Entergy

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Michael A. Krupa
Director
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GNRO-2008/00061

August 28, 2008

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

SUBJECT: Supplement 2 to Amendment Request
Changes to Technical Specification 5.6.5, "Core Operating Limits Report (COLR)"
Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29

REFERENCES:
1. Letter GNRO-2007/00071 from Entergy to USNRC, "License Amendment Request (LAR) Changes to Technical Specification 5.6.5, "Core Operating Limits Report (COLR)" dated December 5, 2007 (ADAMS Accession No. ML073440113)
2. Letter GNRO-2008/00053 from Entergy to USNRC, "Supplement to Amendment Request - Changes to Technical Specification 5.6.5, "Core Operating Limits Report (COLR)" dated July, 21, 2008 (ADAMS Accession No. ML082070087).

Dear Sir or Madam:

By Reference 1 above, Entergy Operations, Inc. (Entergy) requested changes to Grand Gulf Nuclear Station (GGNS) Technical Specification (TS) 5.6.5, "Core Operating Limits Report (COLR)." Specifically, Entergy requested that (1) document NEDC-33383P, "GEXL97 Correlation Applicable to ATRIUM-10 Fuel," Global Nuclear Fuel (GNF), be added to the list of NRC approved analytical methods that are used for determining core operating limits and (2) an exception given in document 24, NEDE 24011-P-A, "General Electric Standard Application for Reactor Fuel (GESTAR-II)" be deleted.

Entergy provided supplemental information and a revision to NEDC-33383P by Reference 2 in response to an NRC staff request for additional information. The response addressed six of the staff's seven questions as the information required to address one of the questions was not yet available. The response to the remaining question is provided as Attachment 1.

The original no significant hazards consideration is not affected by any information contained in the supplemental letter. There are no new commitments contained in this letter.

If you have any questions or require additional information, please contact Ron Byrd at 601-368-5792.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 28, 2008.

Sincerely,

MAK/RWB/amm
Attachment: Response to Request for Additional Information

cc: Mr. Elmo E. Collins
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**Attachment 1 to**

**GNR0-2008/00061**

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
## REGARDING LICENSE AMENDMENT REQUEST: CHANGES TO TECHNICAL SPECIFICATIONS 5.6.5, CORE OPERATING LIMITS REPORT (COLR)

This supplement provides a response to a NRC Question concerning Entergy's request for changes to Grand Gulf Nuclear Station (GGNS) Technical Specifications Section 5.6.5, "Core Operating Limits Report (COLR)" (Reference 1). The changes are needed to allow a fuel transition beginning with operating Cycle 17. Entergy previously responded to six additional questions by Reference 2 of this letter.

**Question**:

The application describes a transition from the current core with a full loading of ATRIUM-10 to a full loading of GE14 fuel. This transition will start with the upcoming refueling outage and continue over several refueling outages. Once the NRC staff approves the inclusion of the GEXL97 correlation into the TS, the licensee calculates the core operating limits listed in TS 5.6.5a and performs the plant accident analyses without further review by the NRC staff. Therefore, the staff requests that the licensee provide additional information to allow the staff to review the impact of the transition on the safety analyses.

Specifically, for Loss-of-Coolant Accident (LOCA), Anticipated Transient Without Scram (ATWS), Abnormal Operation Occurrence (AOO), American Society of Mechanical Engineers (ASME) Code overpressure, and stability analyses performed for the initial transition core:

a) state the approved methodology and/or the computer codes used and the reference (e.g. topical report) documenting the methodology/computer codes,

b) state if the analysis is in compliance with all applicable restrictions in the staff safety evaluation(s) approving the methodology, and

c) provide the quantitative results of the figure(s) of merit (FOM) compared against the acceptance criteria.

