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Docket No. 50-458

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Senior Vice President
River Bend Nuclear Group
Gulf States Utilities Company
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ATTN: Mr. J. E. Booker

Dear Mr. Cahill:

Subject: Draft Safety Evaluation Report (SER) - Radiation Protection
Program - River Bend Station, Units 1 and 2

Enclosed are the radiation protection program sections for the River Bend draft SER. Our review has highlighted eight open items as listed on the cover page of the enclosure.

We plan to make a site visit to resolve these open issues. The Project Manager will contact you in the near future to arrange the details.

Sincerely,

Original signed by

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosure;
As stated

cc: See next page

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RIVER BEND NUCLEAR STATION UNITS 1 AND 2 DRAFT SAFETY
EVALUATION REPORT

The attached SER contains eight open items. A description of the open items follows:

1. The applicant should provide a dose assessment in accordance with Regulatory Guide 8.19 and a listing of plant improvements made as a result of this review;
2. The applicant should provide a tabulation of the expected airborne radioactivity concentrations in equipment cubicles, corridors and operating areas normally occupied by operating personnel;
3. The applicant should describe radiation protection reviews performed to assure that ALARA objectives are being met in the design process and during construction;
4. The applicant should demonstrate that the airborne radioactivity monitors have a minimum capability of detecting 10 mpc-hours of total radioactivity;
5. The applicant should describe the features incorporated in the plant design to control the buildup, transport, and disposition of activated corrosion products in reactor coolant and auxiliary system;
6. The applicant should provide the information requested in II.B.2, II.F.(3) and III.D.3.3 of NUREG-0737, "Clarification of TMI Action Plan Requirements;"
7. The applicant should provide an outline of the qualifications of the individual designated as the Radiation Protection Supervisor (RPS) and his backup;
8. The applicant should commit that the Radiation Protection Supervisor will have direct access to the Plant Manager in all radiation protection matters.

12 RADIATION PROTECTION

Summary Description

The staff has evaluated the proposed radiation protection program presented in Chapter 12 of the River Bend Station FSAR against the criteria set forth in the Standard Review Plan (SRP), NUREG-0800, Chapter 12. This FSAR was submitted by Gulf State Utilities. The radiation protection measures at River Bend are intended to ensure that internal and external exposures to station personnel and contractors due to plant conditions, including anticipated operational occurrences, will be within applicable limits of 10 CFR 20, and will be as low as is reasonably achievable (ALARA).

The basis of the staff's acceptance of the River Bend radiation protection program is that doses to personnel will be maintained within the limits of 10 CFR 20, "Standard for Protection Against Radiation." The applicant's radiation protection designs and program features are consistent with the guidelines of Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will be as Low as is Reasonably Achievable" (Rev. 3). On the basis of our review of the River Bend FSAR, we have concluded that the radiation protection measures incorporated in the design will provide reasonable assurance that occupational doses will be maintained below the limits of 10 CFR 20 and ALARA both during plant operation and during decommissioning, provided the open issues described herein are satisfactorily resolved.

12.1 Assuring that Occupational Exposures are as Low as is Reasonably Achievable

The staff has audited the policy consideration, design considerations and operational considerations contained in the River Bend FSAR against the criteria set forth in NUREG-0800, Section 12.1. The staff review consisted of ensuring that the applicant had either committed to following the criteria of the regulatory

guides and staff positions referenced in Section 12.1 of the SRP or provided acceptable alternatives. In addition, the staff selectively reviewed the applicant's FSAR against the acceptance criteria of the SRP using review procedures identified in the SRP. This selective review found the plant acceptable in these areas. Details of the review follow.

