



Clinton Power Station  
8401 Power Road  
Clinton, IL 61727

U-604219  
June 03, 2015

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555-0001

Clinton Power Station, Unit 1  
Facility Operating License No. NPF-62  
NRC Docket No. 50-461

Subject: Submittal of the Core Operating Limits Report  
for Clinton Power Station, Unit 1, Cycle 16, Revision 10

In accordance with Technical Specification 5.6.5, Core Operating Limits Report (COLR), Item d., Exelon Generation Company (EGC), LLC is submitting Revision 10 of the COLR for Clinton Power Station, Unit 1, Cycle 16.

Should you have any questions concerning this report, please contact Mr. Jeffrey E. Cunningham at (217) 937-2800.

Respectfully,

A handwritten signature in black ink, appearing to read "Mark M. Newcomer".

Mark M. Newcomer  
Site Vice President  
Clinton Power Station

JLP/cas

Attachment: Core Operating Limits Report for Clinton Power Station Unit 1, Cycle 16,  
Revision 10

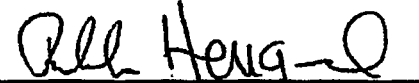
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**ATTACHMENT**  
**Core Operating Limits Report for Clinton Power Station Unit 1, Cycle 16,**  
**Revision 10**

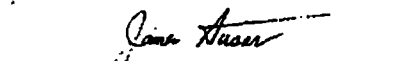
**CORE OPERATING LIMITS REPORT**  
**FOR**  
**CLINTON POWER STATION UNIT 1 CYCLE 16**

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**Table of Contents**

|             |  |           |
|-------------|--|-----------|
| <b>1.0</b>  | <b>Terms and Definitions</b>                           | <b>5</b>  |
| <b>2.0</b>  | <b>General Information</b>                             | <b>7</b>  |
| <b>3.0</b>  | <b>MAPLHGR Limits</b>                                  | <b>8</b>  |
| <b>4.0</b>  | <b>MCPR Limits</b>                                     | <b>10</b> |
| <b>5.0</b>  | <b>Linear Heat Generation Rate Limits</b>              | <b>17</b> |
| <b>6.0</b>  | <b>Reactor Protection System (RPS) Instrumentation</b> | <b>23</b> |
| <b>7.0</b>  | <b>Turbine Bypass System Parameters</b>                | <b>23</b> |
| <b>8.0</b>  | <b>Stability Protection Setpoints</b>                  | <b>24</b> |
| <b>9.0</b>  | <b>Modes of Operation</b>                              | <b>25</b> |
| <b>10.0</b> | <b>Methodology</b>                                     | <b>26</b> |
| <b>11.0</b> | <b>References</b>                                      | <b>26</b> |

**List of Tables**

|  | Page |
|--|------|
| Table 3-1 MAPLHGR Versus Average Planar Exposure – GE14C   | 8    |
| Table 3-2 MAPLHGR Versus Average Planar Exposure – GNF2  | 8    |
| Table 3-3 MAPLHGR Single Loop Operation (SLO) Multiplier   | 9    |
| Table 3-4 MAPLHGR Multiplier for Loss of 'FULL' Feedwater Heating  | 9    |
| Table 4-1 Operating Limit Minimum Critical Power Ratio   | 12   |
| Table 4-2 Power Dependent MCPR Limits MCPR(P) and Multipliers K(P)   | 13   |
| Table 4-3 PROOS/PLUOOS/TCVFASOOS Power Dependent MCPR Limits MCPR(P) and Multipliers K(P)                        | 14   |
| Table 4-4 Dual Loop Operation (DLO) Flow Dependent MCPR Limits MCPR(F) for Base Case or PROOS/PLUOOS/TCVFASOOS   | 15   |
| Table 4-5 Single Loop Operation (SLO) Flow Dependent MCPR Limits MCPR(F) for Base Case or PROOS/PLUOOS/TCVFASOOS | 15   |
| Table 4-6 Dual Loop Operation (DLO) Flow Dependent MCPR Limits MCPR(F) for Two or More TBVOOS                    | 16   |
| Table 4-7 Single Loop Operation (SLO) Flow Dependent MCPR Limits MCPR(F) for Two or More TBVOOS                  | 16   |
| Table 5-1 Linear Heat Generation Rate Limits for UO <sub>2</sub> Rods  | 18   |
| Table 5-2 Linear Heat Generation Rate Limits for Gad Rods  | 18   |
| Table 5-3 Power Dependent LHGR Multiplier LHGRFAC(P)   | 19   |
| Table 5-4 Flow Dependent LHGR Multiplier LHGRFAC(F) for Base Case or PROOS/PLUOOS/TCVFASOOS                      | 20   |
| Table 5-5 Flow Dependent LHGR Multiplier LHGRFAC(F) for Two or More TBVOOS                                       | 20   |
| Table 5-6 LHGR Single Loop Operation (SLO) Reduction Factor  | 20   |

