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10 CFR 50.90

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Acceptance Review Supplemental Information for Alternative Accident Source Term Design Basis Accident Analysis Request for Licensing Action (TAC No. MF3197)

FirstEnergy Nuclear Operating Company submitted a request for licensing action (RLA) to the Nuclear Regulatory Commission (NRC) in a letter dated December 6, 2013 (Accession No. ML13343A013). The RLA requested NRC review of a full implementation of alternative accident source term design basis accident analyses, and an associated technical specification change. In a teleconference on February 11, 2014, the NRC staff identified supplemental information that would need to be provided to accept the submittal for further review. An attachment to this letter provides the information.

There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 27, 2014.

Sincerely,

Ernest J. Harkness

Attachment: Acceptance Review Supplemental Information for Alternative Accident Source Term Design Basis Accident Analysis Request for Licensing Action

cc: NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

FirstEnergy Nuclear Operating Company (FENOC) submitted a request for licensing action (RLA) to the Nuclear Regulatory Commission (NRC) in a letter dated December 6, 2013 (Accession No. ML13343A013). The RLA requested NRC review of a full implementation of alternative accident source term (AST) design basis accident analyses, and an associated technical specification change. In a teleconference on February 11, 2014, the NRC staff identified supplemental information that would need to be provided to accept the submittal for further review. The information needed is presented in bold text, followed by the response.

FENOC is requested to provide the analysis/evaluation supporting a conclusion that:

1. **The AST analyses performed, using GNF2 source term, are appropriate to apply to the existing licensing basis fuel bundle design (i.e., GE-14),**

Response:

Of the design basis radiological consequence analyses submitted for NRC review, the loss of coolant accident (LOCA) and the control rod drop accident (CRDA) use a fuel fission product inventory as the source term. The main steam line break outside containment (MSLBOC) analysis uses a reactor coolant source term based on Technical Specification specific activity limits rather than the fuel specific core source term.

Analysis results indicate it is appropriate to apply the GNF2 accident source term while GE14 fuel remains in the core. The analyses support a determination of the impact on offsite and control room dose consequences due to the two different source terms - Table 1 compares the dose consequences as a result of utilizing the current licensing basis (CLB) source term for GE14 (as clarified by Table 2) with those using the GNF2 source term; all analyses use the new methodology and assumptions used in the RLA.

Table 1

Accident	Current Licensing Basis Source Term Total Effective Dose Equivalent, rem	GNF2 Source Term Total Effective Dose Equivalent, rem
LOCA		
EAB	21.1	21.2
LPZ	6.5	6.5
CR	2.8	2.8
CRDA		
EAB	0.0866	0.161
LPZ	0.0870	0.162
CR	0.141	0.263

Based on the above, the two different source terms (CLB and GNF2) result in acceptably low dose consequences, and the GNF2 results bound the CLB results for offsite (exclusion area boundary (EAB) and low population zone (LPZ)) and for control room (CR) dose consequences. Therefore, it is appropriate to apply the GNF2 source term dose results to the existing licensing basis fuel bundle design while GE14 fuel remains in the core.

For information, the source term used in the current licensing basis LOCA dose analysis is based on the isotopic quantities provided in Table 2. As indicated in Table 2, certain isotopes in the CLB source term are not utilized in the above source term comparison. The RADTRAD library is based on isotopes selected in WASH-1400 with the addition of six isotopes per NUREG/CR-4691, "MELCOR Accident Consequence Code System (MACCS)." NUREG/CR-4467, "Relative Importance of Individual Elements to Reactor Accident Consequences Assuming Equal Release Fractions," also did not include these isotopes in its list of isotopes that could be important for off-site dose consequence analyses in light water reactors. For the above two reasons, these isotopes were not included in the above LOCA source term comparison analysis. For the same reasons, those isotopes were also not included in the CRDA source term comparison analysis.

