/m^3 for 0 to 8 hours, 1.50E-06 sec/m^3 for 8 to 24 hours, 7.70E-07 sec/m^3 for 24 to 96 hours and 4.50E-07 sec/m^3 for 96 to 720 hours– these are the accident X/Q's at the LPZ for CR3. (NUS-1753)
d. Breathing Rate – 3.47E-04 m^3/sec for 0 to 8 hours, 1.75E-04 m^3/sec for 8 to 24 hours and 2.32E-04 m^3/sec for 24 to 720 hours– these are the Reg. Guide specified breathing rates for the LPZ. (Reg. Guide 1.4)

3. Control Room

a. In Compartment 4 – Control Room
b. Breathing Rate Default – not checked
c. X/Q – 9.0E-04 sec/m^3 for the 0-8 hr period, 5.31E-04 for 8 hrs to 24 hrs, 3.38E-04 for 24 hrs to 96 hrs, and 1.49E-04 for 96 hrs to 720 hrs. These are the accident X/Q's for the CR3 control complex based on FPC letter 3F0588-10 and Murphy and Campe.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Murphy and Campe specified breathing rate. This value is entered from time 0 to the end of the accident.

e. Occupancy Factor – 1.0 for the first 24 hours, 0.6 for the subsequent 72 hours and 0.4 for the remainder of the accident. These are the occupancy factors from Murphy and Campe.

D. Source Term

1. Nuclide Inventory

a. Default PWR is checked.
b. Plant Power – 2619 MWt – this is the potential licensed power plus 2% for instrument uncertainty.
c. NIF file – this is automatically entered as PWR_def.nif by the code when Default PWR is selected. It is not edited.
d. Decay and No Daughter products is selected. This matches the standard method used.
e. Iodine Chemical Fractions –When default PWR is chosen above, this automatically enters values into the boxes for each chemical form. The standard PWR assumption is that 4.85% is elemental, 95% is particulate and 0.15% is organic.

2. Release Fractions and Timing

a. PWR-DBA button is checked.
b. Delay (hours) – 0 hrs – This is the standard industry assumption. The delay in the timing of the release is built into the PWR-DBA library.
c. RFT file – this is automatically entered as pwr_dba.rft when the PWR-DBA button is selected. It is not edited.
d. Decay and No Daughter products – automatically set the same as the previous panel
e. Iodine chemical fractions – automatically set the same as the previous panel

3. Dose Conversion Factors

a. MACCS60/FGR 11&12 is selected. This automatically selects the file to be used as fgr11&12.inp. These are dose factors to be used with the TID source term.
b. Decay and No Daughter products – automatically set the same as the previous panel.
c. Iodine chemical fractions – automatically set the same as the previous panel.

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX L

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Letdown Line Rupture RADTRAD Inputs

RADTRAD Inputs
For Letdown Line Rupture
Public and Control Room Dose

There were 16 RATRAD runs:

Case 1 – LOOP / Pre-accident spike – Time Steps 1-4
Case 2 – LOOP / Post-accident spike – Time Steps 1-4
Case 3 – No LOOP / Pre-accident spike – Time Steps 1-4
Case 4 – No LOOP / Post-accident spike – Time Steps 1-4

Most of the inputs remain the same for all 16 runs. The primary changes were to the nuclide files in both the curies available for release and the time of the release. In changing from the LOOP to the no LOOP case there were also changes in the control complex ventilation system flow inputs and filter usage as a function of time. The following presents each RADTRAD input parameter. Differences between runs are noted. If no differences are noted, the input was the same for all 16 runs.

All of the runs will involve modification to the assumed core inventories built into the RADTRAD nuclide libraries, with the use of an assumed power level of 1 MWt. A separate run will be required for each time step, due to the manner in which RADTRAD uses decay (explained further below under Source Term). The results of each time step will then have to be summed to get the total dose. This is the standard method to be used to model the control room dose for accidents where the release input is based on the known release in curies of each nuclide as a function of time. The releases are based on the assumed reactor coolant activity. The TID libraries from RADTRAD will be used as those libraries contain more of the noble gas nuclides than the NUREG-1465 libraries. The NUREG-1465 libraries are not required as there is no fuel failure at the time of the accident and no particulate activity is assumed to be released.

The following are the RADTRAD inputs:

A. Compartments

1. Auxiliary Building – the releases from the letdown line rupture will be into the Auxiliary Building.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 1 ft^3 – This is an arbitrary low value, which will be combined with an arbitrary high flow rate to ensure all the activity is released within seconds.
c. Source term fraction – 1 – This value is based on the fact that the nuclide and release fraction libraries will be adjusted such that the core contains a curie inventory equal to the curies released to the auxiliary building.
d. Compartment features – none selected.