|           |  |    |
|-----------|--|----|
| Table 5-7 | Power Dependent LHGR Multiplier LHGRFAC(P) (Loss of 'FULL' Feedwater Heating)  | 21 |
| Table 5-8 | Flow Dependent LHGR Multiplier LHGRFAC(F) for Base Case or PROOS/PLUOOS/TCVFASOOS (Loss of 'FULL' Feedwater Heating) | 22 |
| Table 5-9 | Flow Dependent LHGR Multiplier LHGRFAC(F) for Two or More TBVOOS (Loss of 'FULL' Feedwater Heating)                  | 22 |
| Table 7-1 | Reactor Power Limitation – Turbine Bypass Valves Out of Service  | 23 |
| Table 8-1 | OPRM PBDA Trip Setpoints   | 24 |
| Table 9-1 | Modes of Operation   | 25 |

## 1.0 Terms and Definitions

|            |   |
|------------|---|
| ADSOOS     | Automatic Depressurization System Valve Out of Service  |
| Base Case  | A case analyzed with two (2) Safety-Relief Valves Out-of-Service (OOS), one (1) Automatic Depressurization System valve OOS, one (1) Turbine Control Valve stuck closed, one (1) Turbine Stop Valve stuck closed, one (1) Turbine Bypass Valve OOS, and up to a 50°F feedwater temperature reduction (FWTR includes feedwater heater OOS or final feedwater temperature reduction) at any point in the cycle operation in Dual Loop mode (Reference 3). |
| Coastdown  | The reactor condition where thermal power gradually decreases due to fuel depletion while the following conditions are met: 1) all operable control rods are fully withdrawn and 2) all cycle extension techniques have been exhausted including FFWTR and ICF.   |
| DLO        | Dual Reactor Recirculation Loop Operation   |
| FFWTR      | Final Feedwater Temperature Reduction   |
| FWHOOS     | Feedwater Heaters Out of Service  |
| ICF        | Increased Core Flow   |
| LHGR       | Linear Heat Generation Rate   |
| LHGRFAC(F) | LHGR thermal limit flow dependent multipliers   |
| LHGRFAC(P) | LHGR thermal limit power dependent multipliers  |
| MAPLHGR    | Maximum Average Planar Linear Heat Generation Rate  |
| MCPR       | Minimum Critical Power Ratio  |
| MCPR(F)    | MCPR thermal limit flow dependent adjustments and multipliers   |
| MCPR(P)    | MCPR thermal limit power dependent adjustments and multipliers  |
| MELLLA     | Maximum Extended Load Line Limit Analysis   |
| MSIV       | Main Steam Isolation Valve  |
| OLMCPR     | Operating Limit Minimum Critical Power Ratio  |
| OPRM       | Oscillation Power Range Monitor   |
| PBDA       | Period Based Detection Algorithm  |

|                  |   |
|------------------|---|
| <b>PLUOOS</b>    | <b>Power Load Unbalance Out of Service</b>  |
| <b>PROOS</b>     | <b>Pressure Regulator Out of Service</b>  |
| <b>SLO</b>       | <b>Single Reactor Recirculation Loop Operation</b>  |
| <b>SRVOOS</b>    | <b>Safety Relief Valve Out of Service</b>   |
| <b>TBVOOS</b>    | <b>Turbine Bypass Valve(s) Out of Service – valves are not credited for fast opening or for normal pressure control</b> |
| <b>TCV</b>       | <b>Turbine Control Valve</b>  |
| <b>TCVFASOOS</b> | <b>Turbine Control Valve Fast Acting Solenoid Out of Service</b>  |
| <b>TSV</b>       | <b>Turbine Stop Valve</b>   |



