UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 11, 2010

Mr. Charles G. Pardee
President and Chief Nuclear Officer
Exelon Generation Company
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 - ISSUANCE OF AMENDMENT RE: TECHNICAL SPECIFICATION CHANGES ADOPTING TSTF-490-A, REVISION 0, DELETION OF E-BAR DEFINITION AND REVISION TO REACTOR COOLANT SYSTEM SPECIFIC ACTIVITY TECHNICAL SPECIFICATION (TAC NO. ME0100)

Dear Mr. Pardee:

The Commission has issued the enclosed Amendment No. 272 to Renewed Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit 1 (TMI-1), in response to your application dated November 6, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083120122), as supplemented by letters dated December 11, 2008 (ADAMS Accession No. ML083470249), July 2, 2009 (ADAMS Accession No. ML091870996), October 2, 2009 (ADAMS Accession No. ML092790495), and November 24, 2009 (ADAMS Accession No. ML093290324).

The amendment replaces the current TMI-1 technical specification (TS) limit on Reactor Coolant System (RCS) gross specific activity with a new limit on RCS noble gas specific activity. The noble gas specific activity limit is based on a new dose equivalent Xe-133 definition that replaces the current E Bar average disintegration energy definition. In addition, the dose equivalent I-131 (DEI) definition has been modified to specify the source of the thyroid dose conversion factor that is consistent with the bounding dose consequence analysis for TMI-1 that uses DEI.

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

Sincerely,

Peter Bamford

Peter J. Bamford, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosures: 1. Amendment No. 272 to Renewed DPR-50
2. Safety Evaluation

cc: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-289

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 272
Renewed License No. DPR-50

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

   A. The application for amendment by Exelon Generation Company, LLC (the licensee, formerly AmerGen Energy Company, LLC), dated November 6, 2008, as supplemented by letters dated December 11, 2008, July 2, 2009, October 2, 2009, and November 24, 2009, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations 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;

   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 amended by 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. DPR-50 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No272 , are hereby incorporated in the license. The Exelon Generation Company shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective immediately and shall be implemented within 60 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the License and
Technical Specifications

Date of Issuance: March 11, 2010

ATTACHMENT TO LICENSE AMENDMENT NO. 272

RENEWED FACILITY OPERATING LICENSE NO. DPR-50

DOCKET NO. 50-289

Replace the following page of the Renewed Facility Operating License with the revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove	Insert
Page 4	Page 4

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
vii	vii
1-6	1-6
1-8	1-8
3-8	3-8
4-9	4-9

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No272 are hereby incorporated in the license. The Exelon Generation Company shall operate the facility in accordance with the Technical Specifications.

(3) Physical Protection

Exelon Generation Company shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822), and the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans[1], submitted by letter dated May 17, 2006, is entitled: "Three Mile Island Nuclear Station Security Plan, Training and Qualification Plan, and Safeguards Contingency Plan, Revision 3." The set contains Safeguards Information protected under 10 CFR 73.21.

(4) Fire Protection

Exelon Generation Company shall implement and maintain in effect all provisions of the Fire Protection Program as described in the Updated FSAR for TMI-1.

Changes may be made to the Fire Protection Program without prior approval by the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. Temporary changes to specific fire protection features which may be necessary to accomplish maintenance or modifications are acceptable provided that interim compensate measures are implemented.

(5) The licensee shall implement a secondary water chemistry monitoring program to inhibit steam generator tube degradation. This program shall include:

a. Identification of a sampling schedule for the critical parameters and control points for these parameters;

b. Identification of the procedures used to measure the values of the critical parameters;

c. Identification of process sampling points;

d. Procedure for the recording and management of data;

[1] The Training and Qualification Plan and Safeguards Contingency Plan are Appendices to the Security Plan.

LIST OF FIGURES

Amendment Nos. ~~11, 17, 29, 39, 45, 50, 59, 72, 106, 109, 120, 126, 134, 142, 150, 164, 167, 168, 184, 211, 227, 234~~, 272

1.9 DELETED

1.10 DELETED

1.11 DELETED

1.12 DOSE EQUIVALENT I-131

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same thyroid dose when inhaled as the combined activities of iodine isotopes I-131, I-132, I-133, I-134, and I-135 actually present. The determination of DOSE EQUIVALENT I-131 shall be performed using thyroid dose conversion factors from Table 2.1 of EPA Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."

1.13 SOURCE CHECK

A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

1.14 DELETED

1.15 OFFSITE DOSE CALCULATION MANUAL (ODCM)

The OFFSITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluent, in the calculation of gaseous and liquid effluent monitoring Alarm/Trip Setpoints, and in the conduct of the Radiological Environmental Monitoring Program. The ODCM shall also contain (1) the Radioactive Effluent Controls and Radiological Environmental Monitoring Programs required by Section 6.8.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Annual Radioactive Effluent Release Reports required by Specifications 6.9.3 and 6.9.4.

