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Prairie Island Nuclear Generating Plant
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10 CFR 50.90

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

Prairie Island Nuclear Generating Plant, Units 1 and 2
Docket Nos. 50-282 and 50-306
License Nos. DPR-42 and DPR-60

Supplement to License Amendment Request to Revise the Licensing Basis Analysis for a Waste Gas Decay Tank Rupture (TAC Nos. MF4680 and MF4681)

By letter dated August 21, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML 14233A431), Northern States Power Company, a Minnesota corporation, doing business as Xcel Energy (hereafter "NSPM"), submitted a license amendment request (LAR) to revise the Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2, licensing basis analysis for a waste gas decay tank (WGDT) rupture.

By email dated December 11, 2014 (ML14345A643), NRC Staff requested additional information (RAIs) on the August 21, 2014, LAR. By letter dated February 9, 2015 (ML15040A510), NSPM submitted responses to the NRC Staff RAIs.

Enclosure 1 to this letter provides supplemental responses to the February 9, 2015, responses of NSPM. NSPM submits these supplemental responses in accordance with the provisions of 10 CFR 50.90.

Enclosure 2 to this letter provides revised marked-up pages to the accident analysis for a waste gas decay tank rupture described in Section 14 of the PINGP Updated Safety Analysis Report. The revision clarifies that the current WGDT activity limit of Technical Specification 5.5.10b effectively limits the dose consequences of a hypothetical WGDT rupture described by the accident analysis.

The supplemental information provided in this letter does not impact the conclusions of the Determination of No Significant Hazards Consideration and Environmental Assessment presented in the August 21, 2014, LAR.

In accordance with 10 CFR 50.91, NSPM is notifying the State of Minnesota of this LAR supplement by transmitting a copy of this letter and enclosure to the designated State Official.

If there is any question or if additional information is needed, please contact Dr. Glenn A. Carlson, P.E., at 651-267-1755.

Summary of Commitments

This letter contains no new commitment and no revision to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: JUL 31 2015

Kevin Davison
Site Vice-President, Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosures (2)

cc: Regional Administrator, Region III, USNRC
Project Manager, Prairie Island Nuclear Generating Plant, USNRC
Resident Inspector, Prairie Island Nuclear Generating Plant, USNRC
State of Minnesota

ENCLOSURE 1

Supplement to License Amendment Request to Revise
the Licensing Basis Analysis for a Waste Gas Decay Tank Rupture
TAC Nos. MF4680 and MF4681

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NRC (RAI) ARCB-RAI-1:

In application dated August 21, 2014, it stated:

> In the updated analysis, the activity in a gas decay tank is taken to be the maximum amount that could accumulate over the plant lifetime (60 years) from operation with one percent of the rated core thermal power being generated by rods with clad defects. For all isotopes except Kr-85, the postulated amount of activity is taken to be one reactor coolant system equilibrium cycle inventory. The Kr-85 inventory represents the activity at the end of a 60 year plant life.

On page 9.1-2 in PINGP USAR section 9 it states, "...the waste disposal system is common to Units 1 and 2."

The waste gas decay tank radionuclide inventory presented in USAR, Table D.7-1 is used as an input to the waste gas decay tank rupture dose analysis, along with an update of Kr-85 to reflect the radioactivity at the end of the 60-year plant life. Explain if USAR, Table D.7-1, including the update of Kr-85 to reflect the radioactivity at the end of the 60-year plant life, reflects the input from both PINGP units 1 and 2 into the waste gas decay tank since the tank is common and receives input from units 1 and 2.

NSPM RESPONSE:

The data in USAR, Table D.7-1 assumes activity from the reactor coolant system of a single unit. This is consistent with the original licensing basis of the gas decay tank rupture accident analysis, and no changes to the method have occurred since.