## **2.0 General Information**

This report is prepared in accordance with Technical Specification 5.6.5 of Reference 1. Power and flow dependent limits and multipliers are listed for various power and flow levels. Linear interpolation is to be used to find intermediate values.

These values have been determined using NRC-approved methodologies presented in Section 10 and are established such that all applicable limits of the plant safety analysis are met.

The data presented in this report is valid for all licensed operating domains on the operating map, including:

- Maximum Extended Load Line Limit down to 99% of rated core flow during full power operation
- Increased Core Flow (ICF) up to 107% of rated core flow
- Final Feedwater Temperature Reduction (FFWTR) up to 50°F during cycle extension operation
- Feedwater Heater Out of Service (FWHOOS) up to 50°F feedwater temperature reduction at any time during the cycle prior to cycle extension.

Equipment out of service conditions are as defined in Section 1 and Section 9.

**3.0 MAPLHGR Limits**

**3.0 Technical Specification Reference:**

Sections 3.2.1 and 3.4.1.

**3.1 Description:**

Table 3-1 is used to determine the maximum average planar linear heat generation rate (MAPLHGR) limit for GE14C fuel. Table 3-2 is used to determine the maximum average planar linear heat generation rate (MAPLHGR) limit for GNF2 fuel. Limits listed in Table 3-1 and Table 3-2 are for dual reactor recirculation loop operation (DLO).

For single reactor recirculation loop operation (SLO), the MAPLHGR limits given in Table 3-1 and Table 3-2 must be multiplied by a SLO MAPLHGR multiplier provided in Table 3-3.

For Loss of 'FULL' Feedwater Heating ( $\pm 10$  °F outside design NORMAL temperature, meaning changes in feedwater temperature greater than 10 °F and less than or equal to 50 °F), the MAPLHGR limits given in Table 3-1 and 3-2 must be multiplied by a LHGR multiplier provided in Table 3-4. This multiplier accounts for potential feedwater riser flow asymmetries (Reference 7).

**Table 3-1**  
**MAPLHGR Versus Average Planar Exposure – GE14C<sup>1</sup>**  
 (Reference 3)

| Avg. Planar Exposure (GWd/ST) | MAPLHGR Limit (kW/ft) |
|-------------------------------|-----------------------|
| 0.00                          | 12.82                 |
| 19.13                         | 12.82                 |
| 57.61                         | 8.00                  |
| 63.50                         | 5.00                  |

**Table 3-2**  
**MAPLHGR Versus Average Planar Exposure – GNF2<sup>1</sup>**  
 (Reference 3)

| Avg. Planar Exposure (GWd/ST) | MAPLHGR Limit (kW/ft) |
|-------------------------------|-----------------------|
| 0.00                          | 13.78                 |
| 17.15                         | 13.78                 |
| 60.78                         | 6.87                  |
| 63.50                         | 5.50                  |

<sup>1</sup> Linear interpolation should be used for points not listed in the table.

**Table 3-3**  
**MAPLHGR Single Loop Operation (SLO) Multiplier**  
(Reference 3)

| Fuel Type      | MAPLHGR SLO Multiplier |
|----------------|------------------------|
| All Fuel Types | 0.760                  |

**Table 3-4**  
**MAPLHGR Multiplier for Loss of 'FULL' Feedwater Heating**  
(Reference 7)

| Fuel Type      | MAPLHGR Multiplier |
|----------------|--------------------|
| All Fuel Types | 0.990              |

## 4.0 MCPR Limits

### 4.0 Technical Specification Reference:

Sections 3.2.2, 3.4.1, and 3.7.6.