1.16 PROCESS CONTROL PROGRAM (PCP)

The PROCESS CONTROL PROGRAM (PCP) shall contain the current formulas, sampling, analyses, test, and determinations to be made to ensure that processing and packaging of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61, and 71, State regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste.

1.17 GASEOUS RADWASTE TREATMENT

The GASEOUS RADWASTE TREATMENT SYSTEM is the system designed and installed to reduce radioactive gaseous effluent by collecting primary coolant system off gases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

1.24 CORE OPERATING LIMITS REPORT

The CORE OPERATING LIMITS REPORT is a TMI-1 specific document that provides core operating limits for the current operating reload cycle. These cycle-specific core operating limits shall be determined for each reload cycle in accordance with Specification 6.9.5. Plant operation within these operating limits is addressed in individual specifications.

1.25 FREQUENCY NOTATION

The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 1.2. All Surveillance Requirements shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance interval. The 25% extension applies to all frequency intervals with the exception of "F." No extension is allowed for intervals designated "F."

TABLE 1.2

FREQUENCY NOTATION

NOTATION	FREQUENCY
S	Shiftly (once per 12 hours)
D	Daily (once per 24 hours)
W	Weekly (once per 7 days)
M	Monthly (once per 31 days)
Q	Quarterly (once per 92 days)
S/A	Semi-Annually (once per 184 days)
R	Refueling Interval (once per 24 months)
P S/U	Prior to each reactor startup, if not done during the previous 7 days
P S/A	Within six (6) months prior to each reactor startup
P	Completed prior to each release
N/A (NA)	Not applicable
E	Once per 18 months
F	Not to exceed 24 months

1.26 DOSE EQUIVALENT Xe-133

Dose Equivalent Xe-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT Xe-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12.

3.1.4 REACTOR COOLANT SYSTEM (RCS) ACTIVITY

3.1.4.1 LIMITING CONDITION FOR OPERATION

RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT Xe-133 specific activity shall be limited to:

a. Less than or equal to 0.35 microcuries/gram DOSE EQUIVALENT I-131, and

b. Less than or equal to 797 microcuries/gram DOSE EQUIVALENT Xe-133.

3.1.4.2 APPLICABILITY: At all times except REFUELING SHUTDOWN and COLD SHUTDOWN.

3.1.4.3 ACTION:

MODES: At all times except REFUELING SHUTDOWN and COLD SHUTDOWN

a.1 With DOSE EQUIVALENT I-131 not within limit, perform the sampling and analysis requirements of Table 4.1.3 until the RCS DOSE EQUIVALENT I-131 is restored to within limit, AND

a.2 Verify that DOSE EQUIVALENT I-131 is less than or equal to 60 microcuries/gram, AND

a.3 Restore DOSE EQUIVALENT I-131 to within limit within 48 hours.

a.4 If the requirements of a.1, a.2 or a.3 cannot be met, be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within 36 hours.

b.1 With DOSE EQUIVALENT Xe-133 not within limit, restore DOSE EQUIVALENT Xe-133 to within limit within 48 hours.

b.2 If the requirements of b.1 cannot be met, be in at least HOT SHUTDOWN within 6 hours and in COLD SHUTDOWN within 36 hours.

Bases

LCO

The iodine specific activity in the reactor coolant is limited to 0.35 μCi/gm DOSE EQUIVALENT I-131, and the noble gas specific activity in the reactor coolant is limited to 797 μCi/gm DOSE EQUIVALENT Xe-133. The limits on specific activity ensure that offsite and control room doses will meet the appropriate 10CFR100.11 (Ref. 1) and 10CFR50 Appendix A GDC19 (Ref. 5) acceptance criteria.

The SLB and SGTR accident analyses (Refs. 3 and 4) show that the calculated doses are within acceptable limits. Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of a SLB or SGTR, lead to doses that exceed the 10CFR100.11 (Ref. 1) and 10CFR50 Appendix A GDC19 (Ref. 5) acceptance criteria.