2. Environment

a. Compartment type – Environment - This defeats all other input parameters.

3. Control Room

a. Compartment type – Control Room
b. Volume - 3.649E+05 ft^3 – (Design Input Transmittal DIT-CR-0044) - Note that this is the volume of the Control Complex Habitability Envelope (i.e. – all levels of the Control Complex except the 95' level). This value must be used as this is the volume into which any activity input will be dispersed and the volume that is processed by the recirculation filters. However, since the control room is a subset of this volume, use of this volume will underestimate the finite cloud correction factor for noble gas submersion. Hence, RADTRAD will provide conservative results for the Deep Dose Equivalent (DDE) from noble gas submersion. This could be adjusted by hand in the calculation, however, for this calculation, the DDE is such a small fraction of the TEDE dose, that the net effect would be negligible. Therefore no finite cloud correction factor adjustment is performed in this calculation.
c. Compartment Features – Recirculating Filters is turned on.
d. Recirculating Filters – Forced flow rate – 3.78E+04 cfm – this is the lower end of the acceptance criteria for the filter system flow testing per Technical Specification 5.6.2.12.
e. Recirculating Filters – Filter efficiencies
   Time 0– all filter efficiencies are 0% as emergency recirculation through filters is not required and is not automatically initiated.
   For the no LOOP cases, the normal ventilation is assumed to be left in service for the entire course of the accident. Therefore, the filter efficiencies remain as 0% for the entire 30 days.
   For the LOOP cases, at Time = 0.6 hours – filter efficiency for all iodine chemical forms is assumed to be 90% as the operator is assumed to manually lineup the emergency filters at 30 minutes after the LOOP, which occurs at 6 minutes. The total time of 36 min = 0.6 hrs. These efficiencies apply until the end of the accident at 30 days. (Although an efficiency of 95% could be assumed for the particulate iodine filter, the value of 90 was chosen to be consistent with the other chemical forms so that the specification of the fraction of each chemical form is unimportant.) The value of 90% is based on the proposed change to ITS 5.6.2.12.

B. Transfer Pathways

1. Leak to environment

a. From Compartment 1 – Auxiliary Building
b. To Compartment 2 – Environment
c. Transfer mechanism – "Filter" selected –No credit for the Auxiliary Building Filters is taken. "Filter" is chosen for ease of input as the Filter panel allows flow inputs in cfm.

d. Filter Efficiency Panel – Flow rate – 10000 cfm – This is an arbitrary value, which combined with the auxiliary building volume of 1 ft3 entered above, will ensure all activity is released within seconds.
e. Filter Efficiency Panel – The filter efficiency is assumed to be 0% for the course of the accident as no credit is taken for the Auxiliary Building filters for any of the cases.
f. Active Pathway – Yes

2. Unfiltered inflow

a. From Compartment 2 – Environment
b. To Compartment 3 – Control Room
c. Transfer mechanism – Filter is selected – Although the inleakage will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The filter efficiencies will be set to zero to account for the fact that the inleakage will be unfiltered.
d. Filter Efficiency Panel – Flow Rate – For both the LOOP and no-LOOP cases, for the first 0.1 hrs, normal ventilation remains on and the intake flow is 5700 cfm. For the no-LOOP cases, the intake is assumed to remain at 5700 cfm for the entire course of the accident. For the LOOP cases, at 0.1 hrs, with the LOOP, the normal ventilation fans are lost and only inleakage exists. The inleakage is assumed to be 1000 cfm, consistent with the proposed License Amendment. The value of 1000 cfm is approximately 2 times the maximum expected inleakage based on previous tracer gas inleakage tests. The value of 1000 cfm is assumed to last from 0.1 hours to 30 days for the LOOP cases.
e. Filter efficiencies – 0% - as noted above this is unfiltered inleakage.
f. Active Pathway - Yes

3. Exhaust

a. From Compartment 3 – Control Room
b. To Compartment 2 – Environment
c. Transfer mechanism – Filter is selected – Although the exhaust will not be filtered, filter is selected for ease of input. The filter panel allows rates to be input as cfm. The air leakage panel requires input in percent per day. Since the CR3 inleakage rates are in cfm, the filter panel is easier to use. The exhaust rate will be assumed to be equal to the inleakage rate. The filter efficiencies will be set to zero to account for the fact that the exhaust will be unfiltered.
d. Filter Efficiency Panel –The flow rates as a function of time are set equal to the intake flow rates, or 5700 cfm for the entire accident for the no-LOOP cases and 5700cfm from 0 to 0.1 hrs, and 1000 cfm from 0.1 hrs to the end of the accident for the LOOP cases.
e. Filter efficiencies – 0% - as noted above this is unfiltered exhaust.
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates within 2 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate for the public (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates within 2 hours.