**Question (continued):**

Below is an example of a format that would provide the set of information to the staff.

| Analysis | Methodology / Code(s) Used | Staff Approval | Comply with all applicable restrictions and conditions | FOM | Result Value vs. Acceptance Criterion |
|---|---|---|---|---|---|
| ATWS | | Ref. xx | Y/N | Peak pressure<br>PCT<br>Peak pool temp<br>Peak containment pres | |
| LOCA | | | | PCT<br>Local MWR<br>Core wide MWR | |
| ASME Overpressure | | | | Peak pressure | |
| Stability | | | | Stability regions[1] | |
| AOO | | | | OLMCPR[2] | |

For the LOCA analysis, also provide a narrative showing that:

a) the limiting break location, break size, and single failure(s) were identified and used.

b) the limiting power/flow conditions and axial power shape were used.

c) the legacy fuel analysis (MAPLHGR) will continue to be applicable through the transition cycles.

Note 1: Stability regions = A figure showing the stability regions, like Figures 4-4 and 4-5 of the Core Operating Limits Report (COLR) submitted by letter dated March 23, 2004 (GNRO-2004/00022).

Note 2: OLMCPR = operating limit minimum critical power ratio.

**Response:**

The response for each of the subject areas doesn't conveniently fit into a single table. The response is organized with the methods information first, followed by the GGNS results. The major subjects are organized in the same order as the table: ATWS, LOCA, ASME Overpressure, Stability, and AOOs (Including Off-Rated Limits).

## ATWS

Methods/Codes

| Methodology / Code(s) Used | Staff Approval | Comply with all applicable restrictions and conditions |
|---|---|---|
| ISCOR09 | Note 1 | Yes |
| PANAC11 | NEDE–30130–P–A, Steady–State Nuclear Methods, April 1985. Note 2 | Yes |
| ODYN09 | NEDC-24154P-A, Qualification of the One-Dimensional Core Transient Model (ODYN) for Boiling Water Reactors, Supplement 4, Volume 1, January 1998. | Yes |
| STEMP04 | Note 3 | N/A |
| TASC03 | NEDC-32084P-A, TASC-03A, A Computer Program for Transient Analysis of a Single Channel, Revision 2, July 2002. | Yes |

NOTES

(1) The ISCOR code is not approved by name. However, the NRC Safety Evaluation (SE) supporting approval of NEDE-24011-P Rev. 0 by the May 12, 1978 letter from D. G. Eisenhut (NRC) to R. Gridley (GE) finds the models and methods acceptable, and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences, Transient, ATWS, Stability, and LOCA applications is consistent with the approved models and methods

(2) The physics code PANACEA provides inputs to the transient code ODYN. The use of PANAC Version 11 in this application was initiated following approval of Amendment 26 of GESTAR II by letter from S.A. Richards (NRC) to G.A. Watford (GE), Subject: "Amendment 26 to GE Licensing Topical Report NEDE-24011-P-A, GESTAR II Implementing Improved GE Steady-State Methods", (TAC NO. MA6481), November 10, 1999.

(3) The STEMP code uses fundamental mass and energy conservation laws to calculate the suppression pool heatup. The use of STEMP was noted in NEDE-24222, "Assessment of BWR Mitigation of ATWS, Volume I & II (NUREG-0460 Alternate No. 3) December 1, 1979." The code has been used in ATWS applications since that time. There is no formal NRC review and approval of STEMP.

Results vs. Acceptance Criteria (ATWS)

| Parameter | Result | Acceptance Criteria |
|---|---|---|
| Peak Vessel Pressure (psig) | 1299 | ≤1500 |
| Peak Suppression Pool Temperature (°F) | 170 | ≤185 |
| Peak Containment Pressure (psig) | 8.2 | ≤15.0 |
| Peak Cladding Temperature (°F) | 1509 | ≤2200 |
| Peak Local Cladding Oxidation (%) | Insignificant | ≤17 |