The total activity inventory of the WGDT in the accident analysis was calculated to be 140,000 Ci DEX (dose equivalent Xenon-133) for 40 years of plant operation (Reference 1). The total activity inventory of the WGDT in the accident analysis assuming a 60-year plant life is greater than 140,000 Ci DEX due to the additional Krypton-85 that accumulates. If the accident analysis were to assume two units contribute to the WGDT inventory, then total activity inventory of the WGDT in the accident analysis would be twice that calculated for one unit.

However, the maximum allowable WGDT activity inventory is specified by Technical Specification 5.5.10b to be 78,800 Ci DEX, a value that is much lower than the hypothetical activity inventory for a two-unit accident analysis case or even the current one-unit case. While the Gaseous Radwaste System, of which the WGDT is a part, supports both units, the TS limit on WGDT activity inventory does not depend on the number of units. The TS results in a system operation limitation that is more restrictive than the accident analysis.

NRC (RAI) ARCB-RAI-2:

PINGP Technical Specifications (TS) 5.5.10, "Explosive Gas and Storage Tank Radioactivity Monitoring Program," states,

> This program provides controls for potentially explosive gas mixtures contained in the waste gas holdup system, the quantity of radioactivity contained in gas storage tanks, and the quantity of radioactivity contained in unprotected outdoor liquid storage tanks.
>
> The program shall include:
>
> *a.* ...
>
> b. A surveillance program to ensure that the quantity of radioactivity contained in each gas storage tank is less than or equal to 78,800 Curies of noble gas (considered as dose equivalent Xe-133); ...

TS 5.5.10 limits the waste gas decay tank quantity of radioactivity as stated above.

Provide the basis for the TS Waste Gas Decay Tank Curie limit, include the dose criteria used to establish the dose equivalent Xe-133 limit of 78,800 curies, and explain how the limit is accounted for in the waste gas decay tank rupture dose analysis.

NSPM RESPONSE:

The WGDT activity inventory limit in TS 5.5.10 was originally issued by the NRC on 10/21/1982 as TS 3.9.B.4.f in Amendment Nos. 59 and 53 to Facility Operating Licenses for the PINGP Unit 1 and 2, respectively (Reference 2). The amendments revised the TS to implement the requirements of Appendix I of 10 CFR Part 50 based on the guidance provided by NUREG-0472 (Reference 3) and NUREG-0133 (Reference 4):

> [TS 3.9.B.4.f] The quantity of radioactivity contained in each gas storage tank shall be limited to ≤78,800 curies of noble gases (considered as dose equivalent Xe-133).

The TS WGDT curie limit assures an uncontrolled release does not result in exposure at the exclusion area boundary (EAB) that exceeds 0.5 rem. As stated in the TS Bases (Reference 2),

> Specification 3.9.B.4.f is provided to limit the radioactivity which can be stored in one decay tank. Restricting the quantity of radioactivity contained in each gas storage tank provides assurance that in the event of an uncontrolled release of the tank's contents, the resulting total body exposure to an individual at the nearest exclusion area boundary will not exceed 0.5 rem.

During the PINGP Measurement Uncertainty Recapture Project, a technical basis document (calculation, evaluation, report, etc.) for the activity limit of 78,800 Ci DEX (dose equivalent Xenon-133) could not be located. As a result, the issue was entered into the PINGP Corrective Action Program, and a validation analysis for the limit was produced.

The validation analysis (Reference 5) applied the methodology of NUREG-0133 (Reference 4) and shows that a WGDT activity inventory of 82,418 Ci DEX results in a 0.5-rem whole body dose at the EAB. The TS limit of 78,800 Ci DEX corresponds to a whole body dose of 0.478 rem at the EAB.

The WGDT rupture accident analysis (Reference 1) does not explicitly account for the TS 5.5.10b activity limit. However, the maximum WGDT activity inventory of 78,800 Ci DEX allowed by TS 5.5.10b effectively imposes an upper limit of 0.5 rem whole body dose on the consequences of the hypothetical tank rupture in the accident analysis.

NRC (RAI) ARCB-RAI-3:

On page 12 of 13 in the Waste Gas Decay Tank Rupture Dose Analysis Calculation the tables show that EAB "Total Gamma + Beta Dose" are 4.32E+00 and the LPZ "Total Gamma + Beta Dose" is 1.18E+00.