12.1.1 Policy Considerations

The applicant provides a management commitment to assure that the River Bend Station will be designed, constructed, and operated in a manner consistent with Regulatory Guides 8.8, 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," and 1.8, "Personnel Selection and Training." The applicant has identified the specific corporate plan to implement that policy and specified in detail the plant design and integrated the layout, shielding, ventilation, monitoring, traffic control, security access control, and health physics aspects to ensure that the overall design is conducive to maintaining exposure ALARA. The Plant Manager is responsible for the overall effectiveness of the ALARA efforts. Each supervisor at the plant is responsible for assuring that doses ^{are} ALARA. The Radiation Protection Supervisor provides technical assistance regarding ALARA implementation and reports to management on the results of ALARA efforts. These policy considerations are consistent with those outlined in Regulatory Guides 8.8 and 8.10 and, therefore, are acceptable.

12.1.2 Design Considerations

The objective of the plant's radiation protection design is to maintain individual and collective doses to plant workers, including construction workers, and to members of the general public, ALARA and to maintain individual doses within the limits of 10 CFR 20. The general arrangements and shielding provisions of River Bend are in accordance with Regulatory Guide 8.8, and are designed to provide levels of dose to operating personnel that are ALARA.

To reduce radiation exposures, the applicant has incorporated general design considerations to reduce (1) the need to enter radiation fields, (2) the time

of exposure when entry is necessary, and (3) the dose rate during exposure. Examples of these design considerations include:

- (1) Redundancy of equipment or components to reduce the need for immediate repair when radiation levels may be high.
- (2) Design of equipment, piping, and valves to minimize the buildup of radioactive material and to facilitate flushing of crude traps.
- (3) Locating equipment, instruments, and sampling sites in the lowest practicable radiation zones.
- (4) Systems and other pieces of equipment which are subject to crud buildup equipped with connectors which can be used for flushing the system to eliminate potential hot-spot buildup.
- (5) Utilization of welded connectors instead of flanged or threaded connectors, high-quality valves, valve packings, and gaskets to minimize leakage and spillage of radioactive materials.
- (6) Provisions of means to control contamination and to facilitate decontamination of potentially contaminated areas where practicable.
- (7) Provisions for draining, flushing, remote cleaning of equipment and piping containing radioactive material.
- (8) Providing adequate space in labyrinth entrances for easy access to radioactive pump, equipment and valve rooms.

These design considerations conform with the guidelines of NUREG-0800, Section 12.1.2 and are acceptable. The applicant will provide at a later date information regarding the continuing radiation protection reviews to assure that ALARA objectives are met in the design change and construction process. (Open Item Q471.13.)

12.1.3 Operational Consideration

The applicant has committed to include in the operational procedures measures for reducing exposure. The criteria for implementation of those measures are consistent with the guidance of Regulatory Guides 8.8 and 8.10.

The applicant has committed that operating and maintenance personnel will follow specific plans and procedures to ensure that "as low as is reasonably achievable" goals are achieved in the operation of the plant. High radiation exposure operations will be preplanned and carried out by personnel trained in radiation protection and using proper equipment. During such activities, personnel will be monitored for exposure to radiation and contamination. Upon completion of major maintenance, repair, surveillance and refueling tasks, results will be factored into the radiation protection procedures to make changes in future job procedures and techniques.

The staff concludes that the policy considerations, design considerations, and operational considerations are adequate to ensure that occupational radiation doses will be ALARA in accordance with Regulatory Guides 8.8, 8.10 and are acceptable.

12.2 Radiation Sources

The staff has audited the contained sources and airborne radioactive material source terms provided in Section 12.2 and Chapter 11 of the River Bend FSAR against the criteria set forth in the Section 12.2 of NUREG-0800. These source terms are used as inputs for dose assessment and for the design of the shielding and ventilation systems. The staff review consisted of ensuring that the applicant had either committed to following the criteria of the regulatory guides and staff positions referenced in Section 12.2 of NUREG-0800 or provided acceptable alternatives. In addition, the staff selectively compared source terms for specific systems used by the applicant against those used for plant's of similar design. This selective review found the plant's source terms equivalent to those used at other plants. Details of the review follow.