TABLE 4.1-3
MINIMUM SAMPLING FREQUENCY

Item	Check	Frequency
1. Reactor Coolant	a. Verify reactor coolant DOSE EQUIVALENT Xe-133 specific activity is less than or equal to 797 microcuries/gram.	i) At least once each 7 days during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN ii) One Sample between 2 and 6 hours following a THERMAL POWER change exceeding 15% of the RATED THERMAL POWER within a one hour period during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN
	b. Isotopic Analysis for DOSE EQUIVALENT I-131 Concentration	i) 1 per 14 days during power operations. ii) One Sample between 2 and 6 hours following a THERMAL POWER change exceeding 15% of the RATED THERMAL POWER within a one hour period during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN iii) # Once per 4 hours, whenever the specific activity exceeds 0.35 μCi/gram DOSE EQUIVALENT I-131 during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN
	c. Deleted	
	d. Chemistry (Cl, F and O2)	5 times/week when Tavg IS GREATER THAN 200°F.
	e. Boron concentration	2 times/week
	f. Tritium Radioactivity	Monthly
2. Borated Water Storage Tank Water Sample	Boron concentration	Weekly and after each makeup when reactor coolant system pressure is greater than 300 psig or Tavg is greater than 200°F.
3. Core Flooding Tank Water Sample	Boron concentration	Monthly and after each makeup when RCS pressure is greater than 700 psig.

Amendment No. ~~62, 95, 108, 204, 211~~ 272

Corrected by ltr dtd 07/08/99

UNITED STATES
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WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 272 TO RENEWED

FACILITY OPERATING LICENSE NO. DPR-50

EXELON GENERATION COMPANY, LLC

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

DOCKET NO. 50-289

1.0 INTRODUCTION

By application dated November 6, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083120122), as supplemented by letters dated December 11, 2008 (ADAMS Accession No. ML083470249), July 2, 2009 (ADAMS Accession No. ML091870996), October 2, 2009 (ADAMS Accession No. ML0092790495), and November 24, 2009 (ADAMS Accession No. ML093290324), Exelon Generation Company (Exelon, or the licensee)[1] requested changes to the Technical Specifications (TSs) for Three Mile Island Nuclear Station, Unit 1 (TMI-1). The supplements provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC or Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on March 10, 2009 (74 FR 10309).

The proposed changes would revise TSs relating to reactor coolant system (RCS) activity limits. It is based upon Revision 0 of Technical Specification Task Force Traveler (TSTF)-490-A, "Deletion of E-Bar Definition and Revision to Reactor Coolant System Specific Activity Technical Specification." The application proposes to replace the current TS limits on RCS gross specific activity with a new limit on RCS noble gas specific activity. The noble gas specific activity limit would reflect a new dose equivalent xenon-133 (DEX) definition that would replace the current E-Bar average disintegration energy definition. The current dose equivalent iodine-131 (DEI) definition is proposed to be revised to specify the appropriate reference for the thyroid dose conversion factors (DCFs), consistent with the dose consequence analyses for TMI-1 that use DEI. Other changes are proposed to TS 3.1.4, "Reactor Coolant System (RCS) Activity," and its associated surveillance requirements, TS Table 4.1-3. These changes primarily impact modes of applicability, sampling requirements and allowable DEI transient values.

[1] The application dated November 6, 2008, was submitted by AmerGen Energy Company, LLC. Effective January 8, 2009, the license for TMI-1 was transferred from AmerGen Energy Company, LLC to Exelon Generation Company, LLC. By letter dated January 9, 2009, (ADAMS Accession No. ML090120538) Exelon Generation Company adopted and endorsed docketed submittals that requested specific licensing actions that were made by AmerGen, and requested that the NRC staff continue to process those pending actions on the schedules previously agreed to by AmerGen.

2.0 REGULATORY EVALUATION

The NRC staff (the staff) evaluated the impact of the proposed changes as they relate to the radiological consequences of affected design-basis accidents (DBAs) that use the RCS activity inventory as the source term. The source term assumed in radiological analyses should be based on the activity associated with the projected fuel damage or the maximum TS RCS values, whichever maximizes the radiological consequences. The limits on RCS specific activity ensure that the offsite doses are appropriately limited for accidents that are based on releases from the RCS with no significant amount of fuel damage.

The steam generator tube rupture (SGTR) accident and the main steam line break (MSLB) accident typically do not result in fuel damage and therefore the radiological consequence analyses are based on the release of primary coolant activity at maximum TS limits. For accidents that result in fuel damage, the additional dose contribution from the initial activity in the RCS is not normally evaluated and is considered to be insignificant in relation to the dose resulting from the release of fission products from the damaged fuel.

For licensees that incorporate the source term as defined in Technical Information Document (TID)-14844,[2] in their dose consequence analyses, the staff uses the regulatory guidance provided in NUREG-0800,[3] for the evaluation of MSLB accident analyses. The staff uses NUREG-0800, SRP Section 15.6.3, "Radiological Consequences of Steam Generator Tube Failure (PWR)," Revision 2, for evaluating SGTR accidents analyses. In addition, the staff uses the guidance from Regulatory Guide (RG) 1.195, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light Water Nuclear Power Reactors," May 2003, for those licensees that choose to use its guidance for dose consequence analyses using the TID-14844 source term.

