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5928-02-20026
February 15, 2002

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

SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – LICENSE AMENDMENT REQUEST NO. 249 CONTAINMENT INTEGRITY DURING REFUELING OPERATIONS

THREE MILE ISLAND, UNIT 1 (TMI UNIT 1)
FACILITY OPERATING LICENSE NO. DPR-50
NRC DOCKET NO. 50-289

Reference: NRC letter to AmerGen dated December 12, 2001 (5928-01-30358)

This letter provides a response to the above referenced NRC request for additional information (RAI) regarding estimated gap release fractions for fuel assemblies exceeding 54 GWD/MTU (gigawatt days per metric ton uranium) burnup and 6.3 kw/ft linear heat generation rate. Enclosed is a detailed response to the NRC request for additional information.

If you have any questions or require additional information, please do not hesitate to contact us.

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

Very truly yours,

2-15-02
Executed On

Michael P. Gallagher
Director, Licensing & Regulatory Affairs
Mid-Atlantic Regional Operating Group

Enclosure – Response To Request For Additional Information

cc: H. J. Miller, USNRC, Regional Administrator, Region I
T. G. Colburn, USNRC, Senior Project Manager, TMI Unit 1
J. D. Orr, USNRC, Senior Resident Inspector, TMI Unit 1
File No. 00109

A001

ENCLOSURE

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

1. NRC Question

Provide gap release fractions estimated for the fuel assemblies exceeding 54 GWD/MTU (gigawatt days per metric ton uranium) burnup and 6.3 kw/ft linear heat generation rate. You may use the simplified method provided in ANSI/ANS Standard 5.4, "Method for Calculating the Fractional Release of Volatile Fission Products from Oxide Fuel," to estimate the worst release fractions using the equilibrium equation given in the standard. An equilibrium release fraction is calculated using the peak fuel rod average temperature plus 200 degrees F at a conservative linear heat generation rate.

Response

AmerGen has calculated the fission product release fractions following the ANSI/ANS–5.4 methodology to determine the release fractions for TMI Unit 1 Fuel Handling Accident dose-significant isotopes of iodine, xenon and krypton. This calculation assumed a peak rod average power of 8.0 kw/ft which bounds the worst case Cycle 13 and 14 fuel assembly peak rod average power of 7.1 kw/ft. The TMI Unit 1 Cycle 13 and 14 fuel rods operating above 6.3 kw/ft will not exceed 57 GWD/MTU and will not operate at burnups in excess of 54 GWD/MTU for more than 45 days. The calculation conservatively assumes that the high power fuel rods operate at burnups in excess of 54 GWD/MTU for 60 days and achieve burnups of 57 GWD/MTU. The determination of release fractions for long-lived isotopes can be simplified by assuming the Regulatory Guide 1.183, Table 3 value at 54 GWD/MTU, and adding the incremental release that is estimated per ANSI/ANS-5.4, Section 3.1.1 for the burnup above 54 GWD/MTU.

The volume-averaged fuel temperature input is 1472°F for typical TMI Unit 1 Framatome Mk-B fuel operating at 8.0 kw/ft at an exposure of 57 GWD/MTU (based on a rod power history representative of the high burnup rods in question). This includes a 214°F conservatism to account for the TACO3 (Framatome ANP's approved fuel performance code) temperature uncertainty and fuel design flexibility.

ANSI/ANS-5.4, Section 3.1.2, Equation 5 is used to determine equilibrium release fractions for short-lived isotopes using a burnup of 57 GWD/MTU and a fuel temperature of 1472°F to determine the diffusion coefficients, D'. The diffusion coefficients for isotopes of iodine are increased by a factor of 7 per Section 4.1 of ANSI/ANS-5.4. The release fractions for Xe-133 and Xe-135 are adjusted for precursor effects per ANSI/ANS-5.4, Section 3.3. Note that low temperature release calculations were also performed but were not limiting.

ANSI/ANS-5.4, Section 3.1.1, Equation 1 is used to determine the incremental release fraction for long-lived isotopes for the incremental burnup period from 54 to 57 GWD/MTU. This incremental release fraction is then added to the appropriate Regulatory Guide 1.183, Table 3 release fraction to determine the cumulative release fraction at 57 GWD/MTU. A final burnup of 57 GWD/MTU and a fuel temperature of 1472°F are used to determine the diffusion coefficients, D'. The diffusion coefficients for isotopes of iodine are adjusted per ANSI/ANS-5.4, Section 4.1. Note that low temperature release calculations were also performed but were not limiting.

The results of the AmerGen calculation of fission product release fractions for TMI Unit 1 Cycle 13 and 14 high burnup/high power fuel rods, following the methodology provided in ANSI/ANS–5.4, are shown in the table below for noble gases and halogens of interest. The results are also compared to the approved values in Regulatory Guide 1.183 as well as the values assumed in the bounding assessment performed to support License Amendment Request No. 249 (AmerGen letter 5928-01-20209 to the NRC dated August 22, 2001).

Summary of ANSI/ANS-5.4 Release Fraction Results
vs.
R.G. 1.183 Values and LAR No. 249 Bounding Assessment Assumptions

	R.G. 1.183	LAR No. 249 Bounding Assessment	ANSI/ANS-5.4 Maximum Value	ANSI/ANS-5.4 Fraction of R.G. 1.183	ANSI/ANS-5.4 Fraction of LAR 249 Assessment
I-131	0.08	0.16	0.029	36%	18%
Kr-85	0.10	0.20	0.119	119%	59%
Other Noble Gases	0.05	0.10	0.018	37%	18%
Other Halogens					
Short-lived	0.05	0.10	0.010	19%	10%
Long-lived (I-129)	0.05	0.10	0.099	198%	99%

These results demonstrate that the assumption made in the bounding assessment to double the release fractions for high burnup/high power fuel rods was conservative relative to a formal calculation following ANSI/ANS–5.4 methodology. Additionally, although AmerGen letter 5928-01-20209 did not explicitly state that noble gas release fractions were doubled, the bounding assessment referred to in that letter doubled halogen and noble gas release fractions as shown in the table above.

These results also indicate that for the short-lived isotopes which are more significant contributors to dose resulting from a fuel handling accident in containment (i.e., noble gas and halogen isotopes except for Kr-85 and I-129), the Regulatory Guide 1.183 release fractions are conservative by more than a factor of 2 as applied to the worst case TMI Unit 1 fuel assembly conditions for Cycle 13 and 14.