## LOCA

Methods/Codes

| Methodology / Code(s) Used | Staff Approval | Comply with all applicable restrictions and conditions |
|---|---|---|
| ISCOR09 | Note 1 | Yes |
| LAMB08 | NEDE-20566P-A, General Electric Analytical Model for Loss-of-Coolant Analysis in Accordance with 10CFR50 Appendix K, September 1986. | Yes |
| SAFER04/ GESTR08 | NEDE-23785-1-PA Rev. 1, The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Vol. 1, GESTR-LOCA – A Model for the Prediction of Fuel Rod Thermal Performance, October 1984.<br>NEDE-23785-1-PA Rev. 1, The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Vol. 2, SAFER – Long Term Inventory Model for BWR Loss-of-Coolant Analysis, October 1984.<br>NEDE-23785-1-PA Rev. 1, The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Vol. 3, SAFER/GESTR Application Methodology, October 1984.<br>NEDE-23785P-A Rev. 1, The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Vol. 3 Supplement 1, Additional Information for Upper Bound PCT Calculation, March 2002.<br>Notes 2 and 3 | Yes<br>Note 4 |
| TASC03 | NEDC-32084P-A, TASC-03A, A Computer Program for Transient Analysis of a Single Channel, Revision 2, July 2002. | Yes |

NOTES

(1) The ISCOR code is not approved by name. However, the SE supporting approval of NEDE-24011-P Rev. 0 by the May 12, 1978 letter from D. G. Eisenhut (NRC) to R. Gridley (GE) finds the models and methods acceptable, and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences, Transient, ATWS, Stability, and LOCA applications is consistent with the approved models and methods.

(2) Letter, J.F. Klapproth (GE) to USNRC, "Transmittal of GE Proprietary Report NEDC-32950P 'Compilation of Improvements to GENE's SAFER ECCS-LOCA Evaluation Model," dated January 2000 by letter dated January 27, 2000.

(3) Letter, S.A. Richards (NRC) to J.F. Klapproth (GE), "General Electric Nuclear Energy Topical Reports NEDC-32950P and NEDC-32084P Acceptability Review," May 24, 2000.

(4) The ECCS-LOCA evaluations are in compliance with the one SE restriction upon the SAFER/GESTR-LOCA methodology. This SE restriction is described within NEDE-23785-1-PA Rev. 1, The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Vol. 3, SAFER/GESTR Application Methodology, October 1984, as "...NRC will require a demonstration that the PCT value calculated by the licensing method always exceeds the upper-bound value". All ECCS-LOCA evaluations explicitly calculate both the licensing PCT and the upper bound PCT, and all evaluations report a licensing PCT which exceeds the upper bound PCT.

Results vs. Acceptance Criteria (LOCA)

| Parameter | ATRIUM-10 Result | GE14 Result | Acceptance Criteria |
|---|---|---|---|
| Licensing Basis PCT | ≤ 1880 °F | ≤ 1630 °F | ≤ 2200 °F |
| Maximum Local Oxidation | ≤ 3% | ≤ 1% | ≤ 17% |
| Core Wide Metal-Water Reaction | ≤ 0.1% | ≤ 0.1% | ≤ 1.0% |
| Coolable Geometry | See Licensing Basis PCT and Maximum Local Oxidation results above | See Licensing Basis PCT and Maximum Local Oxidation results above | Satisfied by:<br>PCT ≤ 2200 °F<br>AND<br>Maximum Local Oxidation ≤ 17% |
| Core Long Term Cooling | Satisfied by:<br>EITHER<br>Core reflooded above TAF<br>OR<br>Core reflooded to the elevation of jet pump suction and 1 core spray system in operation | Satisfied by:<br>EITHER<br>Core reflooded above TAF<br>OR<br>Core reflooded to the elevation of jet pump suction and 1 core spray system in operation | Core temperature acceptably low<br>AND<br>Long-term decay heat removed |

Additional LOCA Analysis Information

a) *Use of Limiting Break and Single Failures*

The ECCS-LOCA evaluations evaluate all potentially limiting single failures including:

- HPCS emergency diesel generator
- LPCS emergency diesel generator
- LPCI emergency diesel generator
- Single ADS valve

The ECCS-LOCA evaluations identify the HPCS emergency diesel generator as the limiting single failure.