### 4.1 Description:

The various MCPR limits are described below.

#### 4.1.1 Manual Flow Control MCPR Limits

The Operating Limit MCPR (OLMCPR) is determined from either Section 4.1.1.1 or 4.1.1.2, whichever is greater at any given power and flow condition.

##### 4.1.1.1 Power-Dependent MCPR

For operation less than 33.3% core thermal power, the MCPR(P) as a function of core thermal power is determined from Table 4-2 or Table 4-3 depending on plant conditions.

For operation at greater than or equal to 33.3% core thermal power, the OLMCPR as a function of core thermal power is determined by multiplying the applicable rated condition OLMCPR limit shown in Table 4-1 by the applicable MCPR multiplier K(P) given in Table 4-2 or Table 4-3.

##### 4.1.1.2 Flow-Dependent MCPR

Tables 4-4 through 4-7 give the MCPR(F) as a function of flow based on the applicable plant condition. The limits for dual loop operation are listed in Tables 4-4 and 4-6. The limits for single loop operation are listed in Tables 4-5 and 4-7. The MCPR(F) determined from these tables is the flow dependent OLMCPR.

#### 4.1.2 Automatic Flow Control MCPR Limits

Automatic Flow Control MCPR Limits are not provided.

#### 4.1.3 Option A and Option B

Option A and Option B refer to use of scram speeds for establishing MCPR operating limits.

Option A scram speed is the BWR/6 Technical Specification scram speed. The Technical Specification scram speeds must be met to utilize the Option A MCPR limits. Reload analyses performed by GNF for Cycle 16 Option A MCPR limits utilized a 20% core average insertion time of 0.516 seconds (Reference 6).

To utilize the MCPR limits for the Option B scram speed, the cycle average scram insertion time for 20% insertion must satisfy equation 2 in Reference 5 Section 4. If the cycle average scram insertion time does not meet the Option B criteria, the appropriate MCPR value may be determined from a linear interpolation between the Option A and B limits as specified by equation 4 in Reference 5 Section 4.

#### 4.1.4 Recirculation Flow Control Valve Settings

Cycle 16 was analyzed with a maximum core flow runout of 109%; therefore the recirculation flow control valve must be set to maintain core flow less than 109% (92.105 Mlb/hr) for all runout events (Reference 3).

**Table 4-1**  
**Operating Limit Minimum Critical Power Ratio**  
 (References 3 and 11)

| <b>EOOS<br/>Combination</b>                    | <b>GNF2 Fuel<br/>Option A<br/>All Exposures</b> | <b>GE14C Fuel<br/>Option A<br/>All Exposures</b> | <b>GNF2 Fuel<br/>Option B<br/>All Exposures</b> | <b>GE14C Fuel<br/>Option B<br/>All Exposures</b> |
|--|---|--|---|--|
| Base Case DLO                                  | 1.40  | 1.35   | 1.30  | 1.30   |
| Base Case SLO <sup>1</sup>                     | 1.43  | 1.38   | 1.33  | 1.33   |
| PROOS/PLUOOS/<br>TCVFASOOS DLO                 | 1.40  | 1.37   | 1.36  | 1.37   |
| PROOS/PLUOOS/<br>TCVFASOOS<br>SLO <sup>1</sup> | 1.43  | 1.40   | 1.39  | 1.40   |
| Two or More<br>TBVOOS DLO                      | 1.44  | 1.40   | 1.35  | 1.32   |
| Two or More<br>TBVOOS SLO <sup>1</sup>         | 1.47  | 1.43   | 1.38  | 1.35   |

Notes for Table 4-1:

1. SLO Option A(B) OLMCPR is the transient DLO Option A(B) OLMCPR plus 0.03.

**Table 4-2**  
**Power Dependent MCPR Limits MCPR(P) and Multipliers K(P)<sup>1,2</sup>**  
 (Reference 3)

| EOOS Combination                                      | Core Flow (% of Rated) | Core Thermal Power (%) |      |       |       |       |       |       |       |       |
|---|------------------------|------------------------|------|-------|-------|-------|-------|-------|-------|-------|
|   |                        | 0.0                    | 21.6 | <33.3 | >33.3 | <43.3 | >43.3 | <70.0 | >70.0 | 100.0 |
|   |                        | MCPR(P)                |      |       | K(P)  |       |       |       |       |       |
| Base Case DLO<br>GNF2/GE14C<br>Option A/B             | ≤ 50                   | 2.31                   | 2.31 | 2.10  | 1.617 | 1.590 | 1.313 | 1.212 | 1.163 | 1.000 |
|   | > 50                   | 2.46                   | 2.46 | 2.17  |       |       |       |       |       |       |
| Base Case SLO<br>GNF2/GE14C<br>Option A/B             | ≤ 50                   | 2.34                   | 2.34 | 2.13  | 1.617 | 1.590 | 1.313 | 1.212 | 1.163 | 1.000 |
|   | > 50                   | 2.49                   | 2.49 | 2.20  |       |       |       |       |       |       |
| Two or More<br>TBVOOS DLO<br>GNF2/GE14C<br>Option A/B | ≤ 50                   | 2.31                   | 2.31 | 2.10  | 1.617 | 1.590 | 1.313 | 1.212 | 1.163 | 1.000 |
|   | > 50                   | 2.46                   | 2.46 | 2.17  |       |       |       |       |       |       |
| Two or More<br>TBVOOS SLO<br>GNF2/GE14C<br>Option A/B | ≤ 50                   | 2.34                   | 2.34 | 2.13  | 1.617 | 1.590 | 1.313 | 1.212 | 1.163 | 1.000 |
|   | > 50                   | 2.49                   | 2.49 | 2.20  |       |       |       |       |       |       |

Notes for Table 4-2:

1. Values are interpolated between relevant power levels.
2. Allowable EOOS conditions are listed in Section 9.0.

**Table 4-3**  
**PROOS/PLUOOS/TCVFASOOS Power Dependent MCPR Limits MCPR(P) and Multipliers K(P)<sup>1,2</sup>**  
 (Reference 3)

| EOOS Combination   | Core Flow (% of Rated) | Core Thermal Power (%) |      |       |       |       |       |       |       |       |
|--|------------------------|------------------------|------|-------|-------|-------|-------|-------|-------|-------|
|  |                        | 0.0                    | 21.6 | <33.3 | ≥33.3 | 43.3  | 60    | <85.0 | >85.0 | 100.0 |
|  |                        | MCPR(P)                |      |       | K(P)  |       |       |       |       |       |
| PROOS/PLUOOS/<br>TCVFASOOS DLO<br>GNF2/GE14C<br>Option A/B | ≤ 50                   | 2.31                   | 2.31 | 2.10  | 1.617 | 1.590 | 1.436 | 1.309 | 1.090 | 1.000 |
|  | > 50                   | 2.46                   | 2.46 | 2.17  |       |       |       |       |       |       |
| PROOS/PLUOOS/<br>TCVFASOOS SLO<br>GNF2/GE14C<br>Option A/B | ≤ 50                   | 2.34                   | 2.34 | 2.13  | 1.617 | 1.590 | 1.436 | 1.309 | 1.090 | 1.000 |
|  | > 50                   | 2.49                   | 2.49 | 2.20  |       |       |       |       |       |       |

Notes for Table 4-3:

1. Values are interpolated between relevant power levels.
2. Allowable EOOS conditions are listed in Section 9.0.



**Table 4-4**  
**Dual Loop Operation (DLO) Flow Dependent MCPR Limits MCPR(F) for Base Case or PROOS/PLUOOS/TCVFASOOS<sup>1</sup>**  
(Reference 3)

| Core Flow<br>(% rated) | MCPR(F) |
|------------------------|---------|
| 0.0                    | 1.88    |
| 25.0                   | 1.70    |
| 84.1                   | 1.27    |
| 109.0                  | 1.27    |

**Table 4-5**  
**Single Loop Operation (SLO) Flow Dependent MCPR Limits MCPR(F) for Base Case or PROOS/PLUOOS/TCVFASOOS<sup>1</sup>**  
(Reference 3)

| Core Flow<br>(% rated) | MCPR(F) |
|------------------------|---------|
| 0.0                    | 1.91    |
| 25.0                   | 1.73    |
| 84.1                   | 1.30    |
| 109.0                  | 1.30    |

<sup>1</sup> Linear interpolation should be used for points not listed in the table.

