May 4, 2007

Mr. G. R. Peterson
Vice President
McGuire Nuclear Station
Duke Power Company LLC
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2, ISSUANCE OF AMENDMENTS REGARDING SUMP MODIFICATION (TAC NOS. MD4748 AND MD4749)

Dear Mr. Peterson:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 240 to Renewed Facility Operating License NPF-9 and Amendment No. 222 to Renewed Facility Operating License NPF-17 for the McGuire Nuclear Station, Units 1 and 2 (McGuire 1 and 2). The amendments consist of changes to the Technical Specifications (TSs) in response to your application dated March 8, 2007, as supplemented March 27, April 13, and May 3, 2007. The amendments revise the McGuire 1 and 2, TS 3.5.2.8, and the associated Bases and authorize changes to the Updated Final Safety Analysis Report concerning modifications to the emergency core cooling system sump.

A copy of the related Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

John Stang, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosures:
1. Amendment No. 240 to NPF-9
2. Amendment No. 222 to NPF-17
3. Safety Evaluation

cc w/encls: See next page

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Package No.: ML071100145
Amendment No.: ML071100160
Tech Spec No.: ML071240266

OFFICE	NRR/LPL2-1/PM	NRR/LPL2-1/LA	OGC	NRR/SRXB/BC	NRR/SSIB/BC	NRR/ITSB/BC	NRR/EMCB/BC	NRR
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DUKE POWER COMPANY LLC

DOCKET NO. 50-369

MCGUIRE NUCLEAR STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 240
Renewed License No. NPF-9

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A The application for amendment to the McGuire Nuclear Station, Unit 1 (the facility), Renewed Facility Operating License No. NPF-9, filed by the Duke Power Company LLC (licensee), dated March 8, 2007, as supplemented March 27, April 13, and May 3, 2007, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-9 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 240, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. Further, Facility Operating License No. NPF-9 is hereby amended to authorize a change to the Updated Final Safety Analysis Report (UFSAR) to allow modifications to the emergency core cooling system sump, as set forth in the license amendment application dated March 8, 2007, as supplemented March 27, April 13, and May 3, 2007, and evaluated in the associated safety evaluation. The licensee shall update the UFSAR by adding a description of this change, as authorized by this amendment, and in accordance with 10 CFR 50.71(e).

4. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to License No. NPF-9
and the Technical Specifications

Date of Issuance: May 4, 2007

DUKE POWER COMPAPNY LLC

DOCKET NO. 50-370

MCGUIRE NUCLEAR STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 222
Renewed License No. NPF-17

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to the McGuire Nuclear Station, Unit 2 (the facility), Renewed Facility Operating License No. NPF-17, filed by the Duke Power Company LLC (the licensee), dated March 8, 2007, as supplemented March 27, April 13, and May 3, 2007, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations as set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is hereby amended by page changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-17 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 222, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. Further, Facility Operating License No. NPF-17 is hereby amended to authorize a change to the Updated Final Safety Analysis Report (UFSAR) to allow modifications to the emergency core cooling system sump, as set forth in the license amendment application dated March 8, 2007, as supplemented March 27, April 13, and May 3, 2007, and evaluated in the associated safety evaluation. The licensee shall update the UFSAR by adding a description of this change, as authorized by this amendment, and in accordance with 10 CFR 50.71(e).

4. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to License No. NPF-17
and the Technical Specifications

Date of Issuance: May 4, 2007

ATTACHMENT TO LICENSE AMENDMENT NO. 240

RENEWED FACILITY OPERATING LICENSE NO. NPF-9

DOCKET NO. 50-369

AND

LICENSE AMENDMENT NO. 222

RENEWED FACILITY OPERATING LICENSE NO. NPF-17

DOCKET NO. 50-370

Replace the following pages of the Renewed Facility Operating Licenses and the Appendix A Technical Specifications (TSs) with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
License Pages	License Pages
NPF-9 page 3	NPF-9 page 3
NPF-17 page 3	NPF-17 page 3
TS Page	TS Page
3.5.2-3	3.5.2-3

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 240 TO RENEWED FACILITY OPERATING LICENSE NPF-9

AND

AMENDMENT NO. 222 TO RENEWED FACILITY OPERATING LICENSE NPF-17

DUKE POWER COMPANY LLC

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 50-370

1.0 INTRODUCTION

By application dated March 8, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML070790248), as supplemented by letters dated March 27, 2007 (ADAMS Accession No. ML070940686), April 13, 2007 (ADAMS Accession No. ML071140173), and May 3, 2007, Duke Power Company LLC (Duke, the licensee), requested changes to the Technical Specifications (TSs) for the McGuire Nuclear Station, Units 1 and 2 (McGuire 1/2). The supplements dated March 27, April 13, and May 3, 2007, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published the *Federal Register* on March 19, 2007 (72 FR 12835).

The proposed changes would revise the McGuire 1/2, TS 3.5.2.8, and the associated Bases and authorize changes to the Updated Final Safety Analysis Report (UFSAR) concerning modifications to the emergency core cooling system sump.