2. Low Population Zone

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.40E-05 sec/m^3 for the period 0 to 8 hours, 1.50E-06 sec/m^3 for the preiod 8 hours to 24 hours, 7.7E-07 sec/m^3 for the period 24 hours to 96 hours and 4.5E-07 sec/m^3 for the period 96 hours to 30 days. These are the LPZ accident X/Q's for CR3 (NUS-1753).
d. Breathing Rate – 3.47E-04 m^3/sec for the period 0 to 8 hours, 1.75E-04 m^3/sec for the period 8 hours to 24 hours and 2.32E-04 m^3/sec for the period 24 hours to 30 days– these are the Reg. Guide specified breathing rates (Reg. Guide 1.4).

3. Control Room

a. In Compartment 3 – Control Room
b. Breathing Rate Default – not checked
c. X/Q – 9.0E-04 sec/m^3 – this is the 0-8 hr accident X/Q for the CR3 control complex (Letter 3F0588-10). This value is entered from time 0 to the end of the accident. There is no point in reducing the value with time as the release terminates within 2 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the specified breathing rate in Murphy and Campe. This value is entered from time 0 to the end of the accident.
e. Occupancy Factor – 1.0 for 0-24 hours, 0.6 for 24 to 96 hours and 0.4 for 96 hours to 30 days. These are the occupancy factors specified by Murphy and Campe.

D. Source Term

Discussion - The RADTRAD source term panels require a selection of either Decay or No Decay. If Decay is selected, the activity of each nuclide, whether in the core or some other location, will be decayed with time. Therefore, if the releases from the T/H calculation of activity released were entered into RADTRAD as the inventory available for release, and it was released over time, then the initial inventory would decay before all activity was released and the total release would be less than calculated. If No Decay were selected, then the total activity released would be consistent with the T/H calculation, however, decay would not be taken credit for as a removal mechanism from the control room. This is an important dose reduction mechanism, especially for noble gases. Therefore, the calculated dose would be higher than necessary. If Decay was selected and all the activity for a given time step was released at the beginning of the time step to ensure no decay was applied to the release, then the dose would be higher than necessary as all of the activity would result in control room doses over the entire time period, rather than a gradual buildup over time. The solution for entering a given curie release into RADTRAD is to run each time step separately. The releases will occur in the middle of the time step and the curies entered for core inventory will be taken from the T/H calculation, but adjusted up to account for decay to the middle of the time step. Decay will be selected in RADTRAD. This method will work because the time steps chosen were such that there were no changes in scenario inputs (e.g. – filtered release, CREVS recirc) during the release period. Additionally, most of the dose is due to nuclides with half-lives much greater than the release periods and the time periods are relatively short.

1. Nuclide Inventory

a. "User Inventory" is checked.
b. Plant Power –1 MWt – The values of the curies released (adjusted for decay to the middle of the time period) will be input in the .nif file in the location for each nuclide that gives the Ci/MWt. The code will multiply this value by the specified power level in MWt. Hence MWt must be 1 for this scenario.
c. NIF File – Eight .nif files will be required. One is required for each of the four release periods. The releases for the pre-accident spike case are different from the post-accident spike case. Therefore, there will be data for four time steps for 2 spike cases, or a total of 8 .nif input files.
   The eight files were created by taking the file "tid_def.nif" and modifying the Ci/MWt value for each nuclide. The adjusted curie values used are shown in the attached tables for each of the time periods and spike cases. These curies will be entered in the Ci/MWt location for each nuclide in the .nif file.
d. Decay and No Daughter products is selected. This matches the standard industry dose method. Decay must be selected as discussed above.
e. Iodine Chemical Fractions – TID is selected. This automatically enters values into the boxes for each chemical form. They are not edited. The chemical form is not important for this analysis, as the filter removal is equal for all forms.