**Table 4-6**  
**Dual Loop Operation (DLO) Flow Dependent MCPR Limits MCPR(F) for Two or More TBVOOS<sup>1</sup>**  
(Reference 3)

| Core Flow<br>(% rated) | MCPR(F) |
|------------------------|---------|
| 0.0                    | 2.04    |
| 25.0                   | 1.85    |
| 100.0                  | 1.27    |
| 109.0                  | 1.27    |

**Table 4-7**  
**Single Loop Operation (SLO) Flow Dependent MCPR Limits MCPR(F) for Two or More TBVOOS<sup>1</sup>**  
(Reference 3)

| Core Flow<br>(% rated) | MCPR(F) |
|------------------------|---------|
| 0.0                    | 2.07    |
| 25.0                   | 1.88    |
| 100.0                  | 1.30    |
| 109.0                  | 1.30    |

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<sup>1</sup> Linear interpolation should be used for points not listed in the table.

## 5.0 Linear Heat Generation Rate Limits

### 5.1 Technical Specification Reference:

Section 3.2.3, 3.4.1, and 3.7.6.

### 5.2 Description:

The linear heat generation rate (LHGR) limit is the product of the exposure dependent LHGR limit (from Table 5-1 for UO<sub>2</sub> fuel rods and Table 5-2 for Gadolinia fuel rods) and the minimum of: the power dependent LHGR Factor, LHGRFAC(P), the flow dependent LHGR Factor, LHGRFAC(F), or the single loop operation (SLO) multiplication factor if applicable. The LHGRFAC(P) is determined from Table 5-3. The LHGRFAC(F) is determined from Tables 5-4 and 5-5, depending on plant conditions. The SLO multiplication factor can be found in Table 5-6. Tables 5-1 and 5-2 are the LHGR limit as a function of peak pellet exposure.

For Loss of 'FULL' Feedwater Heating ( $\pm 10$  °F outside design NORMAL temperature, meaning changes in feedwater temperature greater than 10 °F and less than or equal to 50 °F), LHGRFAC(P) is determined from Table 5-7 and LHGRFAC(F) is determined from Tables 5-8 and 5-9, depending on plant conditions. Concurrent operation with SLO and reduced feedwater heating has not been evaluated and thus is not a valid operating mode. (Reference 8)

**Table 5-1**  
**Linear Heat Generation Rate Limits for UO<sub>2</sub> Rods<sup>1</sup>**  
(References 4, 9, and 10)

| Fuel Type | LHGR Limit                    |
|-----------|-------------------------------|
| GNF2      | See Table B-1 of Reference 9  |
| GE14C     | See Table D-2 of Reference 10 |

**Table 5-2**  
**Linear Heat Generation Rate Limits for Gad Rods<sup>1</sup>**  
(References 4, 9, and 10)

| Fuel Type | LHGR Limit                    |
|-----------|-------------------------------|
| GNF2      | See Table B-2 of Reference 9  |
| GE14C     | See Table D-4 of Reference 10 |

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<sup>1</sup> Linear interpolation should be used for points not listed in the table.

