NUMBER: N/A PROPOSED REVISION: N/A

❶ TITLE: UNIT 1 RHR SERVICE WATER: RELEASE OF CONTAMINATED WATER

DOCUMENT TYPE DEFICIENCY RELATED SAFETY EVALUATION

## SYNOPSIS OF THE "ACTIVITY" TO WHICH THIS EVALUATION APPLIES:

❷ Release of Radioactive RHR Service Water

An analysis of samples from the Unit 1 RHR "B" Loop service water (RHRSW) system, identified several radionuclides at very low concentrations. The first indication of contamination was noted on August 8, 1996 and the second indication was noted on August 23, 1996. The total activity in the RHRSW contained within the heat exchanger and adjacent piping, which was conservatively estimated to be about 4,000 gallons, was respectively estimated to be about 13.7μCi and 25.6 μCi. On August 23, 1996 repairs were made to a Δp instrument which was found to be leaking by in an effort to stop the leak into the service water side of the heat exchanger. To determine if the leak had been repaired, the service water loop of the heat exchanger was decontaminated by operating the RHRSW "B" Loop, and flushing the water to the circulating water flume. The service water in the loop was then resampled and analyzed. The circulating water flume has a blowdown line which diverts a small portion of the total circulating water to the river via the discharge structure. This resulted in a release to an unrestricted area, though this release was both monitored and controlled, it was not through the normally utilized liquid radwaste system but the release to the unrestricted area did in fact take the same release path to the river. The regulatory discreteness of this release is discussed below by evaluating the release, using the higher of the two activities for conservatism, for compliance with the relevant sections of the Technical Specifications (TS), the ODCM, the Code of Federal Regulations and other regulatory documents.

The requirements of the Radioactive Effluent Controls Program are spelled out in TS 5.5.4. This program is implemented by the Offsite Dose Calculation Manual (ODCM) and it conforms to the requirements of 10CFR50.36a for the control of radioactive effluents and for maintaining the doses as low as reasonably achievable. Compliance with TS 5.5.4 regarding liquid releases can be assured by adhering to the requirements of ODCM section 2.1.2, 2.1.3 and 2.1.4 which respectively provide limits on the concentration of the radioactive material at the point of release to an unrestricted area, the resultant dose to a member of the public from the release, and the necessity of using the radwaste treatment system.

ODCM section 2.1.2 requires that the concentrations of the radioactive materials released be limited to 10 times (10X) the concentrations specified in 10CFR20, Appendix B, Table 2, Column 2, with the exception for dissolved or entrained noble gases whose concentration shall be limited to 1 E-4 μCi/ml.



The concentrations of the radionuclides found in the RHRSW sample, from August 23, 1996 and their corresponding 10CFR20 limits are as follows.

| Radionuclide | Concentration (μCi/ml) | Limit (μCi/ml) |
|---|---|---|
| Mn-54 | 4.26 E-7 | 3 E-5 |
| Co-60 | 7.75 E-7 | 3 E-6 |
| Zn-65 | 3.93 E-7 | 5 E-6 |
| Xe-135 | 9.67 E-8 | 1 E-4 |

The following discussion is based on a release duration of 1 minute, a release volume of 4,000 gal and a total dilution of only 10,000 gal. This is very conservative estimate, since credit for the additional dilution provided by the circulating water flume was not taken into consideration. The sum of the ratios of the concentration of each radionuclide in the mixture to its effluent concentration limit (ECL) was 0.14. The

sum of the ECL fractions must be less than ten (<10) to ensure that the concentration limit for the mixture is not exceeded. As can be seen, the sum is much less than ten.
(10CFR20 Appendix B states that the sum of the fractions of the nuclides divided by their effluent concentration limits (ECLs) must be less than one. Further NRC guidance, Technical Specifications, and the ODCM allow the ECLs in Appendix B to be increased by a factor of 10. Mathematically this can be achieved by dividing the nuclides by the original 10CFR20 Appendix B ECLs and ensuring that the sum of the fractions is less than 10. The plant software performs the sum of the ECL fractions to ensure that it is less than 10. This ensures compliance with 10CFR20 limits.)