For licensees using the alternative source term (AST) in their dose consequence analyses, the staff uses the regulatory guidance provided in NUREG-0800, SRP Section 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," Revision 0, July 2000, and the methodology and assumptions stated in RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", July 2000.

The applicable dose criteria for the evaluation of DBAs depends on the source term incorporated in the dose consequence analyses. For licensees using the TID-14844 source term, the maximum dose criteria to the whole body and the thyroid that an individual at the exclusion area boundary (EAB) can receive for the first 2 hours following an accident, and at the low population zone (LPZ) outer boundary for the duration of the radiological release, are specified in Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 100.11. These criteria are 25 roentgen equivalent man (rem) total whole body dose and 300 rem thyroid dose from iodine exposure. The accident dose criteria in 10 CFR 100.11 is supplemented by accident specific dose acceptance criteria in SRP 15.1.5, Appendix A, SRP 15.6.3 or Table 4 of RG 1.195.

For control room dose consequence analyses that use the TID-14844 source term, the regulatory requirement for which the staff bases its acceptance is General Design Criterion (GDC)-19 of Appendix A to 10 CFR Part 50, "Control Room." GDC-19 requires that adequate

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[2] TID-14844, U.S. Atomic Energy Commission (AEC), 1962, "Calculation of Distance Factors for Power and Test Reactors Sites."

[3] NUREG-0800 "Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 15.1.5, "Steam System Piping Failures Inside and Outside of Containment ([pressurized water reactor] PWR)," Appendix A, "Radiological Consequences of Main Steam Line Failures Outside Containment," Revision 2.

radiation protection be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. NUREG-0800, SRP Section 6.4, "Control Room Habitability System," Revision 2, July 1981, provides guidelines defining the dose equivalency of 5 rem whole body as 30 rem for both the thyroid and skin dose. For licensees adopting the guidance from RG 1.196, "Control Room Habitability at Light Water Nuclear Power Reactors," Section C.4.5 of RG 1.195, states that in lieu of the dose equivalency guidelines from Section 6.4 of NUREG 0800, the 10 CFR 20.1201 annual organ dose limit of 50 rem can be used for both the thyroid and skin dose acceptance criteria.

Licensees using the AST are evaluated against the dose criteria specified in 10 CFR 50.67(b)(2). The off-site dose criteria are 25 rem total effective dose equivalent (TEDE) at the EAB for any 2 hour period following the onset of the postulated fission product release and 25 rem TEDE at the outer boundary of the LPZ for the duration of the postulated fission product release. In addition, 10 CFR 50.67(b)(2)(iii) requires that adequate radiation protection be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem TEDE for the duration of the accident.

While TMI-1 has been authorized for the use of AST, via license amendment 235, dated September 19, 2001 (ADAMS Accession No. ML012480262), the SLB and SGTR dose consequence analyses of record continue to use the TID-14844 source term and hence, the application, and the NRC staff review, reflects that consideration.

3.0 TECHNICAL EVALUATION

3. 1 Background

The maximum allowable primary coolant specific activity is governed by the TSs. Due to the importance of iodine in the dose consequence analyses, a separate limit is specified for the iodine isotopes. This limit is specified in units of DEI, which is the concentration of iodine-131 (I-131) that alone would produce the same dose when inhaled as the combined activities of major isotopes of iodine present in the primary coolant. The TS for DEI includes both a long term limit as well as a higher maximum allowable short term limit to account for iodine spiking. The current TMI-1 TSs allow for increases in the maximum allowable spiking limit as a linear function of decreasing power level from 80 to 25 percent of rated thermal power (RTP). The current TMI-1 DEI limit of 60 microcuries per gram (μCi/gm) is constant from 100 percent to 80 percent RTP but is allowed to increase to as high as 275 μCi/gm at 25 percent RTP.

The TS definition of DEI is based on thyroid DCFs and reflects a licensing model in which the radiological consequences of iodine releases for accidents are reported as thyroid, beta and whole body doses. The numerical determination of DEI is dependent on the relative quantities of the isotopes of iodine present in the RCS and on the DCFs used in the calculation. By letter dated July 2, 2009, in response to a request for additional information from the staff, TMI-1 submitted a definition of DEI that uses the thyroid dose conversion factors from Table 2.1 of Environmental Protection Agency (EPA) Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion." This is consistent with the bounding radiological dose consequence analyses for TMI-1 which use DEI (MSLB and SGTR accidents). This reference is also included in the listing of acceptable DCF's from TSTF-490-A. The staff acknowledges that TMI-1 uses other DCF's for analyses using the AST such as the loss-of-coolant accident and the

fuel handling accident. These analyses postulate fuel damage and are not the accidents of concern that the operating restriction provided by TS 3.1.4 is designed to protect against.