What is the technical basis for adding the Beta Skin Dose to the Whole Body Gamma Dose?

NSPM RESPONSE:

The WGDT rupture dose consequence analysis was reconstituted in 2010 (Reference 1) because documentation of the original design basis analysis could not be found, and thus, the technical basis and complete details of the methodology for calculating the whole body dose in original design basis analysis are unavailable. The dose consequence analysis for the revised WGDT rupture licensing basis analysis sums the gamma and beta doses since 1) the reconstituted analysis shows that summing the beta skin dose and the whole body gamma dose gives a result consistent with the result originally reported in the PINGP Final Safety Analysis Report and 2) summing the doses conservatively overestimates the whole body dose relative to the gamma or beta dose alone.

NRC (RAI) ARCB-RAI-4:

Given that the only change in the projected Waste Gas Decay Tank inventory is the increase in Kr-85, and given that Kr-85 is a low energy Beta emitter; please explain the impact of the additional Kr-85 inventory on the Waste Gas Decay Tank TS Dose Equivalent Xe-133 limit of 78,800 curies.

NSPM RESPONSE:

The additional Krypton-85 inventory has no impact on the WGDT TS limit of 78,800 Ci DEX (dose equivalent Xenon-133), since the limit depends on the total DEX activity inventory, not on a particular isotopic composition of the inventory.

To demonstrate compliance with TS, the activities of Krypton-85 and other nuclides that accumulate in a WGDT are converted to dose-equivalent Xenon-133 that is compared to the TS activity limit, but additional Krypton-85 has no impact on the activity limit itself.

REFERENCES

1. NSPM Calculation No. 12400604-UR(B)-001, Rev. 0, Minor Rev A, Waste Gas Tank Rupture Dose Consequences. Enclosure, Attachment 2, to Supplement to License Amendment Request to Revise the Licensing Basis Analysis for a Waste Gas Decay Tank Rupture (Agencywide Documents Access and Management System (ADAMS) Accession No. ML 14233A431).
2. Letter, D. C. Dilanni, NRC Division of Licensing, to D. M. Musolf, Northern States Power Company, 10/21/1982. (Agencywide Documents Access and Management System (ADAMS) Accession No. ML022180206.)
3. NUREG-0472, [Draft Radiological Effluent Technical Specifications for PWRs].
4. NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, October 1987.
5. NSPM Calculation No. GEN-PI-089, Waste Gas Decay Tank Activity Limit.

ENCLOSURE 2

Updated Safety Analysis Report Pages (Markup)

Page 14.5-11
Page 14.5-12
Page 14.11-8

(3 pages follow)

(Reference A)

The activity in a gas decay tank is taken to be the maximum amount that could accumulate over the plant lifetime from operation with one percent of the rated core thermal power being generated by rods with clad defects. For all isotopes except Kr 85, this postulated amount of activity is taken to be one Reactor Coolant System equilibrium cycle inventory as given in Appendix D, Table D.7-1. This value is particularly conservative because some of this activity would normally remain in the coolant, some would have been dispersed earlier through the stack via equipment leakage, and the shorter-lived isotopes will have decayed substantially. The Kr 85 inventory given in Appendix D, Table D.7-1, represents the activity at the end of the 60 year plant life.

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To define the maximum doses, the release is assumed to result from gross failure of any process system storage tank, here represented by a gas decay tank giving an instantaneous release of its volatile and gaseous contents to the atmosphere.

Gas decay tank rupture maximum doses are provided along those for volume control tank rupture, below.

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These gas decay tank maximum doses result from a postulated WGDT activity inventory of 140,000 Ci DEX. Note, however, that the maximum WGDT activity inventory of 78,800 Ci DEX allowed by TS 5.5.10b effectively imposes an upper limit of 0.5 rem whole body dose on the consequences of the hypothetical tank rupture described by the accident analysis.