ODCM section 2.1.3 requires that the annual dose to a member of the public in unrestricted areas due to liquid releases from each unit be limited to 3 mrem to the total body and 10 mrem to any organ. The dose in any quarter is limited to half of the annual limits. Dose calculations were performed for this release, in accordance with ODCM section 2.4, to evaluate the doses relative to this release. The total body dose was 2.31 E-6 mrem (7.7 E-5 % of its annual limit) and the highest organ dose was 1.11 E-5 mrem to the GI-LLI, gastrointestinal track, (1.1 E-4 % of its annual limit). The resultant doses are quite low and essentially do not contribute to the quarterly and/or the annual dose limits. This provides a high degree of assurance that the release in no way presented a threat to the health and safety of a member of the public, even using the very low dilution rate. With a higher dilution value the ECL fraction and the resultant doses are reduced further and become even less significant.

ODCM section 2.1.4 requires that the radwaste system be employed to reduce the radioactivity in the liquid waste prior to its discharge whenever the projected dose due to the release would exceed 0.06 mrem to the total body and 0.2 mrem to any organ. As shown in the previous paragraph, the total body dose due to the release of the RHRSW was much less than 0.06 mrem and the maximum organ dose was much less than 0.2 mrem.

10CFR20.1302(b)(i) requires that a licensee show compliance with the annual limit of 100 mrem to any member of the public by demonstrating that certain concentration limits of the effluent at the point of release are not exceeded. This was addressed above in the assessment of
ODCM section 2.1.2.

10CFR20.1501(a)(2)(ii) & (iii) requires the licensee to evaluate the concentration or quantities of radioactive materials and the potential radiological hazard, respectively. The concentrations and quantity of the radioactive materials in the release was evaluated by sampling and analysis as discussed above. The potential radiological hazard was also evaluated by performance of the dose calculations which would be a result of the release, as discussed above in the assessment of
ODCM section 2.1.3.

This release does not constitute a Licensee Event Report (LER) based on the following.
10CFR50.73(a)(2)(viii)(B) requires the licensee to report any liquid effluent release which exceeds 20 times the applicable concentrations specified in 10CFR20, Appendix B, Table 2, column 2, at the point of entry into the receiving waters (i.e., unrestricted area). This is justified as discussed above in the assessment of ODCM section 2.1.3, it can be seen that the concentrations are much less than the applicable limits.

Design Criterion 64 in Appendix A to 10CFR50 requires the monitoring of effluent discharge paths. This criterion was complied with by performance of the sampling and analysis of the RHRSW service water before its release.

Compliance with Appendix I to 10CFR50 was assured by adherence to the applicable ODCM sections as discussed above. Furthermore, Appendix I is the bases for one of these ODCM sections.

40CFR190 is concerned with the annual dose to any member of the public due to releases of radioactivity and to radiation from the uranium fuel cycle sources. This is addressed by TS 5.5.4.j and implemented by ODCM section 5.1.2, which states that additional calculation and reporting is required when any of the dose limits as specified in the ODCM sections 2.1.3, 3.1.3 or 3.1.4 are exceeded by a factor of two. This requirement is not applicable for the release based on the doses as discussed above in the assessment of ODCM section 2.1.3.

NRC Bulletin 80-10, "Contamination of Nonradioactive Systems and Resulting Potential for Unmonitored, Uncontrolled Releases of Radioactivity to the Environment" lists four actions for the licensee. First: identify the affected systems; the Unit 1 RHR "B" loop was identified. Second: establish a sampling/analysis or monitoring program for the affected systems; this was done. Third: restrict use of the system until the cause of the contamination is identified and corrected, and the system is decontaminated. The release was the result of identifying the leakage, implementation of corrective action and of decontaminating the system. The third action also states, that, if it is considered necessary to continue operation of the system as contaminated, then a 10CFR50.59 evaluation must be performed. At present, actions have been taken to preclude the use of the system, except to characterize the leak and test repairs, if required for safe plant operation, for required surveillances, or during an emergency. A plan is being developed to investigate, repair the leakage and perform post repair samples to ensure the leak has indeed been repaired. The fourth action calls attention to the regulations to be complied with (these are all addressed above) and states that releases must be monitored and controlled. The release of the RHR service water was monitored (evaluated) by the sampling and analysis prior to the flush taking place; the release was controlled in the fact that the flush was a planned evolution. Dose calculations were performed after system operation.