The limiting break location is not a function of fuel type, and the ECCS-LOCA evaluations utilize prior SAFER/GESTR-LOCA evaluations to identify the limiting break location as the recirculation suction line. The ECCS-LOCA evaluations examine break sizes ranging from a double-ended guillotine break of the recirculation suction line to small breaks for which no core heatup is predicted. The break sizes are selected to satisfy the requirement for the use of the Moody Slip Flow Model with a discharge coefficient of 1.0, 0.8, and 0.6; the break sizes are selected to fully characterize the PCT versus break size response and are selected to ensure that the limiting break size is identified. The limiting large break is identified as the double-ended guillotine break of the recirculation suction line, and the limiting small break is identified as a 0.08 $ft^2$ break of the recirculation suction line. The double-ended guillotine break is identified as the overall most limiting break.

b) *Use of Limiting Power/Flow Conditions and Axial Power Shape*

The potentially limiting power and flow conditions are evaluated, including the rated power/flow point and the point on the MELLLA rod line with highest power and lowest flow. Calculations are performed at these power/flow points using both nominal and Appendix K conditions. The point on the MELLLA rod line with the highest power and lowest flow is identified as the limiting power and flow condition. Both mid-peaked and top-peaked axial power shapes are evaluated by the ECCS-LOCA evaluations. The limiting axial power shape is identified as mid-peaked for large breaks and the limiting axial power shape for small breaks is identified as top-peaked.

c) *Applicability of the Legacy Fuel Analysis (MAPLHGR) Through Transition Cycles*

The legacy fuel MAPLHGRs are not applied to the transition cycles because a new SAFER/GESTR-LOCA evaluation is performed for the legacy fuel and new MAPLHGRs are generated. This legacy fuel SAFER/GESTR-LOCA evaluation satisfies all 10CFR50.46 licensing requirements, the one SE restriction, and generates MAPLHGR limits which are applicable to the transition cycles.

## ASME Overpressure

### Methods/Codes

| Methodology / Code(s) Used | Staff Approval | Comply with all applicable restrictions and conditions |
|---|---|---|
| ISCOR09 | Note 1 | Yes |
| PANAC11 | NEDE–30130–P–A, Steady–State Nuclear Methods, April 1985, Note 2 | Yes |
| ODYN09 | NEDC-24154P-A, Qualification of the One-Dimensional Core Transient Model (ODYN) for Boiling Water Reactors, August 1986. | Yes |

NOTES:

(1) The ISCOR code is not approved by name. However, the SE supporting approval of NEDE-24011-P Rev. 0 by the May 12, 1978 letter from D. G. Eisenhut (NRC) to R. Gridley (GE) finds the models and methods acceptable, and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences, Transient, ATWS, Stability, and LOCA applications is consistent with the approved models and methods

(2) The physics code PANACEA provides inputs to the transient code ODYN. The use of PANAC Version 11 in this application was initiated following approval of Amendment 26 of GESTAR II by letter from S.A. Richards (NRC) to G.A. Watford (GE), Subject: "Amendment 26 to GE Licensing Topical Report NEDE-24011-P-A, GESTAR II Implementing Improved GE Steady-State Methods", (TAC NO. MA6481), November 10, 1999.

### Results vs. Acceptance Criteria (ASME Overpressure)

| Event | Steam Line Pressure (psig) | Dome Pressure (psig) | Vessel Pressure (psig) | TS Dome Pressure Limit (1) (psig) | ASME Vessel Limit (2) (psig) |
|---|---|---|---|---|---|
| MSIV Closure (Flux Scram) - ICF (HBB) | 1274 | 1276 | 1308 | 1325 | 1375 |
| MSIV Closure (Flux Scram) - MEOD (HBB) | 1269 | 1271 | 1293 | 1325 | 1375 |

NOTES:

(1) Technical Specification 2.1.2 Reactor Coolant System Pressure SL

(2) GESTAR II, Revision 16, Section S.3 Vessel Pressure ASME Code Compliance Model