Table 2

Isotope	(Ci/MWth)		Isotope	(Ci/MWth)		Isotope	(Ci/MWth)
Kr83m*	3.23E+03		Ru106	1.83E+04		Cs134	8.10E+03
Kr85	4.16E+02		Rh105	2.89E+04		Cs136	2.44E+03
Kr85m	6.70E+03		Sb127	3.05E+03		Cs137	4.64E+03
Kr87	1.27E+04		Sb129	8.97E+03		Ba137m*	4.40E+03
Kr88	1.79E+04		Te127	3.03E+03		Ba139	4.87E+04
Kr89*	2.17E+04		Te127m	4.10E+02		Ba140	4.70E+04
Rb86	7.81E+01		Te129	8.83E+03		La140	5.06E+04
Sr89	2.41E+04		Te129m	1.31E+03		La141	4.44E+04
Sr90	3.33E+03		Te131m	3.99E+03		La142	4.27E+04
Sr91	3.05E+04		Te132	3.86E+04		Ce141	4.46E+04
Sr92	3.33E+04		I131	2.72E+04		Ce143	4.08E+04
Y90	3.44E+03		I132	3.92E+04		Ce144	3.70E+04
Y91	3.13E+04		I133	5.50E+04		Pr143	3.95E+04
Y92	3.35E+04		I134	6.02E+04		Nd147	1.80E+04
Y93	3.92E+04		I135	5.15E+04		Np239	5.68E+05
Zr95	4.43E+04		Xe131m*	3.05E+02		Pu238	3.95E+01
Zr97	4.49E+04		Xe133m*	1.73E+03		Pu239	1.00E+01

Isotope	(Ci/MWth)	Isotope	(Ci/MWth)	Isotope	(Ci/MWth)
Nb95	4.46E+04	Xe133	5.28E+04	Pu240	1.25E+01
Mo99	5.14E+04	Xe135m*	1.09E+04	Pu241	2.16E+03
Tc99m	4.50E+04	Xe135	1.91E+04	Am241	2.19E+00
Ru103	4.34E+04	Xe137*	4.79E+04	Cm242	5.80E+02
Ru105	3.07E+04	Xe138*	4.48E+04	Cm244	3.13E+01

Ci/MWth = Curies/Megawatt-thermal

* Isotope is not included in the source term comparison.

2. The AST assumptions for the radiological consequences are bounding of both the analyzed and the current fuel bundle design.

Response:

Relative to the LOCA dose consequence analysis, the core source term is assumed to be released during the two-hour period between the initial blowdown and termination of the fuel radioactivity release (gap and early in-vessel release phases). During these two phases, the AST evaluation model assumes that there is no emergency core cooling system (ECCS) flow to the reactor vessel. This assumption is very conservative as compared to the assumptions used to determine normal ECCS acceptance criteria such as fuel peak cladding temperature per 10CFR50 Appendix K, "ECCS evaluation models." This conservative AST modeling assumes that the entire core will overheat and become damaged. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," then specifies the fractions of the available radionuclides that are released due to this core wide damage. The results of these analyses bound the amount of damage that could occur during an actual LOCA as evaluated per 10 CFR 50 Appendix K (Appendix K evaluations verify that temperatures remain below the regulatory limit of 2200 degrees Fahrenheit) for both the GNF2 fuel and the currently licensed fuel bundle design.

For the CRDA, Global Nuclear Fuel (GNF) determined that approximately 1,200 GE14 and GNF2 fuel rods have the potential to fail. The FENOC AST analysis summary, included as Addendum 5 in the RLA, instead conservatively assumes that all the fuel rods in the 16 GNF2 bundles adjacent to the dropped control rod fail (equal to approximately 1,376 full length rods). This assumption that nearly 15 percent more fuel rods fail in a CRDA event shows that the PNPP AST assumptions for the CRDA are bounding for both the current bundle design and the GNF2 design. The CLB analysis supporting the above Table 1 CRDA results determined a "per rod" source term, then multiplied that by 1,376. As shown for the CRDA results provided in Table 1 above, a comparison of the dose consequences due to the two different source terms, both performed assuming 1,376 failed rods, showed that the resultant dose consequences are low and the GNF2 results bound the CLB results.