12.2.1 Contained Sources and Airborne Radioactive Material Sources

Inside the containment during power operation, the greatest potential for personnel dose is due to nitrogen-16, noble gases, and neutrons. Outside the containment and after shutdown inside the containment, the primary sources of personnel exposures are fission products from fuel clad defects, and activation and corrosion products. The shielding source terms for normal operation are based on an offgas rate of 0.1 Ci/sec after 30 minutes decay. The coolant and corrosion activation product source terms are based on measurements at operating boiling water reactors (BWRs). Neutron and prompt gamma source terms are based on reactor core physics calculations and applicable reactor operating experience. The contained radiation source terms are comparable to estimated by other applicants with boiling water reactor designs and are acceptable. The accident source terms based on NRC Short-Term Lessons Learned recommendation in NUREG-0737 have not been provided. This is an open item. (Q471.20).

The applicant has not provided a tabulation of normal expected airborne radioactivity concentrations in equipment cubicles, corridors, and operating areas due to equipment leakage. This is an open item (Q471.11). The ventilation systems will be designed to maintain exposures within the limits of 10 CFR 20 limits and are acceptable.

12.3 Radiation Protection Design Features

The staff has audited the facility design features, shielding, ventilation, and radiation and airborne monitoring instrumentation contained in the River Bend nuclear power plant's FSAR against the criteria set forth in NUREG-0800 Section 12.3. The staff review consisted of ensuring that the applicant had either committed to following the criteria of the regulatory guides and staff positions referenced in Section 12.3 of the SRP or provided acceptable alternatives. In addition, the staff selectively reviewed the applicant's FSAR against the acceptance criteria of the SER using the review procedures in NUREG-0800. This review found the plant acceptable in these areas. Details of the review follow.

12.3.1 Facility Design Features

The radiation protection design features at River Bend are intended to help maintain occupational radiation exposures ALARA consistent with 10 CFR 10.1(c) and the dose-limiting provisions of 20.101, 20.103, 20.203, 20.207, as well as Regulatory Guides 8.8 and 8.10. Many of these design features have been incorporated as a result of the applicant's radiation protection design review and from radiation exposure experience gained during the operation of other nuclear power plants. Information on the reviews to assure that ALARA objectives are being met in the design change process and during construction have not been provided. This is an open item. (Q471.13)

Some examples of design features that have been incorporated into the design to reduce the need for maintenance and other operations in radiation fields include:

- (1) Valve galleries are provided with labyrinths for personnel protection;
- (2) tanks are provided with sloped or conical bottoms and bottom outlet connections;
- (3) labyrinth entrance way shields or shielding doors to reduce radiation streaming;
- (4) piping designed to minimize low points and dead legs;
- (5) filters provided with means to remotely backflush the filter cake.

The applicant has provided radiation zone maps showing the expected maximum total (neutron plus gamma) radiation levels during normal operations and refueling for areas inside the plant. These zone maps include the routinely visited areas in the containment, including the areas near major drywell shield penetrations. The reactor water cleanup system, standby liquid control system and traversing incore probe (TIP) are not in line of sight of the drywell purge penetrations, drywell personnel lock or equipment. The penetrations through

the drywell walls were tabulated on all shielding design details are shown on diagrams. The control rod drive (CRD) control area and containment personnel lock areas maximum dose rates were also given. The applicant has also provided an estimation of average daily personnel time in these areas. The radiation dose rates anticipated in these areas indicate doses can be maintained below the 20.101 limits and therefore are acceptable.

The description of the features incorporated in the plant design to maintain occupational radiation exposure ALARA by minimizing the buildup of activated corrosion products will be provided at a later date (Q.471.17).