To ensure that operation of the RHRSW system will not be adversely affected by the leak, the following cases have been considered:

Case 1. Normal Operation based on sample results
Case 2. Normal Operation with bounding assumptions
Case 3. LOSP with bounding assumptions
Case 4. LOCA/LOSP with the estimated small leakage rate
Case 5. LOCA/LOSP with bounding assumptions

Case 1 is addressed in the previous discussions. Cases 2 thru 5 are discussed below. LOCA/LOSP is the most conservative accident for RHRSW operation and dose evaluation.

Case 2: Normal Operation with bounding assumptions

The reason for the above evaluation is to provide reasonable assurance that future operation of "B" RHRSW loop would not create releases in excess of 10CFR20, Technical Specification, or ODCM limits. This evaluation is further bounded by calculations performed using the following conservative assumptions:
1) RHRSW heat exchanger and piping is filled with 4,000 gallons of Suppression Pool/Torus water. After starting the RHRSW pump the system volume is flushed out to the flume in one minute and replaced with non-radioactive service water at a higher pressure than the RHR system which prevents further radioactive water from leaking into the RHRSW system.
2) Minimum dilution flowrate in the flume is 500,000 gpm. This assumes mixing with the circulating water flow stream. No credit is taken for dilution by the circulating water system volume, which is about 6,280,000 gallons.
3) RHRSW discharge flowrate is 4,000 gpm.
This data was put into the Effluent Management System (EMS) computer which performed the dose calculations and sum of the ECL fractions. The results are as follows:
The projected 31 day total body dose is 4.6E-05 mrem which is 0.077% of the 0.06 mrem limit.
The projected 31 day organ dose is 9.13E-05 mrem which is 0.046% of the 0.2 mrem limit.
The cumulative total body dose is 9.70E-05 mrem which is 0.0065% of the quarterly 1.5 mrem limit.
The cumulative organ dose is 1.94E-05 mrem which is 0.00039% of the quarterly 5.0 mrem limit.
The sum of the ECL fractions is 2.7 which is less than the 10 limit.

Consideration was given to RCS water being in the RHRSW system. However, this is not considered to be a credible event. During normal operation, the RHR system is pressurized via the jocky pumps, using torus water. Thus, the worst case would be if Torus water completely filled the RHRSW loop. This is the case described above. RHR is used to circulate RCS water in the shutdown cooling mode during shutdown operation. In this case, RHRSW would be started before RHR, and the worst case initially would be torus water. If the system were shutdown and restarted during a shutdown, RCS water would not be

expected to displace the RHRSW system volume, thus the torus water case is considered to be bounding.

A calculation was also performed using MICROSHIELD to estimate the dose to an individual standing at the RHRSW pipe opening where the water would dump into the flume. Using the assumption from above that all the contaminated water would pass that point in one minute, MICROSHIELD calculated the dose rate at 2.217E-02 mrem/hr which gives a dose to an individual in that one minute equal to 0.00037 mrem which is much less than any dose limit for a member of the public.

Case 3. LOSP with bounding assumptions

If LOSP is considered without a LOCA, then the initial conditions can be assumed to be the same as for normal operation. The circulating water pumps would trip, so dilution by mixing of the circulating water flow stream would not be available. However, the discharge of RHRSW will mix with the flume volume. The volume of the flume from RHRSW discharge point to the point that the flume overflows to the river is estimated to be about 1,000,000 gallons. For simplicity, and because complete mixing of the volumes cannot be assured, 1/2 of this volume is considered for dilution. Thus, this case will be equivalent to the normal operating case, because the release of 4,000 gallons, diluted with 500,000 gpm is conservatively terminated after one minute, due to the expected RHRSW flow rate of 4,000 gpm. No credit was taken for any mixing of the remainder of the circulating water system volume, and the circulating water pumps are assumed to trip in this case, at the onset of the accident.

