Stephen L. Smith
Engineering Vice President

October 11, 2021
ET 21-0012

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

References: 1) Letter ET 21-0005, dated August 12, 2021, from S. L. Smith, WCNOC, to USNRC

2) Letter dated September 23, 2021, from S. S. Lee, USNRC, to C. Reasoner, WCNOC

Subject: Docket No. 50-482: Supplement to License Amendment Request for a Risk-Informed Resolution to GSI-191

Commissioners and Staff:

Reference 1 provided a license amendment request (LAR) that proposed a risk-informed resolution to GSI-191 for the Wolf Creek Generating Station (WCGS). Additionally, Wolf Creek Nuclear Operating Corporation (WCNOC) requested an exemption from certain requirements in Section 50.46(a)(1) of Title 10 of the Code of Federal Regulations (10 CFR) in accordance with the provisions of 10 CFR 50.12, "Specific exemptions." During the acceptance review process, Nuclear Regulatory Commission (NRC) staff identified that more information was necessary to enable the NRC to accept this LAR for detailed review. Reference 2 provided the request for supplemental information from the NRC. A clarification call between WCNOC personnel and NRC staff occurred on September 23, 2021, to discuss the information requested.

The Attachment to this submittal provides the supplemental information requested by the NRC to complete the acceptance review process for this LAR.

The supplemental information provided in the Attachment does not impact the conclusions of the No Significant Hazards Consideration provided in Reference 1. In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," a copy of this supplement is being provided to the designated Kansas State official.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4093, or Ron Benham at (620) 364-4204.

Sincerely,

Stephen L. Smith

SLS/rlt

Attachments: Supplement to License Amendment Request for a Risk-Informed Resolution to GSI-191

cc: S. S. Lee (NRC), w/a
S. A. Morris, (NRC), w/a
N. O'Keefe (NRC), w/a
K. S. Steves (KDHE), w/a
Senior Resident Inspector (NRC), w/a

STATE OF KANSAS)
) SS
COUNTY OF COFFEY)

Stephen L. Smith, of lawful age, being first duly sworn upon oath says that he is Vice President Engineering of Wolf Creek Nuclear Operating Corporation; that he has read the foregoing document and knows the contents thereof; that he has executed the same for and on behalf of said Corporation with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By___ _____
Stephen L. Smith
Vice President Engineering

SUBSCRIBED and sworn to before me this 11th day of October , 2021.

RHONDA L. TIEMEYER
Notary Public, State of Kansas
My Appointment Expires
January 11, 2022

Rhonda L. Tiemeyer
Notary Public

Expiration Date January 11, 2022

Supplement to License Amendment Request for a Risk-Informed Resolution to GSI-191

Reference 1 provided a license amendment request (LAR) that proposed a risk-informed resolution to GSI-191 for the Wolf Creek Generating Station (WCGS). Additionally, Wolf Creek Nuclear Operating Corporation (WCNOC) requested an exemption from certain requirements in Section 50.46(a)(1) of Title 10 of the Code of Federal Regulations (10 CFR) in accordance with the provisions of 10 CFR 50.12, "Specific exemptions." During the acceptance review process, Nuclear Regulatory Commission (NRC) staff identified that more information was necessary to enable the NRC to accept this LAR for detailed review. Reference 2 provided the request for supplemental information from the NRC.

This attachment provides a discussion to address concerns related to the fire probabilistic risk assessment (PRA) model numbers presented in Reference 1. Following that discussion, specific NRC requests along with WCNOC responses are provided.

The risk evaluation done in support of this LAR was completed prior to WCNOC having final fire PRA information beyond the scope of the WCGS IPEEE. The risk evaluation included initial fire PRA quantification results before any significant refinements to the model had been incorporated. These quantification numbers in no way are expected to represent the as-built and as-operated plant and are bounding. The main purpose for the quantification of the fire PRA at that time was to identify and prioritize aspects of the model requiring refinement. WCNOC continues to develop a fire PRA model for use in future risk-informed applications and has planned a peer review of the fire PRA model to occur the week of November 1, 2021. Final peer review results are expected early 2022.