A second limit is used to govern the non-iodine radioisotopes in the RCS. This limit has traditionally been based on an evaluation of the average beta and gamma disintegration energy of the total non-iodine activity in the RCS which is referred to as E-Bar. For TMI-1, E-Bar is defined in the footnotes for TS 3.1.4.1.b as "...the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives greater than 15 minutes, making up at least 95 percent of the total non-iodine activity in the coolant." The RCS non-iodine specific activity limit is then expressed as the quantity 100 divided by E-Bar (100/E-Bar) expressed in units of µCi/gm. In the TMI-1 DBA dose consequence analyses based on releases from the RCS with no significant fuel damage, the concentration of noble gas activity in the coolant is assumed to be that level associated with one percent fuel clad defects. Operating experience has indicated that, depending on the isotopes used to calculate E-Bar and the actual degree of fuel clad defects, the routinely calculated value of E-Bar may not be an effective indicator of the level of noble gas activity relative to the levels used in the DBA dose consequence analyses on which the limit is based.

3. 2 Technical Evaluation of the TMI-1 TSTF-490 Proposed Changes

3.2.1 Revision to the Definition of DEI

TSTF-490-A lists acceptable sources for DCFs as follows:

- Table III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites"
- Table E-7 of RG 1.109, Revision 1, NRC, 1977
- ICRP [International Commission on Radiological Protection] -30, 1979, page 192-212, Table titled "Committed Dose Equivalent in Target Organs or Tissues per Intake of Unit Activity"
- Table 2.1 of Environmental Protection Agency (EPA) Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."

In their application, the licensee has chosen to utilize Table 2.1 of EPA Federal Guidance Report No. 11 in their TS Section 1.12 DEI definition. This is consistent with the TMI-1 dose consequence analysis for the MSLB and SGTR which are the limiting accidents that depend on the RCS activity levels as an initial assumption. The purpose of the TS limit for DEI is to satisfy 10 CFR 50.36(c)(2)(ii)(B), criterion 2, which establishes an operating restriction that is an initial condition of a DBA. This change ensures that TMI-1 calculates DEI using the same DCFs as are used in the applicable dose consequence analyses and is therefore acceptable.

3.2.2 Deletion of E-Bar Definition and Addition of a New Definition for DEX

The licensee proposes to eliminate the term E-Bar and to govern the non-iodine RCS activity by incorporating a new term referred to as DEX. The new definition for DEX is similar to the definition for DEI. The determination of DEX will be performed in a similar manner to that

currently used in determining DEI, except that the calculation of DEX is based on the acute dose to the whole body and considers the noble gases Krypton (Kr)-85m, Kr-87, Kr-88, Xenon (Xe)-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 which are significant in terms of contribution to whole body dose. Some noble gas isotopes are not included due to low concentration, short half life, or small dose conversion factor. The calculation of DEX would use either the average gamma disintegration energies for the nuclides or the effective dose conversion factors from Table III.1 of EPA Federal Guidance Report No. 12. By letter dated July 2, 2009, the licensee submitted a definition of DEX that includes dose conversion factors from Table III.1 of EPA Federal Guidance Report No. 12. Using this approach, the limit on the amount of noble gas activity in the primary coolant would not fluctuate with variations in the calculated values of E-Bar. If a specified noble gas nuclide is not detected, the new definition states that it should be assumed the nuclide is present at the minimum detectable activity. This will result in a conservative calculation of DEX.

In its application dated November 6, 2008, the licensee asserts, and the staff agrees, that when E-Bar is determined using a design basis approach in which it is assumed that one percent of the power is being generated by fuel rods having cladding defects and it is also assumed that there is no removal of fission gases from the letdown flow, the value of E-Bar is dominated by Xe-133. The other nuclides have relatively small contributions. However, during normal plant operation there are typically only a small amount of fuel clad defects and the radioactive nuclide inventory can become dominated by tritium and corrosion and or activation products, resulting in the determination of a value of E-Bar that is different than would be calculated using the design basis approach.

In its application dated November 6, 2008, the licensee asserts, and the staff agrees, that this change will implement an LCO that is consistent with the whole body radiological consequence analyses which are sensitive to the noble gas activity in the primary coolant but not to other, non-gaseous activity currently captured in the E-Bar definition. The current LCO 3.1.4.1.b specifies the limit for primary coolant gross specific activity as 100/E-Bar μCi/gm. The E-Bar definition includes radioisotopes that decay by the emission of both gamma and beta radiation. Thus, the current TS 3.1.4.1.b would rarely, if ever, be entered for exceeding 100/E-Bar since the calculated value is very high (the denominator is very low) if beta emitters such as tritium are included in the determination, as required by the E-Bar definition.

The licensee proposes to delete the definition for E-Bar contained in TS 3.1.4.1.b and insert a new definition for DEX in Section 1.26 which states:

> DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12.