The proposed license amendment seeks to revise existing commitments to Nuclear Regulatory Commission (NRC) Regulatory Guide (RG) 1.82, Revision 0, "Sumps for Emergency Core Cooling and Containment Spray Systems," as stated in the McGuire 1/2 UFSAR. The proposed changes will ensure that plant operations will be consistent with the current licensing basis following the installation of the new modified emergency core cooling system (ECCS) containment sump strainer assemblies and enclosures at each of the two Units.

Additionally, the proposed license amendment request seeks to revise McGuire 1/2 TS Surveillance Requirement (SR) 3.5.2.8 by replacing the phrase "each ECCS train containment sump suction inlet" and "suction inlet trash racks and screens" with the phrase "ECCS containment sump strainer assembly and the associated enclosure."

2.0 REGULATORY EVALUATION

Implementation of the requested amendment will ensure that the UFSAR and TSs Surveillance Requirements (SRs) remain consistent with the design of the containment sump structure, which is being modified at both McGuire 1/2 units.

The current sump structure consists of stainless steel framing that provides an attachment structure for a stainless steel fine mesh inner screen and an outer trash rack grating. A removable solid top deck is provided to facilitate inspection of the structure and pump suction intake. The sump structure provides debris protection for each of two train-specific suction pipes that exit lower containment through horizontal penetrations that incorporate guard pipes. The sump structure has a net screen surface area of approximately 135 square feet.

Replacement of ECCS containment strainers is being performed in response to NRC Generic Letter (GL) 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors”. GL 2004-02 is part of the regulatory framework the NRC staff is using to address issues associated with Generic Safety Issue (GSI) 191, “Assessment of Debris Accumulation on PWR [Pressurized Water Reactor] Sump Performance,” to improve evaluation of plant capability to meet Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.46(b)(5), “Long-term cooling.”

General Design Criterion (GDC) 35, “Emergency core cooling,” GDC 36, “Inspection of emergency core cooling system,” GCD 37, “Testing of emergency core cooling system,” GCD 38, “Containment heat removal,” GCD 39, “Inspection of containment heat removal system,” and GCD 40, “Testing of containment heat removal system,” of “Appendix A to Part 50 - General Design Criteria for Nuclear Power Plants,” require that systems be provided to perform specific functions, e.g., emergency core cooling, containment heat removal, and containment atmosphere clean-up following a postulated design-basis accident. These systems must be designed to permit appropriate periodic inspection and testing to ensure their integrity and operability.

RG 1.82, “Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident,” describes a method acceptable to the NRC staff for implementing these requirements with respect to the sumps and pools performing the functions of water source for the emergency core cooling, containment heat removal, or containment atmosphere clean-up. RG 1.82 has been revised (Revision 3) to incorporate guidance found in NRC Bulletin 2003-01, “Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors.” Supplemental guidance specific to debris blockage can also be found in GL 2004-02. However, the licensee is committed to Revision 0 (June 1974) of RG 1.82 for its plant licensing basis.

3.0 BACKGROUND

The McGuire 1/2 ECCS containment sumps provide a long-term source of cooling water to the ECCS and the containment spray system (CSS). In general, the lowest floor in the containment building is considered to be the ECCS containment sump; i.e., there are no ECCS train-specific separate collection pits provided. The ECCS containment sump collects ice condenser melt, reactor coolant system spill (including ECCS injection water), and containment spray water and provides water for the ECCS recirculation phase. Two suction lines (the ECCS recirculation

lines) are provided. Each ECCS recirculation line supplies one train of ECCS and one containment spray pump. The lower elevation of the containment collects a sufficient volume of water following the injection phase of safety injection to allow for the initiation of recirculation. Water collected in the lower containment reaches the ECCS containment sump suction lines in the pipechase (outside the crane wall) by flowing through multiple penetrations in the crane wall located near the containment floor level.

McGuire 1/2's original ECCS design incorporated the advantages of a remote containment recirculation sump. Locating the ECCS containment sump structure outside the crane wall (in the pipechase) provides protection from impacts and/or direct exposure to break-generated debris from the limiting large break loss-of-coolant accident (LOCA). The original McGuire 1/2 sump design complied with the generic guidance by providing a fine inner screen (comprised of 0.063-inch diameter wire strands), protected by a heavy, coarse outer trash rack (comprised of grating, 1-inch thick with nominally 1-inch by 4-inch openings). The strainer framework of the original design attached the trash rack on the frame exterior and attached the fine inner screen on the inside of the same frame, such that the flow surface areas of the trash rack and fine inner screen were approximately equal. The original sump existed completely outside the crane wall (in the pipe chase) which provided protection from impacts and/or direct exposure to break-generated debris from limiting large break LOCAs. The net screen surface area provided for both ECCS trains was approximately 135 square feet, or 67.5 square feet per train.