Case 4. LOCA/LOSP with the estimated small leakage rate

Consideration was given to LOCA/LOSP post-accident operation of the RHRSW system. Contamination of the RHR system could be very high due to water coming in contact with potentially failed fuel. This water could be transported to the RHRSW system via leakage between the system interfaces. However the leakage into the RHRSW system is very small. This is evidenced by sampling and analysis of the water in the RHRSW system over time, during normal operation. Samples taken near the heat exchanger show contamination levels much less than that of torus water, which was taken as the bounding case during normal operation. Samples taken further away from the heat exchanger in upstream piping have shown no contamination. Also, during normal operation, the RHR system is pressurized by the jockey pump system, and has been observed to be about 60 psig. RHRSW "B" Loop system pressure has been observed to be 0 psig. Any significant leakage would be expected to pressurize the RHRSW loop. It follows that any leakage into the RHRSW system prior to post accident operation would be very small. Although there are no time limits for starting RHRSW after an accident, analysis assumes that RHRSW will be started at 10 minutes following an accident which could lead to fuel failure, and thus increase the contamination present in the torus water. During post accident operation, no leakage to RHRSW can occur. Determining the actual leakage rate prior to starting the system is very difficult, thus, rigorous calculations have not been performed. However, samples taken near the heat exchanger within 8 hours after flushing the RHRSW system showed contamination levels about 1,000 times less than that of Torus water. Taking the volume of the RHRSW in the heat exchanger of about 1320 gallons (not taking credit for the piping volume), the leakage rate could be estimated to be as small as 0.0027 gpm, with the RHR system at 60 psig, or about 0.005 gpm with the RHR system operating in the LPCI mode, at about 205 psig, taking suction from the Torus. The sensitivity of post-accident dose to various leakage rates have been previously considered in the evaluation for DCR 94-045, at a leak rates from 0.1 gpm to 50 gpm (using accident source terms for torus water). Resultant dose rates at 0.1 gpm (much greater than estimated leakage) are very small, and are within the licensing basis for 10CFR100 limit following an accident.

Case 5. LOCA/LOSP with bounding assumptions

As discussed, the leakage rate during normal operation and post-accident is very small, and expected radiological consequences are not increased. However, because actual leakage rate cannot be easily determined, and for added conservatism, we can assume that 4,000 gallons of Torus Water leaks into the RHRSW system prior to starting the system. Assuming that the system is started in 10 minutes, the leakage rate is 400 gpm. This is roughly equivalent to a complete rupture of a heat exchanger tube, which

is very conservative. Prior to starting the system, the RHRSW system valves are closed, and are expected to leak much less than 400 gpm. In order to achieve this leakage rate, the operator would have

to open the discharge valve, and then start the RHRSW pump 10 minutes later, or a gross valve failure must occur prior to system startup. This would require a complete tube failure and failure of the operator to start the pump within a reasonable time, or a tube failure with a valve failure. Either of these scenarios would involve more than one failure, which would not be a credible event. However, to apply bounding conservatism, dose is calculated assuming this amount of leakage. Using source terms for post-accident torus water, assuming fuel failure, with 500,000 gallon dilution factor, and a release rate of 4,000 gpm, then the resultant dose to the public is about 0.163 Rem Whole Body, and about 35.4 Rem Organ Dose. This is within the licensing basis for 10CFR100 limits of 25 Rem Whole Body and 300 Rem Organ Dose, after adding this dose to dose from all other sources (ref. Bechtel Calculation 305, rev. 0, vol. 3, binder 24, folder 2339 for source term concentrations). The dilution factor was determined to be about 1/2 of the volume of the flume between the RHRSW discharge point and the flume overflow to the river, which is equivalent to the LOSP case. No credit was taken for any mixing of the remainder of the circulating water system volume, and the circulating water pumps are assumed to trip in this case, at the onset of the accident.