## **Stability**

Methods/Codes

| **Methodology / Code(s) Used** | **Staff Approval** | **Comply with all applicable restrictions and conditions** |
|---|---|---|
| ISCOR09 | Note 1 | Yes |
| PANAC11 | NEDE–30130–P–A, Steady–State Nuclear Methods, April 1985. | Yes |
| ODYSY05 | NEDC-32992P-A, ODYSY Application for Stability Licensing Calculations, July 2001.<br>NEDO-32339-A, Reactor Stability Long-Term Solution: Enhanced Option I-A, Revision 1, April 1998.<br>NEDO-32339-A Supplement 3, Reactor Stability Long-Term Solution: Enhanced Option I-A, Flow Mapping Methodology, Revision 1, April 1998.<br>NEDO-32339-A Supplement 4, Reactor Stability Long-Term Solution: Enhanced Option I-A, Generic Technical Specifications, Revision 1, April 1998.<br>NEDC-32339P-A Supplement 1, Reactor Stability Long-Term Solution: Enhanced Option I-A, ODYSY Application to E1A, December 1996.<br>NEDC-32339P-A Supplement 2, Reactor Stability Long-Term Solution: Enhanced Option I-A, Solution Design, Revision 1, April 1998. | Yes |

NOTES:

(1) The ISCOR code is not approved by name. However, the SE supporting approval of NEDE-24011-P Rev. 0 by the May 12, 1978 letter from D. G. Eisenhut (NRC) to R. Gridley (GE) finds the models and methods acceptable, and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences, Transient, ATWS, Stability, and LOCA applications is consistent with the approved models and methods

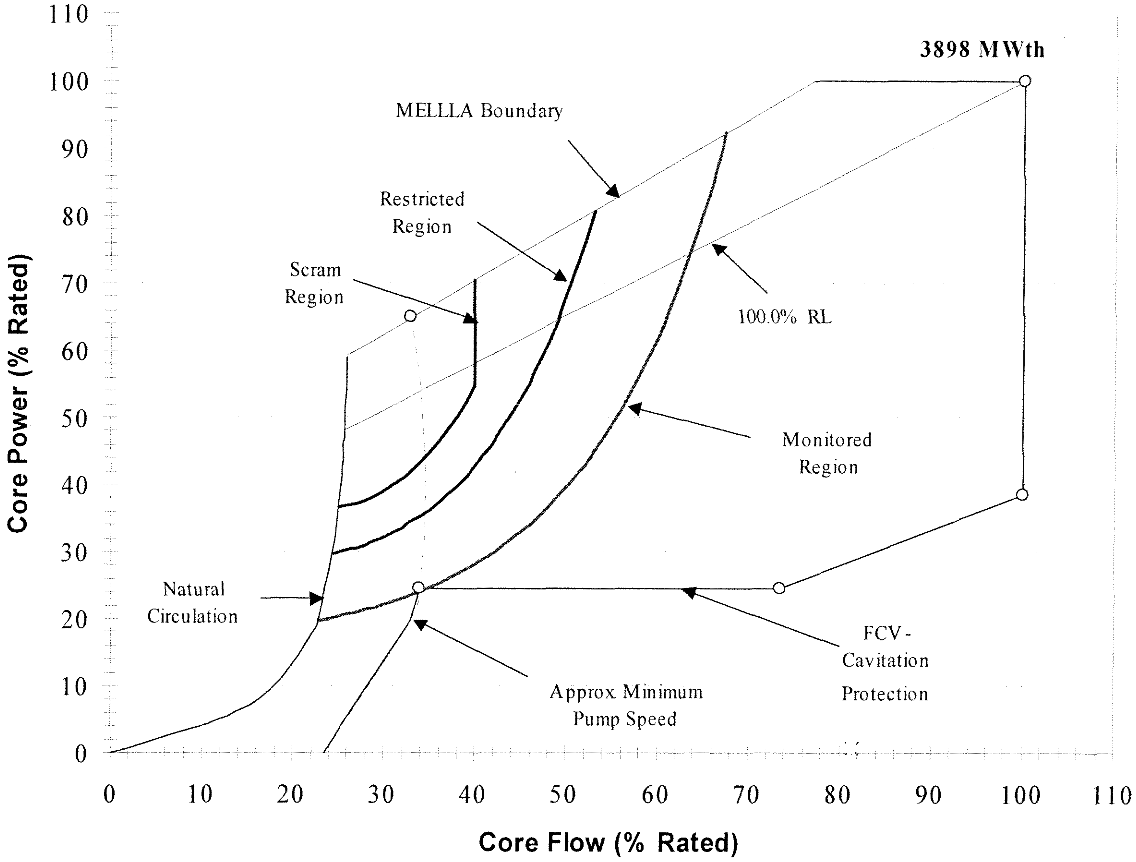
Results vs. Acceptance Criteria (Stability)

Below are the decay ratios resulting from ODYSY analysis for Grand Gulf Cycle 17. Figure 1 shows the stability regions. Figure 2 provides a comparison of the result values to the Acceptance Criteria.