2. Release Fractions and Timing

a. User RFT file is selected. Four .rft files will be required. They will be named llrts1_def.rft, llrts2_def.rft, llrts3_def.rft, and llrts4_def.rft for the four time steps respectively. These files were created by taking the TID_def.rft file and changing the release durations and fractions. The release durations were chosen to be consistent with the above approach of having the release occur in the middle of the four time periods. The first duration is to the middle of the specified time period, so the duration is entered as 0.0167 hrs in llrts1_def.rft, 0.0667 hrs in llrts2_def.rft, 0.16 hrs in llrts3_def.rft and 0.274 hrs in llrts4_def.rft. The fractional activity released during this period is a nominal 1E-5 for both the iodines and noble gases, to avoid having a zero release period and potential code errors. The second duration is a nominal 1E-5 hrs, so that the entire adjusted curie inventory is released within 1 second. The fractional release during this period is 0.9999 for both the iodines and noble gases. All other values are 0.

b. Delay (hours) - 0 hrs –Standard assumption.
c. Decay and No Daughter products – automatically set the same as the previous panel
d. Iodine chemical fractions – automatically set the same as the previous panel

3. Dose Conversion Factors

a. TID 14844 is selected. This automatically selects the file to be used as tid14.inp. The TID files are being used as they contain more of the noble gas nuclides than the NUREG-1465 files.
b. Decay and No Daughter products – automatically set the same as the previous panel
c. Iodine chemical fractions - automatically set the same as the previous panel

LLR-Pre-Accident Spike
Adjusted Curie Releases

0-0.033 hr Adj.Ci Rel.	0.033-0.1 hr Adj. Ci Rel.	0.1-0.22 hr Adj. Ci Rel.	0.22-0.325 hr Adj. Ci Rel.	Nuclide
3.257E+01	5.701E+01	9.228E+01	7.644E+01	I131
1.258E+01	2.235E+01	3.719E+01	3.187E+01	I132
3.911E+01	6.855E+01	1.113E+02	9.245E+01	I133
4.389E+00	7.983E+00	1.388E+01	1.254E+01	I134
1.592E+01	2.801E+01	4.573E+01	3.835E+01	I135
2.586E+00	4.527E+00	7.324E+00	6.065E+00	Xe131m
4.419E+00	7.740E+00	1.254E+01	1.039E+01	Xe133m
4.163E+02	7.289E+02	1.180E+03	1.285E+03	Xe133
4.716E-01	9.481E-01	1.988E+00	2.968E+00	Xe135m
1.029E+01	1.808E+01	2.946E+01	3.237E+01	Xe135
4.816E-01	8.596E-01	1.441E+00	1.247E+00	Kr83m
2.376E+00	4.192E+00	6.878E+00	5.797E+00	Kr85m
1.235E+00	2.219E+00	3.773E+00	4.368E+00	Kr87
3.810E+00	6.754E+00	1.118E+01	1.252E+01	Kr88

LLR -Post -accident Spike
Adjusted Curie Releases

0-0.033 hr Adj.Ci Rel.	0.033-0.1 hr Adj. Ci Rel.	0.1-0.22 hr Adj. Ci Rel.	0.22-0.325 hr Adj. Ci Rel.	Nuclide
7.779E-01	2.655E+00	9.303E+00	1.084E+01	I131
1.159E+00	5.796E+00	2.474E+01	3.098E+01	I132
1.193E+00	4.589E+00	1.738E+01	2.065E+01	I133
9.070E-01	4.927E+00	2.237E+01	2.968E+01	I134
7.449E-01	3.294E+00	1.329E+01	1.613E+01	I135
2.586E+00	4.527E+00	7.324E+00	6.065E+00	Xe131m
4.419E+00	7.740E+00	1.254E+01	1.039E+01	Xe133m
4.163E+02	7.289E+02	1.180E+03	1.285E+03	Xe133
4.716E-01	9.481E-01	1.988E+00	2.968E+00	Xe135m
1.029E+01	1.808E+01	2.946E+01	3.237E+01	Xe135
4.816E-01	8.596E-01	1.441E+00	1.247E+00	Kr83m
2.376E+00	4.192E+00	6.878E+00	5.797E+00	Kr85m
1.235E+00	2.219E+00	3.773E+00	4.368E+00	Kr87
3.810E+00	6.754E+00	1.118E+01	1.252E+01	Kr88

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

DOCKET NUMBER 50-302 / LICENSE NUMBER DPR-72

APPENDIX M

LICENSE AMENDMENT REQUEST #262, REVISION 0
Alternative Source Term and
Control Room Emergency Ventilation System

Waste Gas Decay Tank Rupture RADTRAD Inputs

RADTRAD Inputs
For Waste Gas Decay Tank Accident

The run will involve modification to the assumed core inventories built into the RADTRAD nuclide libraries, with the use of an assumed power level of 1 MWt. This is the standard method to be used to model the dose for accidents where the release input is based on the known release in curies of each nuclide. The releases are based on the assumed reactor coolant activity and waste gas decay tank curie limits. The TID libraries from RADTRAD will be used. The NUREG-1465 libraries are not required as there is no fuel failure at the time of the accident and no particulate activity is assumed to be released.