12.3.2 Shielding

The shielding was designed to meet the criteria of the radiation dose rate zone system discussed above. The applicant's shielding design methods, including the use of source terms, cross section data, shield and source geometries, and radiation transport calculational schemes, are consistent with generally accepted practice. The Applicant has committed that the shield design and construction will be consistent with the guidance of Regulatory Guide 1.69, "Concrete Radiation Shields for Nuclear Power Plants." The basic radiation transport analysis used for the applicant's shield design are consistent with RP-8A, "Radiation Shielding Design and Analysis Approach for LWR," May 1975. The applicant also used shielding information from operating nuclear plants as input data for the shield design calculation. We find the shielding design and methodology acceptable.

The radiation shielding will be designed to provide protection against radiation for operating personnel, both inside and outside the plant, and for the general public. The following are several of the shielding design features incorporated into River Bend:

- (1) All systems containing radioactivity are identified and shielded based on the access requirements of adjacent areas.

- (2) Penetrations are placed so that they do not pass through the shield wall in a direct line with the radiation source in order to prevent shielding.
- (3) Radioactive piping is routed through high radiation areas where practicable, or in shielded pipe chases in low radiation areas.
- (4) Labyrinth entrance way shields or shielding doses are provided for each compartment from which radiation could stream to access areas and exceed the radiation zone dose limits for those areas.

These shielding techniques are designed to maintain personnel relation exposures as low as is reasonably achievable, in accordance with the ALARA provisions of Regulatory Guides 8.8 and 8.10 and are acceptable.

Shielding for the spent fuel transfer canal was reviewed. The applicant has committed that all plant radiation sources capable of producing radiation levels in excess of 100 rads per hour will be shielded and clearly marked, indicating that potentially lethal radiation fields are possible. If other than permanent shielding is used, administrative controls will be initiated and local audible and visible alarming monitors must be installed to alert personnel if temporary shielding is removed.

The ventilation system at River Bend is designed to ensure that plant personnel are not inadvertently exposed to airborne radioactive material exceeding the limits and action points in 10 CFR Sec. 20.103. The applicant intends to maintain personnel exposures as low as is reasonably achievable by: (1) maintaining air flow from areas of potentially low airborne contamination to areas of higher potential concentrations; (2) ensuring negative or positive pressures to prevent exfiltration or infiltration of potential contaminants, respectively; and (3) locating ventilation system intakes so that intake of potentially contaminated air from other building exhaust points is minimized.

These design criteria are in accordance with the guidelines of Regulatory Guide 8.8 and 1.52, "Design, Testing, and Maintenance Criteria for Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units

of Light-Water-Cooled Nuclear Power Plants." Some examples of exposure reduction features in the ventilation system are listed below.

- (1) Ventilation fans and filters are provided with adequate access space to permit servicing with minimum personnel radiation exposure. The ventilation system is designed to allow rapid replacement of components.
- (2) Ventilation ducts are designed to minimize the buildup of radioactive contamination within the ducts to the maximum extent practicable. Welded seams are used to join ductwork segments; and internal obstructions are avoided wherever practicable.
- (3) Potentially contaminated equipment is designed to minimize the potential for airborne contamination during maintenance operations.

12.3.4 Area Radiation and Airborne Radioactivity Monitoring Instrumentation

12.3.4.1 Area Radiation Monitoring Instrumentation

The applicant's area radiation monitoring system is designed to: (1) monitor the radiation in areas where radiation levels could become significant and where personnel may be present; (2) alarm when the radiation levels exceed present levels to warn of excess radiation levels; and (3) provide a continuous record of radiation levels at key locations and throughout the plant. In order to meet these objectives, the applicants plan to use 40 area monitors per unit, with an additional 8 monitors shared, located in areas where personnel may be present and where radiation levels could become significant. The area radiation monitoring system is equipped with local and remote audio and visual alarms and a facility for central recording.

The applicant has provided area radiation monitors around the fuel storage areas to meet the requirements of 10 CFR Sec. 70.24 and to be consistent with the guidance of Regulatory Guide 8.12, "Criticality Accident Alarm Systems."