The new McGuire 1/2 strainer modification removes the original ECCS containment sump structure and replaces it with a complex strainer assembly (Unit 1 approximately 1,740 square feet and Unit 2 approximately 1,640 square feet). The strainer assembly is located both inside and outside the crane wall. The strainer assembly consists of robust materials (i.e., structural steel, platform grating, perforated plate, solid plate, strainers (tophats), water boxes, 18-inch pipe, and plenums connecting the strainers and the water boxes). The plenums and strainer portions located inside the crane wall (ICW) are housed within a stainless steel enclosure. The licensee concludes that the ICW enclosure will preserve the original 'remote sump' design by requiring the ECCS water supply to navigate a tortuous path with obstacles to provide conditions conducive to debris settlement. The ICW enclosure is constructed of stainless steel using a structural framework and grating, covered by plating. The side plating is perforated, the top is solid plate.

Outside the crane wall (in the pipechase), the two train-specific ECCS/CSS recirculation lines connect directly to the strainer main waterboxes. The two waterboxes are interconnected to one another via plenums and connected to the ICW strainer assemblies by 18-inch diameter pipes that pass through crane wall penetrations.

The strainer elements are stainless steel tubular modules (tophats) constructed from perforated plates with a bypass eliminator.

Vortex suppressors are installed above the tophat strainer assemblies located in the pipechase. Vortex suppression for ICW strainer assemblies is provided by the solid top deck of the enclosure.

Each unit’s new containment sump strainer assembly and enclosure are nuclear safety-related and designed to withstand safe shutdown earthquake loadings and protected from tornado missiles by virtue of being located within the containment building which, in turn, is protected by

the seismically designed reactor building. The structures are passive assemblies (i.e., no moving parts) qualified for the design environmental conditions of the sump.

4.0 TECHNICAL EVALUATION

The NRC staff has reviewed the licensee's regulatory and technical analyses in support of its proposed license amendment, which are described in the licensee's submittal. The detailed evaluation described in this section supports the conclusion that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

4.1 Exceptions to RG 1.82 Criteria

4.1.1 Criterion C.1

RG 1.82, Criterion C.1 states a minimum of two sumps should be provided, each with sufficient capacity to serve one of the redundant halves of the ECCS and the CSS.

The RG recommends providing two sumps to establish clear compliance with GDC 35, which requires long-term mitigation capability of a loss of coolant accident assuming a single failure. This recommendation is consistent with the guidance provided in NUREG 0800, "Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants," Chapter 6.3, Emergency Core Cooling System." SRP Chapter 6.3 states the ECCS should retain its capability to cool the core in the event of a failure of any single active component during the short term immediately following an accident, or a single active or passive failure during the long-term recirculation cooling phase following an accident.

The licensee's position is that redundancy is provided by the two separate suction pipes utilizing the containment side structure and floor as the intake structure boundary with a high post-LOCA water level, protected by a strainer and guard pipes. The two ECCS recirculation lines are sized to provide adequate capacity for one train of ECCS and one containment spray pump.

The licensee stated in the application that a single, shared (non-redundant) strainer meets the intent of Regulatory Position C.1 if it can be shown that it is not susceptible to a credible failure that would result in the loss of both trains of ECCS/CSS. The licensee indicated that this is consistent with the previously approved staff position documented in SECY-77-439 (ADAMS Accession No. 7812180291).

The licensee also indicated in the application that additional support is provided for this position by the following statement in RG 1.82, Revision 3 on page 1.82-6, "Consistent with the plant licensing basis single-failure criterion, redundant ECCS sumps and sump outlets should be separated to the extent practical to reduce the possibility that a single event could render both sumps inoperable."

The current licensing basis for single failures for McGuire 1/2 , as reflected in Chapters 3.0 and 6.0 of the McGuire 1/2 UFSAR, assumes that within the first 24 hours following the initiating incident, the single failure is limited to the failure of an active component to complete its

function as required. Should a single failure occur during the long-term period, the engineered safety features are designed to tolerate an active failure or a passive failure without loss of its protective function.

The licensee reviewed postulated high energy pipe breaks that could potentially interact with the new strainer. The licensee reviewed high energy pipe rupture composite drawings for postulated breaks in close proximity to the new strainer. The licensee also reviewed isometric drawings associated with the breaks along with applicable rupture restraint drawings to determine if the new strainer was a target of pipe whip or jet impingement. Most piping in the area was either too far away to create an interaction, was low-energy piping, or was already restrained/blocked. The licensee identified, two postulated pipe breaks that resulted in an unacceptable jet impingement interaction with the new sump screen. A new rupture restraint/jet barrier was installed to protect the strainer. The licensee included small breaks in the evaluation. Based on review of the results of the licensee's evaluation, the NRC staff finds that piping and other miscellaneous components in the area of the new strainer are mounted such that following a design-basis accident they will not pose a threat to the new screen.

The licensee evaluated internally generated missiles resulting from an event or accident inside containment as part of the new sump design. The ECCS containment sump does not introduce components that could become missiles during a LOCA. The NRC staff's evaluation of each of these missile sources concluded that:

- missile generation from that source was not credible (i.e., catastrophic failure of the reactor vessel, steam generators, pressurizer, reactor coolant pump casings and piping leading to generation of missiles is not postulated, including sections of piping as free missiles),

- the missile was not close enough to damage the ECCS sump strainer and its associated enclosure,

- structural barriers existed between the source of the missile and the ECCS sump strainer and its associated enclosure, or

- the missiles were of low mass (i.e., incapable of causing damage to the strainer or the associated enclosure).