The following are the RADTRAD inputs:

A. Compartments

1.Waste Gas Decay Tank – the releases will be from the waste gas decay tanks.

a. Compartment type – Other – since it is not the environment or control room.
b. Volume – 1 ft^3 – This is an arbitrary low value, which will be combined with an arbitrary high flow rate to ensure all the activity is released within seconds.
c. Source term fraction – 1 – This value is based on the fact that the nuclide and release fraction libraries will be adjusted such that the core contains a curie inventory equal to the curies released to the environment.
d. Compartment features – none selected.

2. Environment

a. Compartment type – Environment - This defeats all other input parameters.

B. Transfer Pathways

1. Leak to environment

a. From Compartment 1 – Waste Gas Decay Tank
b. To Compartment 2 – Environment
c. Transfer mechanism – "Filter" selected – No credit for the Auxiliary Building Filters is taken. The release is assumed to be instantaneously released to the environment with no credit for decay or filtration in the Auxiliary Building. "Filter" is chosen for ease of input as the Filter panel allows flow inputs in cfm.
d. Filter Efficiency Panel – Flow rate – 1000 cfm – This is an arbitrary value, which combined with the auxiliary building volume of 1 ft3 entered above, will ensure all activity is released within seconds.

e. Filter Efficiency Panel – The filter efficiency is assumed to be 0% for the course of the accident as no credit is taken for the Auxiliary Building filters for any of the cases.
f. Active Pathway – Yes

C. Dose Locations

1. Exclusion Area Boundary

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.60E-04 sec/m^3 – this is the 0-2 hr accident X/Q for CR3. (NUS-1753). This value is entered from time 0 to the end of the accident, assumed to be 2 hours.
d. Breathing Rate – 3.47E-04 m^3/sec – this is the Reg. Guide specified breathing rate for the public (Reg. Guide 1.4). This value is entered from time 0 to the end of the accident.

2. Low Population Zone

a. In Compartment 2 – Environment
b. Breathing Rate Default – not checked
c. X/Q – 1.40E-05 sec/m^3 for the period 0 to 2 hours, which is the assumed end of the accident. This is the LPZ short-term accident X/Q for CR3 (NUS-1753).
d. Breathing Rate – 3.47E-04 m^3/sec for the period 0 to 2 hours. This is the Reg. Guide specified breathing rate (Reg. Guide 1.4).

D. Source Term

1. Nuclide Inventory

a. "User Inventory" is checked.
b. Plant Power –1 MWt – The values of the curies released from the main body of the calculation will be input in the .nif file in the location for each nuclide that gives the Ci/MWt. The code will multiply this value by the specified power level in MWt. Hence MWt must be 1 for this scenario.
NIF File – The .nif file was created by taking the file "tid_def.nif" and modifying the Ci/MWt value for each nuclide. Since the release in the main body of the report is based on Dose Equivalent Curies, only the curies for Xe133 and I131 need to be entered. All other nuclides will be entered as 0 Ci/MWt. For Xe133, the value entered is 0.117E6 Ci/MWt and for I131 the value is 0.9E1 Ci/MWt. This file is saved as Tid_wgdt.nif.
c. Decay and No Daughter products is selected. This matches the standard industry dose method.

d. Iodine Chemical Fractions – TID is selected. This automatically enters values into the boxes for each chemical form. They are not edited. The chemical form is not important for this analysis.

2. Release Fractions and Timing

a. User RFT file is selected. The file was created by taking the TID_def.rft file and changing the release fractions. The release duration was left as 0.1E-05 hrs to mimic an instantaneous release. The fractional release during this period is 1 for both the iodines and noble gases. All other values are 0.
b. Delay (hours) - 0 hrs –Standard assumption.
c. Decay and No Daughter products – automatically set the same as the previous panel
d. Iodine chemical fractions – automatically set the same as the previous panel

3. Dose Conversion Factors

a. TID 14844 is selected. This automatically selects the file to be used as tid14.inp.
b. Decay and No Daughter products – automatically set the same as the previous panel
c. Iodine chemical fractions - automatically set the same as the previous panel