The objective of the applicant's accident radiation monitoring system is to provide the capability to assess the radiation hazard in areas which may be occupied during the course of an accident. The installed instruments have emergency power supplies; and the portable instruments are placed to be readily accessible to personnel responding to an emergency. The systems are designed for use in the event of an accident in terms of (1) usable instrument range, and (2) the environment the instrument can withstand, and meeting the provisions of Section II.F.1 of NUREG-0737 and Regulatory Guide 1.97.

12.3.4.2 Airborne Radioactivity Monitoring Instrumentation

The design objectives of the applicant's airborne radioactivity monitoring system are: (1) to assist in maintaining occupational radiation exposure to airborne contaminants as low as is reasonably achievable; (2) to check on the integrity of systems containing radioactivity; and (3) to warn of inadvertent release of airborne radioactivity to prevent undue exposure of personnel. The applicant will install airborne radioactivity monitors to work in areas where there is a potential for airborne radioactivity. The applicant has not committed that these airborne radioactivity monitors have the capability to detect ten MPC-hours of radioactivity in any compartment which has a possibility of containing airborne radioactivity and which may be occupied by personnel. This is an open item (Q471.16). The applicant will provide portable continuous air monitors when needed to monitor air in areas not provided with fixed airborne radioactivity monitors. All airborne and area radioactivity monitors will be calibrated at regular intervals in accordance with station procedures. The applicant has not provided information on the high-range monitors that will be installed per TMI Action Plan Item II.F.1-3. This is an open item (Q471.20).

The objectives and location criteria of River Bend area and airborne radiation monitoring systems are in conformance with those portions of 10 CFR Parts 20.201, 70.24, as well as Regulatory Guides 1.97, 8.2, and 8.8, related to airborne radioactivity monitoring.

12.4 Dose Assessment

The staff has audited the applicant's dose assessment for the River Bend against the criteria set forth in NUREG-0800, Section 12.3. The staff review consisted of ensuring that the applicant had either committed to following the criteria of the regulatory guides and staff positions referenced in Section 12.3 of NUREG-0800 or provided acceptable alternatives. The applicant has not provided an assessment of the doses that will be received by plant and contractor personnel. This information will be provided at a later date. (Open item Q471.10.)

12.5 Operational Radiation Protection Program

The staff has audited the organization, equipment, instrumentation and facilities, and procedures for radiation protection contained in the River Bend FSAR against the criteria of NUREG-0800, Section 12.5. The plant's health physics program objectives are to provide reasonable assurance that the limits of 10 CFR 20 are not exceeded, to further reduce unavoidable exposures, and to ensure that every reasonable effort is made to maintain occupational radiation doses ALARA. The staff review consisted of ensuring that the applicant had either committed to following the criteria of the regulatory guides and staff positions referenced in Section 12.5 of NUREG0800 or provided acceptable alternatives. The review selectively compared the applicant's FSAR against the specific areas of review and using the review procedures identified in NUREG-0800. This selective review found the plant acceptable in these areas. Details of the review follow.

It is the responsibility of the health physics group to prepare and recommend procedures for controlling radiation doses and intakes within the limits of 10 CFR 20.101 and 20.103 for all routine and nonroutine activities and that such exposures are kept ALARA; to provide radiation protection controls for personnel and operations onsite; to provide radiation surveys of station areas and maintain records of results; to assist in the station training program; to provide, maintain, and calibrate radiation detection instrumentation; to provide, maintain, and issue protective clothing; to assist in shipping and receiving all radioactive materials; to assist in decontamination of personnel and equipment;

be responsible for the respiratory protection program; and to develop and maintain the personnel dosimetry system.

12.5.1 Organization

The applicant's organization will include health physics professionals and technicians. The Radiation Protection Supervisor will have the responsibility for implementing the health physics programs and procedures and the program for maintaining exposure as low as is reasonably achievable. The Plant Manager is responsible for the overall effectiveness of the radiation protection program. It is the responsibility of the plant supervisory personnel to ensure that plant personnel are made aware of the management commitment to keep all occupational radiation exposure ALARA. An outline of the qualifications of the Radiation Protection Supervisor and of the individual who will act as the backup for the RPM in his absence have not been provided. Therefore, this is an open item (Q471.22). Additionally, the River Bend plant organization shows that the Radiation Protection Supervisor does not have direct access to the Plant Manager in all radiation protection matters. This apparent lack of direct access to the Plant Manager is also an open item (Q471.22).