14.5.3.2 Volume Control

The volume control tank con
which are normally a source
iodine concentrations and volatility are quite low at the temperature, pH and pressure of the fluid in the volume control tank. The same assumptions detailed in the preceding subsection apply to this tank. As the volume control tank and associated piping are not subjected to any high pressures or stresses, failure is very unlikely. However, a rupture of the
from s

The WGDT rupture analysis results have been approved by the NRC in License Amendment _ _ _ and _ _ _, for Units 1 and 2, respectively. (Reference B)

Rupture of the volume control tank is assumed to release all the contained noble gases and 1% of the halogen inventory of the tank plus that amount contained in the 40 gpm flow from the demineralizers, which would continue for up to fifteen minutes before isolation would occur. The 1% halogen release is a very conservative estimate of the decontamination factor expected for these conditions.

Based on 1% fuel defects, the activities available for release are 7700 Ci of Xe^{133} dose equivalent noble gases and .022 Ci of I^{131} dose equivalent halogens.

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Method of Analysis

In calculating off-site plume center-line exposure it is assumed that the activity is discharged to the atmosphere at ground level and is dispersed as a Gaussian plume downwind taking into account building wake dilution.

Dispersion coefficients based on the on-site meteorology program are used. A wind velocity of 0.89 meters per second is assumed to remain in one direction for the duration of the accident under Pasquill F conditions. The dispersion characteristics are discussed in Appendix H. Curves corrected for building wake effects by the volumetric source method, are presented on Figure 8 of Appendix H.

The following parameters have been used in the dose assessment:

a. A 0-8 hour EAB X/Q value of 6.49×10^{-4} sec/m^3

b. A 0-8 hour LPZ X/Q value of 1.77E-04 sec/m^3

c. Breathing rate equal to 3.47×10^{-4} m^3/sec

d. An I^{131} equivalent dose conversion factor equal to 1.48×10^6 rem/curie

e. A Kr^{85} dose equivalent conversion factor equal to 6.20×10^{-2} rem-m^3/curie-sec

f. A Xe^{133} dose equivalent conversion factor equal to 3.57×10^{-2} rem-m^3/curie-sec (Ref. A)

The following tabulation summarizes the whole body and thyroid doses at the exclusion distance, consistent with a receptor on the plume centerline.

	Thyroid Dose		Whole Body Dose	
	EAB	**LPZ**	**EAB**	**LPZ**
Gas Decay Tank Rupture	N/A	N/A	4.32 rem	1.18 rem
Volume Control Tank Rupture	7.3E-03 rem	1.7E-03	0.18 rem	0.05 rem
10CFR100 Limits	300 rem	300 rem	25 rem	25 rem

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It is concluded that a rupture in the waste gas system or in the volume control tank would present no undue hazard to public health and safety.

107. S.L. Humphreys et al., "RADTRAD: A Simplified Model for Radionuclide Transport and Removal and Dose Estimation," NUREG/CR-6604, USNRC, December 2007.

108. Calculation GEN-PI-080, "Prairie Island Atmospheric Dispersion Factors (X/Qs) - AST Additional Releases," Revision 1.

109. NRC Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Plants," July 2000.

110. Thomas J. Wengert (USNRC) to Mr. James E. Lynch (NSPMN), "Subject: Prairie Island Nuclear Generating Plants, Units 1 and 2 - Issuance of Amendments Re: Adoption of Alternative Source Term Methodology (TAC Nos. ME2609 and ME2610)," January 22, 2013. [ML112521289]

111. LTR-LIS-13-274, "Prairie Island Units 1 and 2, 10 CFR 50.46 Summary Sheets for the Evaluation to Support the Unit 2 Installation of AREVA Model 56/19 Replacement Steam Generators (RSGs)," June 28, 2013.

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A. Calculation # 12400604-UR(B)-001, Waste Gas Tank Rupture Dose Consequences, Revision ??.

B. NRC SER for License Amendment _ _ _ / _ _ _ , dated _ _ /_ _ /_ _.

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