Therefore, the NRC staff finds that the licensee has demonstrated reasonable assurance that damage to the new ECCS containment sump structure and its associated enclosure from missiles is precluded by a combination of distance, trajectory, obstructions and low kinetic energy.

The new ECCS containment sump strainer assembly and enclosure are nuclear safety-related, are designed to withstand safe shutdown earthquake loadings, hydrodynamic mass, dead weights, operating loads, debris, thermal expansion, buoyancy, differential pressure, and are protected from tornado missiles by virtue of being located within the containment building which, in turn, is protected by the seismically designed reactor building. The ECCS strainers are passive assemblies (i.e., no moving parts) qualified for the design environmental conditions of the sump. These structures are also designed for the containment subcompartment differential pressures from the limiting case pressurizer surge line pipe break

The NRC staff has approved the use of leak-before-break (LBB) methodology as applied to the dynamic effects of a LOCA from a break of the reactor coolant system piping main loop. Impacts to the ECCS sump from high-energy line breaks were evaluated in accordance with design and licensing requirements described in the UFSAR. Postulated high-energy pipe breaks that could potentially interact with the new strainer were identified and evaluated for potential targets of pipe whip or jet impingement. Two postulated pipe breaks were identified that resulted in unacceptable jet impingement interaction with the new sump screen. To address this issue, the licensee committed to install a new rupture restraint and jet barrier to protect the sump screen from these postulated breaks.

The validity of the licensee's conclusion that there is no credible single failure that could result in structural failure of the proposed strainer has been reviewed by the NRC staff and found to be acceptable. The NRC staff reviewed the planned replacement strainer to determine whether the licensee has adequately considered potential dynamic effects of jet impingement, missile impact, and pipe whip. The NRC staff requested that the licensee provide additional information concerning the jet barrier, reference calculations for pipe whip, jet impingement evaluations, load combinations, and reference for the strainer structural design calculation establishing its design adequacy.

The NRC staff reviewed licensee's sump modifications and load calculations. Based upon the information contained in the March 8, 2007, application and the March 27 and April 13, 2007, supplements, the NRC staff concludes that the structural design of proposed modifications to the containment sump strainer assemblies is acceptable. Further, the NRC staff finds that these restraints, in combination with the significant portion of the strainer that will remain outside the crane wall, will protect the ECCS/CSS suction strainer in such a manner that it will perform its intended function following a design-basis accident.

Each unit's new ECCS containment sump strainer assembly and enclosure are safety-related, designed to withstand safe shutdown earthquake loadings and protected from tornado missiles by virtue of being located within the containment. The structures are passive assemblies that are qualified for the environmental conditions of the sump, and the design containment sub-compartment differential pressure. The licensee will inspect the strainer on a periodic basis to ensure that it has not experienced any significant degradation or condition that could adversely affect functionality. The inspection frequency is consistent with standard industry practices to detect abnormal degradation.

In the application the licensee states that the ECCS sump strainer modification enhances the original design by providing a much larger surface area for the filtration of debris, increasing from approximately 135 square feet to over 1600 square feet for each unit. The design includes a complex geometry, and provides a coolant velocity less than 0.2 ft/sec based on one-half of the free surface area of the strainer available. Industry and NRC-sponsored testing on ECCS strainer design has shown that complex geometries and coolant velocities in this range are greatly effective in enhancing debris settlement and prevent compression of fibrous debris that may reach the strainer. Both of these factors reduce the impact on strainer head loss. The crane wall and containment strainer enclosure act as a primary filter to prevent large debris from reaching the sump strainer. Vortex suppression is provided to preclude air entrainment in the recirculated coolant.

The licensee states in the application that, along with providing physical protection from impacts, the crane wall and ICW enclosure also preserve the original 'remote sump' design by diverting the ECCS water supply through a tortuous path, with obstacles, through the crane wall penetrations into the pipechase area, and around the outside of containment. The floor in the pipechase is sloped away from the strainer to provide resistance to debris that might slide along the floor. To reach the portion of the strainer located inside the crane wall, water and debris must again pass through crane wall penetrations located above the floor. The licensee indicates that this provides conditions conducive for interception of debris, and debris settlement.

In the case of an ECCS sump strainer design that has two fully separate trains and non-communicating strainers, if a single ECCS train were lost, suspended debris would accumulate on the strainer for the remaining operating train. The resulting debris bed would be thicker as compared to a common strainer of the same size, with the potential for higher head losses.

As an alternative, consider an ECCS sump strainer design that has redundant suction pipes and valves, but common, interconnected strainer surfaces. Under the same failure scenario described above, the suspended debris would still accumulate over the entire available strainer. Debris bed thickness would be no worse than under dual-train operation, and given that total flow through the debris bed would be reduced by the loss of a single train, head loss for the remaining operating train would actually be less than for the same amount of debris in two-train operation.