At the time of the risk evaluation, it was understood that the fire PRA numbers were very high due to significant conservatisms inherent to the modeling. The understanding and expectation was that model refinements would result in significant reduction in both core damage frequency (CDF) and large early release frequency (LERF) numbers. However, because the fire PRA model does not have any effect on the quantitative results from the risk-informed GSI-191 evaluation, WCNOC did not see any reason to postpone developing the risk evaluation supporting the LAR until after the fire PRA was complete. RG 1.174 states that if the calculated values of ΔCDF and ΔLERF are very small, as defined by Region III in Figures 4 and 5, a detailed quantitative assessment of the base values of CDF and LERF is not necessary. However, for completeness, the baseline CDF and LERF values from all modeled hazards were included in the submittal, along with an explanation that the fire PRA was not finalized, and that those values were expected to decrease.

Table 3 in Attachment VII of the original LAR submittal provides a summary of the ΔCDF and ΔLERF calculations for each of the evaluated hazards. The three hazards that contribute to the GSI-191 risk quantification are pipe/non-pipe break loss of coolant accidents (LOCAs), secondary side breaks, and seismically induced LOCAs. The contribution from each of these hazards is less than 1E-6. If the contributions from the hazards are summed together, the value is 1.4E-6, which is slightly above the RG 1.174 Region III guideline for ΔCDF. However, as stated in RG 1.174:

> *These guidelines are intended to provide assurance that proposed increases in CDF and LERF are small and are consistent with the intent of the Commission's Safety Goal Policy Statement. As indicated in the footnote to Figures 4 and 5, the boundaries between regions are not definitive. In applying these guidelines, it is*

> *particularly important to recognize that the risk metrics calculated using PRA models are a function of the assumptions and approximations made in the development of those models. This is particularly important when the results from PRA models for multiple hazard groups are combined, since the results from some hazard groups, depending on the state of practice, may be conservatively or nonconservatively biased.*

The calculations performed for each of the three hazards that contribute to the risk quantification in the submittal were conservatively biased based on the methodology used. These conservatisms are described in the submittal and a paragraph included below Table 3 explaining that because bounding methods were used for the evaluation, the ΔCDF and ΔLERF values were not added together. Based on the information provided in the submittal, including the methods and conservatisms used for the risk quantification, there is a strong basis for concluding that the risk associated with the effects of debris at WCGS is very small.

The following discussion provides the NRC staff's specific requests for supplemental information and WCNOC's responses (specific NRC requests in italics).

<u>NRC Request 1:</u>

Justification supporting the claim that "the CDF and LERF values are expected to decrease," including the anticipated extent of the decrease, details of the existing fire PRA model conservatisms and non-conservatisms on the PRA results as presented in the application, any plant modifications affecting potential fire risk, and details of the new fire PRA model, current status, and schedule for finalization.

<u>WCNOC Supplemental Information for Request 1:</u>

At the time of submitting this supplemental information, WCGS does not have a fire PRA model-of-record and still relies on the IPEEE for fire insights as necessary. A peer review of the developed fire model is scheduled for the week of November 1, 2021. Following any necessary resolution of facts and observations from the peer review, WCNOC intends to issue the resulting fire model as the initial Fire PRA model-of-record in early 2022. The early draft model used as input for the GSI-191 LAR submittal was dated May 2019. In 2019, the Fire PRA model was initially quantified with risk values of CDF = 5.49E-04 and LERF = 1.33E-05.

The WCGS fire PRA model has been developed in accordance with ASME-ANS RA-Sa-2009, Part 4 (Fire PRAs At-Power). The methodology used to create the Fire PRA model is in alignment with the following tasks from NUREG/CR-6850 (EPRI-1011989).

Task 1 - Plant Boundary Definition and Partitioning (PP)
Task 2 - Fire PRA Components Selection (ES)
Task 3 - Fire PRA Cable Selection (CS)
Task 5 - Fire-Induced Risk Model (PRM)
Task 6 - Fire Ignition Frequencies (IGN)
Tasks 8 & 11 - Scoping and Detailed Fire Modeling (FSS)
Task 9 - Detailed Circuit Failure Analysis (CF)
Task 10 - Circuit Failure Mode Likelihood Analysis (CFMLA)
Task 12 - Post-Fire Human Reliability Analysis (HRA)
Task 14 - Fire Risk Quantification (FQ)
Task 15 - Uncertainty and Sensitivity Analysis (UNC)

Since 2019 the WCGS Fire PRA model has been refined to achieve more realistic risk results. The refinements included verifying and updating (as necessary) fire PRA inputs, incorporating the latest industry guidance, performing additional cable and component selection, and refining model conservatisms.