**Decay Ratios**

| | | Cycle 17 | |
|---|---|---|---|
| **Case** | **State** | **Core Decay Ratio** | **Channel Decay Ratio** |
| RVM1 | B | 0.427 | 0.172 |
| RVM2 | A' | 0.520 | 0.280 |
| RVM3 | B' | 0.587 | 0.124 |
| RVM4 | FRE H1 | 0.615 | 0.276 |
| RVM5 | FRE H0 | 0.422 | 0.021 |
| RVM6 | A' LOFH | 0.754 | 0.297 |
| RVM7 | B' LOFH | 0.709 | 0.307 |

**Figure 1. GGNS C17 E1A Stability Regions**



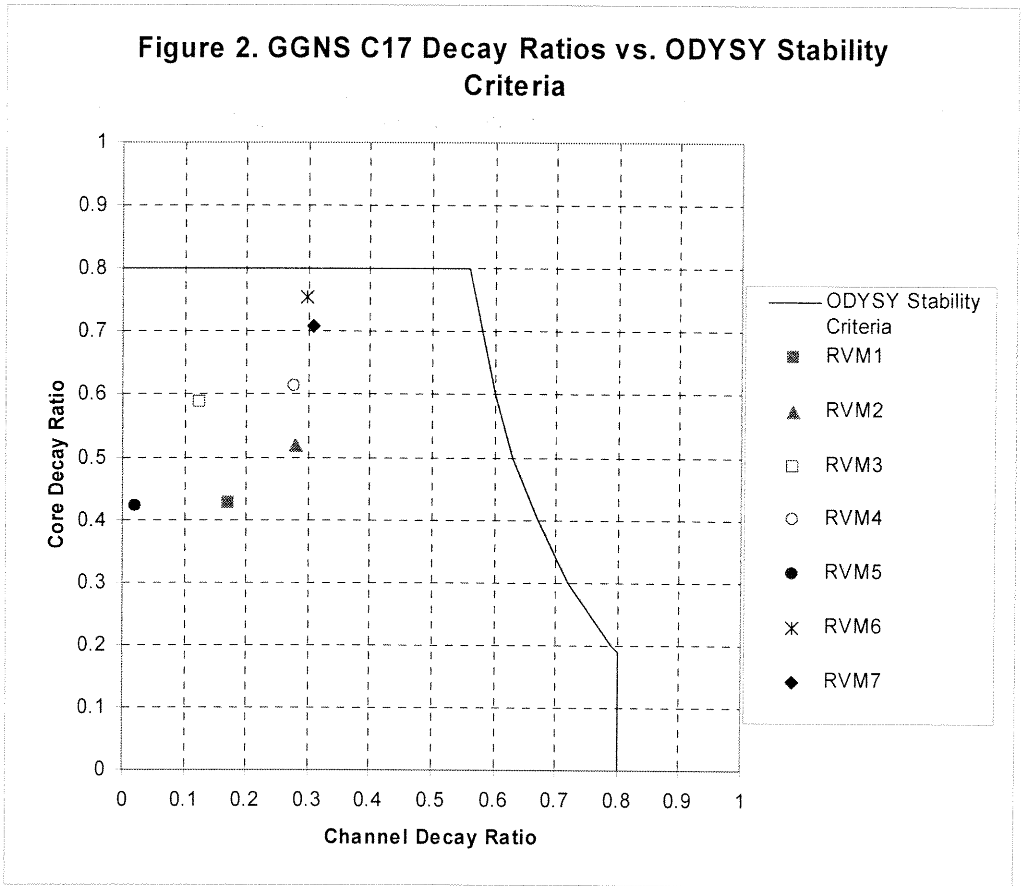


Figure 2. GGNS C17 Decay Ratios vs. ODYSY Stability Criteria
Core Decay Ratio
Channel Decay Ratio
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
ODYSY Stability Criteria
RVM1
RVM2
RVM3
RVM4
RVM5
RVM6
RVM7