Thus, intercommunication between the redundant suction lines of the ECCS trains has a benefit for a given strainer size. There are benefits of having independent strainers as well. These include the ability to handle some beyond-design-basis situations. For example, excessive blockage could possibly be mitigated by stopping flow through one strainer. Independent strainers also provide some protection from a random beyond-design-basis passive failure. While having two sumps clearly supports demonstration of compliance with GDC 35, the staff accepts that single or common sumps are also compliant with the GDC if single failure of the strainer is precluded. The staff, in reviewing submittals related to GSI-191, does not believe there is an overriding case for one configuration or the other. Licensees have a number of options for addressing the issue, as long as compliance with the regulations is demonstrated.

The licensee implemented a rigorous foreign material exclusion (FME) process for the installation of the new ECCS sump. This process utilized a station procedure to ensure the correct installation of the new sump strainer assembly and enclosure. This procedure incorporated predefined quality control (QC) inspection hold points to ensure that specific installation acceptance criteria (e.g., welds, bolt torque, dimensional tolerance, fit up, etc.) had been met. This procedure also included ‘data sheets’ for each tophat, plenum, waterbox, and connector pipe to ensure foreign material exclusion practices were established and effectively implemented. Each sump component/part (tophat, plenum, water box, pipe) of the sump was identified with a designated identifier/number. As the sump was assembled, each component and part was inspected by an FME monitor and a QC inspector. After the strainer assembly was complete in the pipe chase, it was covered to prevent foreign material intrusion into or around the assembly. The inside of the sump structure is a designated clean zone; any time it is opened or entered it is controlled under Nuclear Station Directive 104, “Materiel Condition/Housekeeping, Cleanliness Foreign Material Exclusion and Seismic Concerns,” and FME procedure MP/0/A/7700/123. In addition, video inspections were made inside the

previously existing piping to ensure no foreign material was present. The interior sections of the new ECCS sump were visually inspected for foreign material during installation. Therefore, the NRC staff finds there is reasonable assurance that the sump has been installed appropriately and foreign material has been excluded from inside the ECCS sump during installation.

In summary, the NRC staff finds that the licensee has demonstrated reasonable assurance that the new strainer is designed to provide debris filtration with acceptable head loss and adequate net positive suction head (NPSH) to the ECCS/CSS pumps under the current licensing basis during the post-LOCA recirculation phase. The licensee stated that the strainer design was developed in accordance with Nuclear Energy Institute's (NEI's) NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," guidance, and is sized to accommodate all transported debris. The licensee has committed to install a new rupture restraint and jet barrier to protect the sump screen from postulated breaks that could threaten the strainer integrity. The licensee stated in the application that periodic inspections (once per refueling outage) will be used to identify any potential degradation or condition that could adversely affect functionality. The licensee stated that this inspection frequency has been confirmed by operating experience to be sufficient to detect abnormal degradation. The NRC staff finds that this frequency is reasonable. Further, the NRC staff finds, based on (1) its evaluation that pipe whip and impingement are not concerns, (2) the lack of a requirement or overriding advantage to having independent sumps, and (3) the adequacy of the surveillance to detect damage caused by degradation, maintenance, or other operation-related consideration, that the licensee's proposed exception to RG 1.82 Criterion C.1 is acceptable, and that the licensee meets GDC 35. The NRC staff's preference for independent sumps remains, as stated in Regulatory Position C.1 of RG 1.82.

The licensee states in the March 8, 2007, application that the completion of the chemical effects' studies and other evaluations is required to confirm that McGuire 1/2 ECCS recirculation functions will fully address NRC GL 2004-02.

4.1.2 Criterion C.2

RG 1.82, Criterion C.2 states redundant sumps should be physically separated from each other and from high-energy piping systems by structural barriers to the extent practical, to preclude damage to the sump intake filters by whipping pipes or high-velocity jets of water or steam.

The licensee's position is that ECCS redundancy begins at the suction pipes from the containment sump, and the need to provide redundancy and ECCS train separation within the common sump strainer is not required due to the absence of any credible failure of the sump strainer.

To address pipe rupture and jet impingement vulnerabilities, the licensee committed to install pipe rupture restraints. The NRC staff finds that these restraints, in combination with the significant portion of the strainer that will remain outside the crane wall, will protect the ECCS/CSS suction strainer in such a manner that there are no credible pipe rupture or jet impingement scenarios capable of causing a failure of both trains of the ECCS/CSS.

The NRC staff finds that ECCS/CSS train redundancy and separation within the common sump strainer are not required due to the absence of any credible single failure that could completely

disable the sump strainer, as discussed above in Section 4.1.1 of this Safety Evaluation (SE).

4.1.3 Criterion C.3

RG 1.82, Criterion C.3 states that the sumps should be located on the lowest floor elevation in the containment exclusive of the reactor vessel cavity. At a minimum, the sump intake should be protected by two screens: (1) an outer trash rack, and (2) a fine inner screen. The sump screens should not be depressed below the floor elevation.