The proposed change incorporating the newly defined quantity DEX will result in an LCO that more closely relates the non-iodine RCS activity limits to the dose consequence analysis. In addition, the definition uses DCFs that are consistent with the limiting dose consequence analyses that are sensitive to initial RCS activity levels. Based on these considerations, the

proposed changes involving the deletion of the E-Bar definition and incorporating the newly defined quantity DEX are acceptable to the staff.

3.2.3 Revision of TS LCO 3.1.4, and Deletion of Figure 3.1-2a

The licensee proposes to modify LCO 3.1.4 to specify that iodine specific activity in terms of DEI and noble gas specific activity in terms of DEX shall be within limits. The limiting indicators are explicitly identified in LCO 3.1.4.1.a for DEI and LCO 3.1.4.1.b for DEX.

The proposed change states "RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT Xe-133 specific activity shall be limited to less than or equal to 0.35 microcuries/gram Dose Equivalent I-131 and 797 microcuries/gram Dose Equivalent Xe-133." By letter dated July 2, 2009, the licensee stated that:

> The radiological dose consequence analyses for the main steam line break and steam generator tube rupture accidents do not postulate fuel damage. These accidents are analyzed using the maximum reactor coolant system activity allowed by TS. This activity is presented in the form of DEI and noble gas activity. Since these accidents are the bounding design basis accidents that use DEI, the dose conversion factors associated with the determination of DEI used in the radiological dose consequence analyses are consistent with the site-specific limits for DEI and for the determination of DEI surveillances.

Likewise, by letter dated July 2, 2009, the licensee provided a calculation for the determination of the DEX limit. The licensee stated that the proposed limits on specific activity ensure that the offsite and control room doses will meet appropriate 10 CFR 100.11 and GDC-19 of Appendix A to 10 CFR Part 50 acceptance criteria.

Based upon the information provided, the staff independently verified that the proposed value of DEX is correct. Based upon the licensee's calculation, the licensee's statement that the DEI and DEX definitions are consistent with the applicable dose consequence analysis and that the specific activity ensures that appropriate acceptance criteria are met, the staff finds that the proposed activity levels for DEI and DEX are acceptable.

The licensee proposes to revise TS 3.1.4.3.a to remove the reference to Figure 3.1-2a "Dose Equivalent I-131 Primary Coolant Specific Activity Limit versus Percent of RATED THERMAL POWER (with the Primary Coolant Specific Activity > 0.35 µCi/gram Dose Equivalent I-131)" and insert a limit of less than or equal to 60 µCi/gm. The curve contained in Figure 3.1-2a was based on a June 12, 1974, letter from the AEC on the subject, "Proposed Standard Technical Specifications for Primary Coolant Activity." Radiological dose consequence analyses for SGTR and MSLB accidents that take into account the pre-accident iodine spike do not consider the elevated RCS iodine specific activities permitted by Figure 3.1-2a for operation at power levels below 80 percent RTP. Instead, the pre-accident iodine spike analyses assume a DEI concentration of 60 µCi/gm, which corresponds to the specific activity limit associated with 100 percent RTP operation. By reference to TSTF-490-A in its application dated November 6, 2008, the licensee asserts, and the staff agrees, that TS 3.1.4.3.a should be based on the short term site specific DEI spiking limit consistent with the assumptions contained in the radiological consequence analyses. Therefore, the proposed changes to TS 3.1.4.3.a, removing reference to Figure 3.1-2a, are acceptable to the staff. In addition to removing the reference to Figure 3.1-2a, the actual figure will also be removed. This is consistent with the preceding evaluation and is acceptable to the NRC staff.

3.2.4 TS 3.1.4.2 Applicability Revision

The licensee proposes to modify the TS 3.1.4.2 APPLICABILITY to include all times except REFUELING SHUTDOWN and COLD SHUTDOWN as opposed to the current APPLICABILITY of "at all times except refueling." This deletes the COLD SHUTDOWN mode from the APPLICABILITY. By reference to TSTF-490-A in its application dated November 6, 2008, the licensee asserts, and the staff agrees, that it is necessary for the LCO to apply during modes above COLD SHUTDOWN to limit the potential radiological consequences of an SGTR or MSLB that may occur during these modes. In its application dated November 6, 2008, the licensee asserts, that in REFUELING SHUTDOWN and COLD SHUTDOWN, the steam generators are transitioning to decay heat removal, the RCS and steam generators are depressurized, and primary to secondary leakage is minimal. The staff agrees that in these modes the steam generators are not used for decay heat removal, the RCS is depressurized or significantly below it normal operating pressure and primary-to-secondary leakage is minimal. Therefore, the monitoring of RCS specific activity during these modes is not required and the staff concurs with the requested change.