Administrative controls and sampling have been established to ensure that any future releases during normal operation would be within 10CFR20 limits, reference Lab Standing Order, SO-HPC-001-0896.

**ONCE A SCREENING QUESTION IS ANSWERED "YES", THE REMAINDER OF THE SCREENING QUESTIONS ARE NOT REQUIRED TO BE ANSWERED.**

**10 CFR 50.59 SCREENING (i.e., BLOCKS ❸ AND ❹):**

☐ YES ; ☒ NO

**Is the "ACTIVITY" itself a change to one of the following, OR is a change to one of the following required as a result of the "ACTIVITY":**

a. **the Technical Specifications and / or the Environmental Protection Plan (Non-Radiological) incorporated in the Operating License, OR**

b. **other licensing document(s) as defined in 00AC-REG-003-0S?**

**BASIS FOR ANSWER:**

❸ The event described in the synopsis does not cause a change to any licensing document because this is simply the description of and the relative evaluations for a release via the RHRSW system to an unrestricted area (the river) and a means to provide documentation for the evaluation for the safety related significance of the event.

**IF the answer is "YES", complete the CONTROL OF CHANGES TO LICENSING DOCUMENTS form, AND make it a part of the 10 CFR 50.59 EVALUATION package.**

GEORGIA POWER COMPANY
PLANT E.I. HATCH

FORM TITLE:
10 CFR 50.59 EVALUATION

❺ SHEET 6 OF 8

## 10 CFR 50.59 SCREENING (CONTINUED):

IF APPLICABLE / DESIRED, GO DIRECTLY TO A QUESTION THAT HAS A "YES" ANSWER

Does the "ACTIVITY" to which this evaluation applies represent:

1. ☐ YES ☒ NO A change to the plant (EITHER temporary OR permanent) as described in the FSAR?

BASIS FOR ANSWER:

This event did not change the plant in any way. The plant systems, structures and components were not effected or altered by this activity.

2. ☒ YES ☐ NO A change to procedures described in the FSAR?

BASIS FOR ANSWER:

❹ This is an evaluation of an event and does not cause a change to the FSAR in any way but the RHRSW to flume as a pathway for the release is different from the routine release via the radwaste system. The systems and procedures used for their operation were not effected, the systems were operated as described within the FSAR, thus no change to the FSAR exists.

3. ☐ YES ☒ NO A test or experiment not described in the FSAR?

BASIS FOR ANSWER:

This event was neither a test or experiment but a release via the RHRSW system. The safety related function of plant equipment, structures or components required for the safe operation and shutdown was not affected by this event nor was the health and safety of the public threatened by event.

IF the answers to ALL the questions in Blocks ❸ and ❹ are "NO," complete Blocks ❺ through ❼.

IF the answer to ANY question in Blocks ❸ and ❹ is "YES," complete Blocks ❺ through ❽.

❼ PREPARED: Jim Wade Jim Wade DATE: 9/11/96

REVIEWED: Dwight A. Hostetter DATE: 9/10/96

APPROVED: A.C. Bennett for W.B. Kirkley DATE: 9/11/96

## SAFETY EVALUATION

1. ☐ YES ☒ NO **Does the proposed "ACTIVITY" increase the probability of occurrence of an accident previously evaluated in the FSAR?**

**BASIS FOR ANSWER:**

The RHR, RHRSW, and heat exchanger are not affected by the small amount of radioactive inleakage into the RHRSW. The RHR and RHRSW system will continue to operate as designed providing the required heat sink as described in the FSAR.

2. ☐ YES ☒ NO **Does the proposed "ACTIVITY" increase the (radiological) consequences of an accident previously evaluated in the FSAR?**

**BASIS FOR ANSWER:**

The leakage path into the RHRSW system does not occur during periods of RHRSW operation due to the fact that the RHRSW is at a higher pressure. The leakage would be from the RHRSW into the system being cooled.