The proposed licensing basis change removes the requirement for a trash rack. The function of the trash rack is to provide protection from missiles and large debris. The intended functions of the trash rack are provided by alternate means as discussed below in Section 4.1.4 of this SE. The sump location remains on the lowest floor elevation in the containment exclusive of the reactor vessel cavity.

Based on the NRC staff's independent review of the proposed sump modification, the NRC staff finds the new strainer design provides adequate protection of the ECCS/CSS inlet pipes, the intended function of the trash rack is maintained by other design considerations, and the design still complies with the intent of Criterion C.3.

4.1.4 Criterion C.6

RG 1.82, Criterion C.6 states that a vertically mounted outer trash rack should be provided to prevent large debris from reaching the fine inner screen. The strength of the trash rack should be considered in protecting the inner screen from missiles and large debris.

The licensing basis change proposed by the licensee removes the requirement for a trash rack. The function of the trash rack is to provide protection from missiles and large debris. The application states that the physical location and layout of the sump strainer assembly provides protection from missiles and large debris. The crane wall and ICW enclosure act as a primary filter to prevent large debris from reaching the sump strainer by retaining the "remote sump" feature that provides a tortuous flowpath for the ECCS water supply that allows large debris to settle out. The crane wall and ICW enclosure also provide protection from missiles. The licensee has committed to install an integral structure consisting of a new rupture restraint and jet barrier on the residual heat removal system to protect the sump screen from postulated breaks that could threaten the integrity of the ICW portion of the strainer. Therefore, the intended functions of the trash rack are provided by alternate means.

The NRC staff finds that the new strainer design addresses the potential for large debris. Missile and impact protection for the revised ECCS sump strainer design is provided by the location of the strainer elements (in the pipechase or shielded by the ICW enclosure). In addition, the crane wall and strainer enclosure act as a primary filter to prevent large debris from reaching the sump strainer. Therefore, the intended function of the trash rack is maintained by the sump modification design and complies with the intent of Criterion C.6.

4.1.5 Criterion C.7

RG 1.82, Criterion C.7 states that a vertically mounted fine inner screen should be provided. The design coolant velocity at the inner screen should be approximately 6 cm/sec (0.2 ft/sec).

The available surface area used in determining design coolant velocity should be based on 1/2 of the free surface area of the fine inner screen to conservatively account for partial blockage. Only the vertical screens should be considered in determining available surface area.

The licensing basis change proposed by the licensee removes the reference to vertically mounted fine inner screen. The modified strainer includes a complex geometry, with vertical screen, and provides a design coolant velocity less than 0.2 ft/sec based on one-half of the free surface area of the strainer available. The application states that strainer modification enhances the original design by providing a much larger surface area for the filtration of debris, such that it precludes loss of NPSH for ECCS and CSS pumps during the period these components are required to operate.

The NRC staff finds that the new strainer design includes vertical surface area incorporated into a complex design, and a much larger strainer. The inner screen is not required since its intended functions are maintained by other design considerations. Therefore, the intent of Criterion C.7 is met.

4.1.6 Criterion C.8

RG 1.82, Criterion C.8 states that a solid top deck is preferable, and the top deck should be designed to be fully submerged after a LOCA and completion of the safety injection.

The licensing basis change proposed by the licensee indicates that vortex suppression is provided to preclude air entrainment in the recirculated coolant. The application states that the preference for a submerged solid top deck is intended to provide an additional protective barrier against missiles and protection against air or debris entrainment via a vortex. Rather than incorporating a completely encompassing solid top-deck, the proposed sump modification design incorporates the solid deck feature into the ICW enclosure for missile protection and vortex suppression for the strainer modules located inside the crane wall, and utilizes horizontal grating for vortex suppression for the strainer modules in the pipechase. The pipechase is a shielded location that provides protection from missiles. The application stated that the efficacy of the horizontal grating in the pipechase serving as a vortex suppressor was demonstrated through qualification testing. The application stated, that the ICW deck plate and the strainer enclosure top grating will be completely submerged after a LOCA.

The NRC staff has reviewed the design of the sump modification and finds that the ICW enclosure deck plate and strainer enclosure top grating meet the intent of providing additional protection for the strainer assembly, and will function as a vortex suppression device. In addition, the top plates/gratings will be completely submerged following a LOCA. Therefore, the intent of Criterion C.8 is met.

4.1.7 Criterion C.9

RG 1.82, Criterion C.9 states that the trash rack and screens should be designed to withstand the vibratory motion of seismic events without loss of structural integrity.

The licensing basis change proposed by the licensee eliminates the reference to a trash rack. The modified strainer does not include a trash rack. Trash rack functions are provided by alternate means as discussed in Section 4.1.4 of this SE.

The NRC staff finds that the new sump modification does not need a trash rack, and, therefore, elimination of the reference to a trash rack is acceptable. The NRC staff has reviewed the structural design of the new strainers, and finds that the design still complies with the intent of Criterion C.9.

4.1.8 Criterion C.10

RG 1.82, Criterion C.10 states that the size of openings in the fine screen should be based on the minimum restrictions found in the systems served by the sump. The minimum restriction should take into account the overall operability of any system served.