3.2.5 TS 3.1.4.3 Revision to Include Action for DEX Limit

The licensee proposes to replace the current TS 3.1.4.3.b with a new TS 3.1.4.3.b.1 and TS 3.1.4.3.b.2 for DEX not within limits. This change is made to be consistent with the change to the TS 3.1.4.1.b which requires the DEX specific activity to be within limits as discussed in Section 3.2.3 above. The site specific limit of DEX in µCi/gm is established based on the maximum accident analysis RCS activity corresponding to one percent fuel clad defects with sufficient margin to accommodate the exclusion of those isotopes based on low concentration, short half life, or small dose conversion factors. The primary purpose of the TS 3.1.4.1.b LCO on RCS specific activity is to support the dose analyses for DBAs. The whole body dose is primarily dependent on the noble gas activity, not the non-gaseous activity currently captured in the E-Bar definition.

The proposed completion time for TS 3.1.4.3.b.1 requires restoration of DEX to within limits in 48 hours. This is consistent with the completion time for current Required Action 3.1.4.3.a and proposed Required Action 3.1.4.3.a.3 for DEI. The radiological consequences for the SGTR and the MSLB accidents, as described in the TMI-1 Updated Final Safety Analysis Report (UFSAR), Sections 14.1.2.10 (SGTR) and 14.1.2.9 (MSLB), demonstrate that the calculated thyroid doses are a greater percentage of the applicable acceptance criteria than the calculated whole body doses. It then follows that the completion time for noble gas activity being out of specification should be at least as great as the completion time for iodine specific activity being out of specification. Therefore, the completion time of 48 hours for the revised TS 3.1.4.3.b is acceptable.

3.2.6 TS 3.1.4.3 Required Action Revision

The proposed change that adds TSs 3.1.4.3.a.4 and 3.1.4.3.b.2 requires the plant to be in HOT SHUTDOWN within 6 hours and adds a new Required Action which requires the plant to be in COLD SHUTDOWN within 36 hours. These changes are consistent with the changes made to the TS 3.1.4.2 APPLICABILITY, as described in Section 3.2.4 of this evaluation. The NRC agrees that in COLD SHUTDOWN, the steam generators are normally not used for decay heat removal. In COLD SHUTDOWN, due to the reduced temperature and pressure of the RCS, the probability of an accident involving the release of significant quantities of RCS inventory is

greatly reduced. Therefore, monitoring of RCS specific activity is not required. In REFUELING SHUTDOWN, the steam generators are not used for decay heat removal, the RCS loops and steam generators are depressurized, and primary-to-secondary leakage is minimal. Therefore, the monitoring of RCS specific activity is not required.

Placing the plant into the COLD SHUTDOWN mode limits the potential radiological consequences of a SGTR or MSLB. The time limit of 36 hours to COLD SHUTDOWN provides a reasonable time based on operating experience to reach the required plant conditions in an orderly manner without challenging plant systems and is acceptable due to the low probability of a SGTR or MSLB during this time.

3.2.7 Table 4.1-3 Revision to Include Surveillance for DEX and Modify Sampling Requirements for DEI and DEX

The proposed change replaces the current Table 4.1-3, Item 1.a, surveillance for RCS gross specific activity with a surveillance to verify that the reactor coolant DEX specific activity is less than or equal to 797 µCi/gm. This change provides a surveillance for the new LCO limit described in TS 3.1.4.1.b for DEX. The revised surveillance, Table 4.1-3, Item 1.a.i requires performing an analysis as a measure of the noble gas specific activity of the reactor coolant at least once every 7 days which is the same frequency required under the current Table 4.1-3, Item 1.a, surveillance for RCS gross non-iodine specific activity. The surveillance provides an indication of any increase in the noble gas specific activity. In its application dated November 6, 2008, the licensee asserts, and the staff agrees, that the results of the surveillance on DEX allow proper remedial action to be taken before reaching the LCO limit under normal operating conditions. The licensee proposes to require this surveillance during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN. Since this is consistent with the LCO applicability, the staff finds the proposed surveillance frequency acceptable. The licensee also proposes to add surveillance frequency Table 4.1-3, Item 1.a.ii, which requires a DEX sample between 2 and 6 hours after power changes exceeding 15 percent of RATED THERMAL POWER within a 1 hour period. This is a conservative change as compared to the previous TS requirements for RCS gross specific activity, is consistent with the timing requirements for DEI sampling, and is therefore acceptable. The licensee proposes to require the Table 4.1-3, Item 1.a.ii, sampling requirement during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN. Since this is consistent with the LCO applicability, the staff finds the proposed mode requirements for the surveillance frequency acceptable.