## AOOs Including Off-Rated Limits

Methods/Codes

| Methodology / Code(s) Used | Staff Approval | Comply with all applicable restrictions and conditions |
|---|---|---|
| ISCOR09 | Note 1 | Yes |
| PANAC11 | NEDE–30130–P–A, Steady–State Nuclear Methods, April 1985, Note 2 | Yes |
| ODYN09 | NEDC-24154P-A, Qualification of the One-Dimensional Core Transient Model (ODYN) for Boiling Water Reactors, August 1986. | Yes |

NOTES:

(1) The ISCOR code is not approved by name. However, the SE supporting approval of NEDE-24011-P Rev. 0 by the May 12, 1978 letter from D. G. Eisenhut (NRC) to R. Gridley (GE) finds the models and methods acceptable, and mentions the use of a digital computer code. The referenced digital computer code is ISCOR. The use of ISCOR to provide core thermal-hydraulic information in reactor internal pressure differences, Transient, ATWS, Stability, and LOCA applications is consistent with the approved models and methods

(2) The physics code PANACEA provides inputs to the transient code ODYN. The use of PANAC Version 11 in this application was initiated following approval of Amendment 26 of GESTAR II by letter from S.A. Richards (NRC) to G.A. Watford (GE), Subject: "Amendment 26 to GE Licensing Topical Report NEDE-24011-P-A, GESTAR II Implementing Improved GE Steady-State Methods", (TAC NO. MA6481), November 10, 1999.

The following tables provide operating limit information for Cycle 17. Although not in graphic form as normally expressed in the COLR, the information is comparable to the current Cycle 16 power-dependent and flow-dependent operating limits. The COLR figures for Cycle 17 will be provided upon issuance with the normal COLR submittal as required by Technical Specification 5.6.5.d.

**Limiting Pressurization Events OLMCPR[1] Summary Table**

| Application Condition / Exposure Range | Option A GE14C ATR10 | |
|---|---|---|
| **Equipment in Service** | | |
| BOC to MOC | 1.18 | 1.19 |
| MOC to EOC | 1.31 | 1.33 |
| **FWH OOS** | | |
| BOC to MOC | 1.18 | 1.19 |
| MOC to EOC | 1.32 | 1.33 |
| **EOC-RPT OOS** | | |
| BOC to MOC | 1.23 | 1.23 |
| MOC to EOC | 1.37 | 1.39 |
| **EOC-RPT + FWH OOS** | | |
| BOC to MOC | 1.23 | 1.23 |
| MOC to EOC | 1.39 | 1.40 |

NOTES:

(1) The OLMCPR values presented apply to rated power operation based on the two loop operation safety limit MCPR.

(2) BOC = Beginning of Cycle
MOC = Middle of Cycle
EOC = End of Cycle
FWH = Feedwater Heater
EOC-RPT = End-of-Cycle Recirculation Pump Trip
OOS = Out of Service