During normal operation, a bounding case was considered, assuming that 4,000 gallons of torus water were in RHRSW prior to starting the system.

For post-accident operation, a bounding case was considered, assuming 4,000 gallons of torus water (using post-accident source terms) were in RHRSW prior to starting the system. This would require two single failures, which would not be a credible event. Even so, in both bounding cases, the radiological consequences are not increased above the licensing basis 10CFR100 limits evaluated in the FSAR. (See U1 FSAR, section 14.7, and U2 FSAR, section 15). In actuality, the leakage rates and anticipated releases are expected to be much lower than the bounding cases, which demonstrate this very conservative approach.

3. ☐ YES ☒ NO **Does the proposed "ACTIVITY" increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in the FSAR?**

**BASIS FOR ANSWER:**

The operation of the RHR system is not affected by the small amount of inleakage as previously discussed and does not increase the probability of malfunction of any equipment important to the operation and shutdown of the plant. A catastrophic failure of a tube would not affect the operability of the system because the tube failure would not prevent the RHRSW from providing the required cooling to the system.

4. ☐ YES ☒ NO **Does the proposed "ACTIVITY" increase the (radiological) consequences of a malfunction of equipment important to safety previously evaluated in the FSAR?**

**BASIS FOR ANSWER:**

## SAFETY EVALUATION

Due to the fact that the RHRSW operates at a higher pressure, any additional leakage in the heat exchanger would be from RHRSW into the system being cooled. Therefore, no increase in consequences is introduced. When the system is not in operation, the radiological consequences have been evaluated to have no adverse impact on public health and safety. As discussed in the synopsis and the answer to question 2, conservative bounding cases are considered. Complete rupture of a heat exchanger tube, coupled with excess leakage out of the system, or operator failure to start a pump, would be the only failures that could lead to the bounding case for post-LOCA/LOSP operation. Thus, the consequences due to failure or malfunction of equipment are not increased.

5. ☐ YES ☒ NO **Does the proposed "ACTIVITY" create the possibility of an accident of a different type than any previously evaluated in the FSAR?**

**BASIS FOR ANSWER:**

The suspected leakage in the heat exchanger would not reduce the effectiveness of the RHR system in providing the required cooling and therefore, does not create the possibility of a different type accident.

6. ☐ YES ☒ NO **Does the proposed "ACTIVITY" create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the FSAR?**

**BASIS FOR ANSWER:**

(8) Due to the fact that the RHRSW operates at a higher pressure, any additional leakage in the heat exchanger would be from RHRSW into the system being cooled. Therefore, no increase in the possibility of malfunction is introduced. During normal operation with RHRSW not operating, any radioactivity detected will be measured and evaluated. No new failure modes are being introduced in the operation of the RHRSW heat exchanger with this small leak. The leak rate has been bounded with conservative case considerations, thus, the possibility of malfunction of equipment of a different type is not created.

7. ☐ YES ☒ NO **Does the proposed "ACTIVITY" reduce the margin of safety as defined in the basis for any Technical Specification?**

**BASIS FOR ANSWER:**

The activity does not affect the margin of safety because the Tech Spec. limitations as specified within Section 5.5.4 are met as previously discussed. This is further supported by consideration of NRCB 80-10, which requires this evaluation to be performed.

**IF a change to the Technical Specifications or the Environmental Protection Plan (Non-Radiological) is required, OR, IF ANY of the questions in Block ⑨ is answered "YES," an unreviewed safety question IS indicated. In that case, approval from the NRC is required BEFORE the "ACTIVITY" can be implemented. Refer to subsection 8.5.1.2 for guidance on exceptions to this.**

*GEORGIA POWER COMPANY*

*E. I. HATCH NUCLEAR PLANT*

*UNITS NO. 1 & 2*

*ANNUAL REPORT*

*JANUARY 1, 1996 - DECEMBER 31, 1996*

APPENDIX B