The licensee proposes to change licensing bases such that the size of openings in the sump strainer is based on the minimum restrictions found in systems served by the sump. The minimum restriction takes into account the overall operability of the system served. Strainer perforations are less than $1/10^{t/h}$ of an inch in diameter.

The NRC staff finds this change is editorial in nature. The proposed change corrects the licensing basis, based on the new sump design, by referring to a strainer versus a screen, and providing a specific dimension for the strainer perforations. The NRC staff finds that this proposed change meets the intent of Criterion C.10, and is, therefore, acceptable.

4.1.9 Criterion C.12

RG 1.82, Criterion C.12 states that materials for trash racks and screens should be selected to avoid degradation during periods of inactivity and operation and should have low sensitivity to adverse effects such as stress-assisted corrosion that may be induced by the chemical reactive spray during LOCA conditions.

The proposed licensing basis change eliminates the reference to a trash rack and screen. Trash rack functions are provided by alternate means as discussed in Section 4.1.4 of this SE. The materials of construction of the new strainer and enclosure (stainless steel) will minimize degradation during inactivity and will be appropriately resistant to adverse post-LOCA environmental effects. The NRC staff finds that based on the acceptance of the elimination of the trash rack in the new sump modification and the robust construction of the new strainer and its enclosure, this proposed change meets the intent of Criterion C.12.

4.1.10 Criterion C.13

RG 1.82, Criterion C.13 states that the trash rack and screen structure should include access openings to facilitate that inspection of the structure and pump suction intake.

The proposed licensing basis again eliminates the reference to a trash rack and screen. Trash rack functions are provided by alternate means as discussed in Section 4.1.4 of this SE. The new strainer incorporates design features to allow inspection of conditions that could affect strainer functionality as discussed in Section 4.2 of this SE. Therefore, the NRC staff finds the proposed change acceptable and that it meets the intent of Criterion C.13.

4.1.11 Criterion C.14

RG 1.82, Criterion C.14 states that inservice inspection requirements for coolant sump components (trash racks, screens, and pump suction inlets) should include the following:

a. Coolant sump components should be inspected during every refueling period downtime.

b. The inspection should be a visual examination of the components for evidence of structural distress or corrosion.

The proposed change replaces the term “trash racks, screens, and pump suction inlets” with the term “strainer assembly and enclosure” along with some additional minor editorial items. Therefore, the NRC staff finds the proposed change acceptable and meets the intent of Criterion C.14.

4.1.12 Summary of NRC Staff’s Evaluations of RG 1.82 Exemptions

The NRC staff finds the proposed changes generally meet the intent of the guidance criteria to the extent they remain applicable given a significantly enhanced strainer design. Further, exceptions taken are acceptable. The new strainer is designed to provide debris filtration with acceptable head loss and adequate NPSH to the ECCS/CSS pumps at the maximum postulated debris loads during the post-LOCA recirculation phase. The licensee stated that the strainer design was developed in accordance with NEI 04-07 guidance, and is sized to accommodate all transported debris. In the March 8, 2007, application the licensee committed to install a new rupture restraint and jet barrier to protect the sump screen from postulated breaks that could threaten the strainer integrity. Periodic inspections will be used to identify any potential degradation or condition that could adversely affect functionality. The licensee states that inspection frequency is considered to be sufficient to detect abnormal degradation. The NRC staff finds that there is reasonable assurance that the new sump design at McGuire 1/2 will provide adequate debris protection for each of two train-specific suction pipes that exit lower containment.

4.2 Technical Specification Revisions

The proposed amendment revises the TS SR 3.5.2.8 to reflect the ECCS containment sump modification. This modification encloses the containment sump suction inlet, thus making it an integral part of the strainer assembly. The use of the phrase “ECCS containment sump strainer assembly and the associated enclosure” reflects the replacement ECCS containment strainer configuration, which does not include trash racks. Removal of the trash racks is evaluated in Section 4.1.4 of this SE and found acceptable.

McGuire 1/2 TS SR 3.5.2.8 requires that the ECCS sump be visually inspected to verify there is no restriction as a result of debris, and no evidence of structural distress or abnormal corrosion present prior to declaring the ECCS sump operable for transition from mode 5 to mode 4 during each reactor startup. When the pre-mode 4 inspections are performed, major outage work is complete, and any remaining loose material in containment must be logged and tracked in accordance with station procedures for control and accountability. If any debris, damage or deficiency were to be discovered during the inspection, station processes require entry into the corrective action program, with the requisite investigation and implementation of appropriate

corrective action prior to the transition from mode 5 to mode 4. The visual inspection of the ECCS sump required by SR 3.5.2.8 is to ensure the absence of conditions which could adversely affect sump functionality. The licensee stated that this surveillance includes a sufficiently detailed inspection of the enclosure and exterior tophat surfaces to establish reasonable assurance that no adverse conditions are present prior to operation.