## MCPRp Limits for GE14 and Atrium10

| | | | Below Pbypass | | | | Above Pbypass | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| App. Group | Exp. | Fuel | 25% P ≤50% flow | 25% P >50% flow | 40% P ≤50% flow | 40% P >50% flow | 40% P | 50% P | 70% P | 70% P | 90% P | 100% P |
| 1 | MOC | GE14 | 1.93 | 2.03 | 1.73 | 1.93 | 1.56 | 1.52 | 1.44 | 1.43 | 1.23 | 1.21 |
| | | Atrium10 | 1.89 | 1.99 | 1.69 | 1.88 | 1.56 | 1.52 | 1.44 | 1.40 | 1.23 | 1.21 |
| | EOC | GE14 | 2.02 | 2.10 | 1.81 | 1.93 | 1.58 | 1.58 | - | 1.53 | 1.35 | 1.31 |
| | | Atrium10 | 1.98 | 2.06 | 1.78 | 1.88 | 1.57 | 1.57 | - | 1.51 | 1.37 | 1.33 |
| 2 | MOC | GE14 | 1.93 | 2.03 | 1.73 | 1.93 | 1.56 | 1.52 | 1.44 | 1.43 | 1.23 | 1.21 |
| | | Atrium10 | 1.89 | 1.99 | 1.69 | 1.88 | 1.56 | 1.52 | 1.44 | 1.40 | 1.23 | 1.21 |
| | EOC | GE14 | 2.02 | 2.10 | 1.81 | 1.93 | 1.61 | 1.58 | - | 1.53 | 1.37 | 1.32 |
| | | Atrium10 | 1.98 | 2.06 | 1.78 | 1.88 | 1.61 | 1.57 | - | 1.51 | 1.39 | 1.33 |
| 3 | MOC | GE14 | 1.93 | 2.03 | 1.73 | 1.93 | 1.56 | 1.52 | 1.44 | 1.43 | 1.23 | 1.23 |
| | | Atrium10 | 1.89 | 1.99 | 1.69 | 1.88 | 1.56 | 1.52 | 1.44 | 1.40 | 1.24 | 1.23 |
| | EOC | GE14 | 2.02 | 2.10 | 1.81 | 1.93 | 1.61 | 1.58 | - | 1.53 | 1.41 | 1.37 |
| | | Atrium10 | 1.98 | 2.06 | 1.78 | 1.88 | 1.62 | 1.58 | - | 1.52 | 1.43 | 1.39 |
| 4 | MOC | GE14 | 1.93 | 2.03 | 1.73 | 1.93 | 1.56 | 1.52 | 1.44 | 1.43 | 1.24 | 1.23 |
| | | Atrium10 | 1.89 | 1.99 | 1.69 | 1.88 | 1.56 | 1.52 | 1.44 | 1.40 | 1.25 | 1.23 |
| | EOC | GE14 | 2.02 | 2.10 | 1.81 | 1.93 | 1.67 | 1.60 | - | 1.53 | 1.44 | 1.39 |
| | | Atrium10 | 1.98 | 2.06 | 1.78 | 1.88 | 1.67 | 1.60 | - | 1.52 | 1.45 | 1.40 |

*NOTES:

Application Group 1: Equipment in Service

Application Group 2: FWH OOS

Application Group 3: EOC-RPT OOS

Application Group 4: EOC-RPT + FWH OOS

## LHGRFACp Limits for GE14 and Atrium10

| App. Group | Exp. | Fuel | Below Pbypass 25% P ≤50% flow | Below Pbypass 25% P >50% flow | Below Pbypass 40% P ≤50% flow | Below Pbypass 40% P >50% flow | Above Pbypass 40% P | Above Pbypass 50% P | Above Pbypass 70% P | Above Pbypass 90% P | Above Pbypass 100% P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MOC | GE14 | 0.822 | 0.767 | 0.904 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | EOC | GE14 | 0.822 | 0.767 | 0.885 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| 2 | MOC | GE14 | 0.822 | 0.767 | 0.904 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | EOC | GE14 | 0.822 | 0.767 | 0.885 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| 3 | MOC | GE14 | 0.822 | 0.767 | 0.904 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | EOC | GE14 | 0.822 | 0.767 | 0.885 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| 4 | MOC | GE14 | 0.822 | 0.767 | 0.904 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | EOC | GE14 | 0.822 | 0.767 | 0.885 | 0.780 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | Atrium10 | 0.854 | 0.761 | 0.911 | 0.782 | 0.911 | 1.0 | 1.0 | 1.0 | 1.0 |

*NOTES:

Application Group 1: Equipment in Service

Application Group 2: FWH OOS

Application Group 3: EOC-RPT OOS

Application Group 4: EOC-RPT + FWH OOS

## MCPRf Limits for GE14 and Atrium10

| 20% F | 30% F | 70% F | 110% F |
|---|---|---|---|
| 1.30 | 1.30 | 1.21 | 1.21 |

## LHGRFACf Limits for GE14 and Atrium10

| 20% F | 30% F | 60% F | 110% F |
|---|---|---|---|
| 0.748 | 0.748 | 1.000 | 1.000 |