12.5.2 Equipment, Instrumentation and Facilities

The radiation protection features at River Bend include a radiochemistry lab, personnel decontamination areas, an access control point, counting room, calibration room, respirator testing facility, office and laundry. These facilities are sufficient to maintain occupational radiation exposures ALARA and are consistent with the provisions of Regulatory Guide 8.8.

Equipment to be used for radiation protection purposes includes portable radiation survey instruments, personnel monitoring equipment, fixed and portable area and airborne area radioactivity monitors, laboratory equipment, air samplers, respiratory protective equipment, and protective clothing. The number and types of equipment to be used are adequate, meet the criteria of Regulatory Guide 1.97 for portable survey meters, and provide reasonable assurance that the applicant will be able to maintain occupational exposures ALARA.

All station personnel entering controlled radiation areas will be assigned thermoluminescent dosimeter (TLD) badges and pocket dosimeters. Special neutron surveys or badges will be provided when plant personnel enter neutron areas when required by 10 CFR 20. Neutron dosimetry will be provided in accordance with RG 8.14.

All personnel assigned TLDs or film badges are also required to wear direct reading dosimeters when entering the controlled area. The readings from these dosimeters will be used to keep a running total of an individual's dose prior to TLD or film badge processing. Plant visitors wear TLD and a self-reading dosimeter when in controlled areas or are escorted by an individual wearing such personnel dosimetry devices. Appropriate caution signs, labels, and signals will be provided, in accordance with 10 CFR Part 20, Sections 20.203 and 20.204 or in accordance with Standard Technical Specifications. Whole body counts of all plant personnel will be conducted on a scheduled basis and other bioassays will be provided when deemed necessary, in accordance with 10 CFR Part 20.103, Regulatory Guide 8.26. Records of surveys, personnel monitoring, and bioassay will be maintained in accordance with 10 CFR Part 20, Sections 20.102, 20.201, 20.202, 20.401, 20.402, 20.405, 20.407, and 20.408, as well as Regulatory Guides 8.7, 8.27, and 8.29. All radiation exposure information will be processed and recorded in accordance with 10 CFR Part 20.

The applicant to date has not submitted the information required for Item III.D.3.3 of NUREG-0737 "Improved In-Plant Iodine Instrumentation Under Accident Conditions." The staff will review this information when it is provided. This is an open item.

12.5.3 Procedures

The applicant has described the station procedures which will be used to implement the radiation protection program. The procedures described are for access control, radiation work permits, radiation surveys, personnel monitoring, bioassay, radiation protection training, contamination control, methods of maintaining exposures as low as is reasonably achievable, and reviews of the effectiveness of the health physics program. Procedures are also developed to

administer and control conditions of radiation work permits; to post radiation areas; to establish radiation access control zones; to control all radioactive material entering or leaving the plant site; and to train all visitor personnel in radiation protection policies and procedures and meet the guidance of Regulatory Guide 1.33. For long-term repair jobs, consideration will be given to setting up a communications network such as sound-powered telephones or closed-circuit television to assist supervising personnel in checking on work progress from a lower radiation area. On complex jobs with exceptionally high radiation levels, dry runs, mockups, and specialized training will be utilized to familiarize the workers with the operations they must perform.

Based on the information presented in the FSAR and the applicant's responses to our questions, we conclude that the applicant intends to implement a radiation protection program that will maintain in-plant radiation exposures within the applicable limits of 10 CFR 20 and will maintain exposures as low as is reasonably achievable in accordance with Regulatory Guide 8.8.