The licensee stated that the scope and frequency of the inspections have been confirmed by operating experience to be sufficient to detect abnormal degradation that could adversely affect functionality. These requirements are consistent with standard industry practices, which have been reviewed and accepted by the NRC. Further, the NRC staff finds that these practices, if properly implemented, are adequate to detect strainer damage that could adversely impact the ability of the ECCS to perform as designed post-LOCA. Therefore, the NRC staff finds the proposed change to the TS acceptable.

By letter dated May 3, 2007, the licensee withdrew their request in the March 8, 2007, application for the NRC to review and approve the bases changes associated with the licensing basis changes concerning the ECCS sump modifications. The licensee stated in the May 3, 2007, letter that the TS bases would be changed to reflect the licensing basis and TS changes associated with the sump modification in accordance with Section 5.5.14 of the McGuire 1/2 TSs. The NRC staff finds this acceptable.

5.0 SUMMARY

The NRC staff performed an independent review of the proposed licensing basis and TS changes. Based on the above evaluation the NRC staff finds the licensee's proposal to modify the McGuire 1/2 licensing basis, as described in the UFSAR and the changes to the TS acceptable.

6.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION

The Commission's regulations in 10 CFR 50.92(c), "Issuance of amendment," state that the Commission may make a final determination that a license amendment involves no significant hazards consideration if operation of the facility in accordance with the amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

The NRC staff has reviewed the licensee's analysis against the standards of 10 CFR 50.92(c). The licensee's analysis is presented below.

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

Implementation of the proposed amendment does not significantly increase the probability or the consequences of an accident previously evaluated. The ECCS [emergency core cooling system] containment sump functions in the mitigation of a Loss of Coolant Accident (LOCA). It is not an accident initiator.

Commitments to Regulatory Guide 1.82, Rev 0, as currently described in the UFSAR [Updated Final Safety Analysis Report], are being revised to establish appropriate exceptions associated with the modified ECCS sump strainer design. This modified ECCS containment sump assembly, consisting of a complex geometry, and crediting all effective strainer surface area, was designed using the methodology contained in NEI 04-07, “Pressurized Water Reactor Sump Performance Evaluation Methodology,” Rev 0, and the associated NRC [Nuclear Regulatory Commission] Safety Evaluation Report.

Removal of the implied licensing basis requirement to physically separate the containment sump into two halves or provide ECCS train separation within the same containment sump will not impact the assumptions made in Chapter 15 of the McGuire UFSAR. There are no changes in any failure mode or effects analysis associated with this change. Since there are no credible failures which could result in the introduction of debris within the strainer assembly, the need to provide this physical separation is not warranted.

Although the configurations of the existing ECCS containment sump trash racks and screen and the replacement sump strainer assemblies are different, they serve the same fundamental purpose of passively removing debris from the sump's suction supply of the supported system pumps. Removal of trash racks does not impact the adequacy of the pump NPSH [net positive suction head] assumed in the safety analysis. Likewise, the change does not reduce the reliability of any supported systems or introduce any new system interactions. The greatly increased surface area of the modified strainer is designed to reduce head loss.

Thus, based on the above, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed amendment will not create the possibility of a new or different kind of accident. The ECCS containment sump strainer serves as a passive component of the ECCS accident mitigation system. It is, therefore, not an accident initiator. The modified design requirements result in a strainer that performs the same functions in the same manner as the original design, such that no different kind of accident is created.

A change to McGuire Technical Specification Surveillance Requirement [SR] 3.5.2.8 does not alter the nature of events postulated in the Safety Analysis Report nor do they introduce any unique precursor mechanisms.

Therefore, the proposed changes will not create the possibility of a new or different kind

of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in the margin of safety?

Response: No.

Margin of safety is related to the confidence in the ability of the fission product barriers to perform their design functions during and following an accident situation. These barriers include the fuel cladding, the reactor coolant system, and the containment system. The performance of the containment system, fuel cladding, and the reactor coolant system will not be impacted by the proposed change.

Duke's [the licensee's] evaluation concludes that there are no credible failure mechanisms applicable to the modified ECCS containment sump strainer design. The revised design requirements result in enhanced strainer performance under more conservative debris loading assumptions.

The proposed change to Technical Specification SR 3.5.2.8 will have no effect on the manner in which safety limits, limiting safety system settings, or limiting conditions for operation are determined nor will there be any effect on those plant systems necessary to assure the accomplishment of protective functions. The proposed change does not adversely affect the fuel, fuel cladding, Reactor Coolant System, or containment integrity.

Thus, it is concluded that the proposed changes do not involve a significant reduction in the margin of safety.

The NRC staff has reviewed the licensee's analysis and, based on this review, has concluded that the three standards of 10 CFR 50.92(c) are satisfied. Therefore, the NRC staff has made a final determination that the proposed amendment involves no significant hazards consideration.

7.0 STATE CONSULTATION

In accordance with the Commission's regulations, the North Carolina State official was notified of the proposed issuance of the amendments. The State official had no comments.

8.0 ENVIRONMENTAL CONSIDERATION

The amendments change the surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (72 FR 12835). The Commission has made a final finding that the amendments involve no significant hazards consideration. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in

10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

9.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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