Examples of recently published industry guidance which has been incorporated into the WCGS Fire PRA model since 2019 include:

- NUREG-2178, Volumes 1 and 2,
- NUREG-2230,
- NUREG-2233,
- Multiple Fire PRA related Frequently Asked Questions (FAQs)

Examples of model refinements incorporated to reduce prior conservatisms include:

- Use of more sophisticated fire modeling tools (i.e., CFAST and FDS) in high risk fire compartments such as the cable spreading rooms and the main control room.
- IEEE-383 cable qualification analysis to remove the assumption that all cables are unqualified.
- Refinement of fire scenario severity factors, fire growths, suppression and detection credit, and target sets.
- Additional cable selection to remove components from the assumed failures list.
- Fault tree and HRA refinements to allow the risk model to realistically represent the as-built as-operated plant.
- Application of FAQ 08-0047 to updated spurious failure probabilities.

WCNOC did not incorporate any explicit plant modification for the purposes of reducing fire PRA risk numbers. Several modifications that were previously incorporated to reduce overall plant risk (and are accordingly accounted in the existing PRA modeling) include Station Blackout Diesels, a non-safety auxiliary feedwater pump, and the Shield reactor coolant pump (RCP) seals.

The current quantified fire model CDF and LERF values, that will be peer reviewed, are CDF = 2.67E-05 and LERF = 1.11E-06. Replacing the originally reported CDF and LERF values for fire in Table 1 of Attachment VII of the original LAR submittal results in the following:

PRA Model	**CDF (yr^{-1})**	**LERF (yr^{-1})**
Internal Events	7.25E-06	7.31E-08
Internal Flood	9.06E-06	3.77E-08
Internal Fire*	2.67E-05	1.11E-06
High Winds*	3.40E-06	7.98E-09
Total	**4.64E-05**	**1.23E-06**

*NOTE: As previously discussed, the Internal Fire model has not yet been incorporated as a model-of-record. Similarly, the High Winds model, though peer reviewed, has not been incorporated as a model-of-record due to overly conservative modeling.

While additional refinements to the fire PRA model have been identified and are planned for future implementation in the model, current results show that the risk associated with internal fires is well within the Commission's Safety Goals embedded in the RG 1.174 guidelines.

NRC Request 2:

Discussion of whether ways to reduce baseline CDF and LERF, consistent with the guidance in RG 1.174, have been identified, and the associated implementation schedule, or justification why such steps are unnecessary.

WCNOC Supplemental Information for Request 2:

As discussed above in WCNOC Supplemental Information for Request 1, significant fire PRA model refinement has been made to reduce the baseline CDF and LERF. Though the quantified fire model has not been peer reviewed and is not a model-of-record, current values are now within the RG 1.174 guidelines.

NRC Request 3:

Justification that the margins from the Commission's Safety Goals embedded in the 10-4 per reactor year and 10-5 per reactor year guidelines for CDF and LERF in RG 1.174, respectively, are maintained based on the baseline CDF and LERF values described in the application. Provide any actions and an implementation schedule to maintain the margins if necessary.

WCNOC Supplemental Information for Request 3:

As demonstrated above in WCNOC Supplemental Information for Request 1, the current CDF and LERF values are within the RG 1.174 guidelines. Though the quantified fire model has not been peer reviewed and is not a model-of-record, CDF/LERF values reflect sufficient margin to the RG 1.174 total CDF/LERF numbers. Additionally, further refinements to the fire PRA model have been identified and will be incorporated in future updates as appropriate.

NRC Request 4:

Justification that the total change in risk remains within "Region III" of RG 1.174 after aggregating the change in risk from the different contributors listed in Table 3 of the application.

WCNOC Supplemental Information for Request 4:

Aggregating the change in risk from all contributors shown in Table 3 of the LAR Attachment VII would result in a ΔCDF value slightly higher than the RG 1.174 Region III guideline (ΔCDF < 1E-6).