Similarly, for DEI, Table 4.1-3, Items 1.b.ii and 1.b.iii, the licensee proposes to maintain the existing sampling frequencies. The sampling requirements apply during all plant conditions except REFUELING SHUTDOWN and COLD SHUTDOWN. For Item 1.b.ii, this is a conservative change, as it includes more modes than the previous requirements. For Item 1.b.iii, when DEI exceeds 0.35 µCi/gm, the licensee proposes to change the 4 hour sampling requirements to correspond with the mode of applicability versus the current requirement of all modes except refueling. The proposed modes are consistent with the LCO applicability and are therefore, acceptable, consistent with the discussion is Section 3.2.4 of this evaluation. In addition, the requirement to sample for DEI at 4 hour intervals when gross specific activity exceeds 100/E-Bar is deleted. This change is consistent with the deletion of the 100/E-Bar surveillance and therefore, the elimination of the required DEI samples when gross specific activity is out of specification is acceptable.

3.2.8 Table 4.1-3 Deletion of E-Bar Determination

The licensee proposes to delete the current Table 4.1-3, item 1.c surveillance which requires the determination of E-Bar. The proposed TS 3.1.4.1.b LCO on RCS specific activity supports the dose analyses for DBAs, in which the whole body dose is primarily dependent on the noble gas concentration, not the non-gaseous activity currently captured in the E-Bar definition. The NRC staff agrees that with the elimination of the limit for RCS gross specific activity and the addition of the new LCO limit for noble gas specific activity, consistent with the discussion in sections 3.2.2 and 3.2.3 of this evaluation, the surveillance to determine E-Bar is no longer required.

3.2.9 List of Figures

The licensee proposes to delete the reference to Figure 3.1-2a in the List of Figures on TS page vii. This change is administrative in nature, corresponds to the changes described in Section 3.2.3 of this evaluation and is, therefore, acceptable to the staff.

3.2.10 Conclusion

The staff has reviewed proposed amendment to revise the definition of DEI, delete the definition of E-Bar, add a new definition for DEX, modify TS Section 3.1.4, delete Figure 3.1-2a and modify Table 4.1-3. As described above, the staff reviewed the assumptions, inputs, and methods used by the licensee to assess the radiological impacts of the proposed license amendment at TMI-1. The staff finds that analysis methods and assumptions consistent with the conservative regulatory requirements and guidance identified in Section 2.0 above were used. The staff finds, with reasonable assurance, that the licensee's estimates of the EAB, LPZ, and control room doses will continue to comply with the applicable criteria in Section 2.0 of this evaluation. The proposed changes will not impact the dose consequences of the applicable DBAs because the proposed changes will limit the RCS iodine and noble gas specific activity to ensure consistency with the values assumed in the site specific DBA radiological consequence analyses. Therefore, the staff finds that the proposed changes are acceptable.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20, as well as a surveillance requirement. The NRC staff has determined that the amendment involves 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 amendment involves no significant hazards consideration, and there has been no public comment on such finding (74 FR 10309). Accordingly, the amendment meets 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 amendment.

6.0 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 amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: M. Blumberg
P. Bamford

Date: March 11, 2010

March 11, 2010

Mr. Charles G. Pardee
President and Chief Nuclear Officer
Exelon Generation Company
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: THREE MILE ISLAND NUCLEAR STATION, UNIT 1 - ISSUANCE OF AMENDMENT RE: TECHNICAL SPECIFICATION CHANGES ADOPTING TSTF-490-A, REVISION 0, DELETION OF E-BAR DEFINITION AND REVISION TO REACTOR COOLANT SYSTEM SPECIFIC ACTIVITY TECHNICAL SPECIFICATION (TAC NO. ME0100)

Dear Mr. Pardee:

The Commission has issued the enclosed Amendment No. 272 to Renewed Facility Operating License No. DPR-50 for the Three Mile Island Nuclear Station, Unit 1 (TMI-1), in response to your application dated November 6, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083120122), as supplemented by letters dated December 11, 2008 (ADAMS Accession No. ML083470249), July 2, 2009 (ADAMS Accession No. ML091870996), October 2, 2009 (ADAMS Accession No. ML092790495), and November 24, 2009 (ADAMS Accession No. ML093290324).

The amendment replaces the current TMI-1 technical specification (TS) limit on Reactor Coolant System (RCS) gross specific activity with a new limit on RCS noble gas specific activity. The noble gas specific activity limit is based on a new dose equivalent Xe-133 definition that replaces the current E Bar average disintegration energy definition. In addition, the dose equivalent I-131 (DEI) definition has been modified to specify the source of the thyroid dose conversion factor that is consistent with the bounding dose consequence analysis for TMI-1 that uses DEI.

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

Sincerely,
/ra/
Peter J. Bamford, Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-289

Enclosures: 1. Amendment No. 272 to Renewed DPR-50
2. Safety Evaluation
cc: Distribution via Listserv

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