Hazard	**ΔCDF (yr^{-1})**	**ΔLERF (yr^{-1})**
Piping and Non-Piping LOCAs	6.6E-07	1.9E-11
Water Hammer Induced LOCAs	0.0	0.0
Secondary Side Breaks	6.5E-08	1.1E-10
Fire Induced LOCAs	0.0	0.0
Seismically Induced LOCAs	6.9E-07	2.0E-11
Other External Hazards	0.0	0.0

As discussed in RG 1.174, if the assessments of the risk implications from different hazard groups must be combined, it is important to understand the relative level of realism associated with the modeling of each of the hazard groups.

For WCGS, using aggregated risk metrics does not provide a realistic picture of the true risk associated with the effects of debris on strainer performance, because each of the three contributing hazards was evaluated in a bounding manner. The key conservatisms include the following items:

- Competing conservatisms were used in the GSI-191 evaluation (e.g., a conservatively high sump temperature was used for calculations where a maximum temperature is bounding, and a conservatively low sump temperature was used for calculations where a minimum temperature is bounding). Many breaks that are currently predicted to fail would be likely not to fail if all calculations were performed with consistent inputs (e.g., using a consistent temperature for all parts of the GSI-191 evaluation would significantly reduce the level of conservatism and the number of breaks that fail).
- A single, bounding threshold break size was determined for all equipment configurations without taking credit for the fact that the most likely equipment configuration (all pumps running) would have a larger threshold break size. Taking credit for the probability of the various equipment configurations along with the associated threshold break sizes would significantly reduce ΔCDF and ΔLERF.
- All breaks greater than or equal to the threshold break size were assumed to fail even though all of the breaks at the threshold break size and many of the larger breaks would not fail. Taking credit for the successful mitigation of breaks larger than or equal to the threshold break size that do not fail would significantly reduce the conditional failure probability and the corresponding ΔCDF and ΔLERF.
- All secondary side break scenarios that require ECCS strainer recirculation were assumed to fail due to the effects of debris, even though most (if not all) secondary side breaks would be successfully mitigated due to the relatively low strainer flow rates and debris loads for these scenarios.
- The risk contribution for seismically induced LOCAs was assumed to be equal to the large LOCA frequency. This is a very conservative assumption because it includes breaks that are smaller than the threshold break size as well as larger breaks that would not generate enough debris to fail the acceptance criteria.

In section C.2.5 of RG 1.174 it states the following:

> *In the context of integrated decisionmaking, the acceptance guidelines should not be interpreted as being overly prescriptive. They are intended to give a numerical indication of what is considered acceptable. The lines between the regions are intentionally blurry to indicate that the NRC has discretion when making licensing decisions involving the risk acceptance guidelines. Thus, the numerical values associated with defining the regions in Figures 4 and 5 of this RG are approximate values indicating changes that are generally acceptable.*

Later in C.2.5 of RG 1.174 discussion with regard to “aggregation” of risk from different hazards implies that it may be better not to combine contributors from different hazards if there is a significant level of conservatism associated with some hazards. This is the case for the WCGS GSI-191 risk quantification since all three contributors were evaluated using bounding methods that significantly skew the results toward higher increases of CDF and LERF. Based on this understanding, WCNOC asserts it is better not to aggregate the risk contributors since this would give the false understanding that the risk associated with GSI-191 is in Region II rather than

Region III. A refined risk assessment would show that each of the three contributors are significantly lower than the values presented in the submittal.

The information included in the LAR submittal provides strong justification that the risk associated with the effects of debris at WCGS are very small, as defined by RG 1.174 Region III.

REFERENCES:

1. WCNOC Letter ET 21-0005 from S. L. Smith to USNRC, "License Amendment Request for a Risk-Informed Resolution to GSI-191," August 12, 2021. ADAMS Accession No. ML21224A118

2. Letter from S. S. Lee, USNRC, to C. Reasoner, WCNOC, "Wolf Creek Generating Station, Unit 1 – Supplemental Information Needed for Acceptance of Requested Licensing Actions RE: License Amendment and Regulatory Exemption for a Risk-Informed Approach to Address Generic Safety Issue 191 and Respond to Generic Letter 2004-02 (EPID L-2021-LLA-0152 and EPID L-2021-LLE-0039)," September 23, 2021. ADAMS Accession No. ML21253A090