**Table 5-3**  
**Power Dependent LHGR Multiplier LHGRFAC(P)<sup>1</sup>**  
 (Reference 3)

| EOOS Combination               | Core Flow (% of Rated) | Core Thermal Power (%) |       |       |       |       |       |       |       |       |       |       |       |
|--------------------------------|------------------------|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                |                        | 0.0                    | 21.6  | <33.3 | ≥33.3 | 40.0  | 43.3  | <60.0 | ≥60.0 | <85.0 | ≥85.0 | 100.0 |       |
|                                |                        | LHGRFAC(P)             |       |       |       |       |       |       |       |       |       |       |       |
| Base Case DLO/SLO              | ≤ 50                   | 0.634                  | 0.634 | 0.689 | 0.651 | -     | 0.684 | -     | -     | -     | -     | -     | 1.000 |
|                                | > 50                   | 0.572                  | 0.572 | 0.600 |       | -     | -     | -     | -     | -     | -     | -     | -     |
| PROOS/PLUOOS/TCVFASOOS DLO/SLO | ≤ 50                   | 0.560                  | 0.560 | 0.560 | 0.560 | 0.560 | -     | 0.709 | 0.749 | 0.868 | 0.906 | 1.000 |       |
|                                | > 50                   | 0.560                  | 0.560 | 0.560 |       | -     | -     | -     | -     | -     | -     | -     | -     |
| Two or More TBVOOS DLO/SLO     | ≤ 50                   | 0.634                  | 0.634 | 0.689 | 0.651 | -     | 0.684 | -     | -     | -     | -     | -     | 1.000 |
|                                | > 50                   | 0.572                  | 0.572 | 0.600 |       | -     | -     | -     | -     | -     | -     | -     | -     |

Notes for Table 5-3:

1. Linear interpolation should be used for points not listed in the table.

**Table 5-4**  
**Flow Dependent LHGR Multiplier LHGRFAC(F) for Base Case or PROOS/PLUOOS/TCVFASOOS<sup>1</sup>**  
 (Reference 3)

| Core Flow<br>(% rated) | LHGRFAC(F) |
|------------------------|------------|
| 0.0                    | 0.442      |
| 25.0                   | 0.612      |
| 30.0                   | 0.646      |
| 82.2                   | 1.000      |
| 109.0                  | 1.000      |

**Table 5-5**  
**Flow Dependent LHGR Multiplier LHGRFAC(F) for Two or More TBVOOS<sup>1</sup>**  
 (Reference 3)

| Core Flow<br>(% rated) | LHGRFAC(F) |
|------------------------|------------|
| 0.0                    | 0.140      |
| 25.0                   | 0.365      |
| 30.0                   | 0.410      |
| 40.0                   | 0.500      |
| 50.0                   | 0.630      |
| 80.0                   | 0.860      |
| 98.3                   | 1.000      |
| 109.0                  | 1.000      |

**Table 5-6**  
**LHGR Single Loop Operation (SLO) Reduction Factor**  
 (Reference 3)

| Fuel Type      | LHGR SLO Multiplier |
|----------------|---------------------|
| All Fuel Types | 0.760               |

<sup>1</sup> Linear interpolation should be used for points not listed in the table.

**Table 5-7**  
**Power Dependent LHGR Multiplier LHGRFAC(P)**  
**(Loss of 'FULL' Feedwater Heating)<sup>1,2</sup>**  
 (Reference 3)

| EOOS Combination                  | Core Flow (% of Rated) | Core Thermal Power (%) |       |       |       |       |       |       |       |       |       |       |
|-----------------------------------|------------------------|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                                   |                        | 0.0                    | 21.6  | <33.3 | ≥33.3 | 40.0  | 43.3  | <60.0 | ≥60.0 | <85.0 | ≥85.0 | 100.0 |
|                                   |                        | LHGRFAC(P)             |       |       |       |       |       |       |       |       |       |       |
| Base Case DLO                     | ≤ 50                   | 0.628                  | 0.628 | 0.682 | 0.644 | -     | 0.677 | -     | -     | -     | -     | 0.990 |
|                                   | > 50                   | 0.566                  | 0.566 | 0.594 |       | -     | -     | -     | -     | -     | -     | -     |
| PROOS/PLUOOS/<br>TCVFASOOS<br>DLO | ≤ 50                   | 0.554                  | 0.554 | 0.554 | 0.554 | 0.554 | -     | 0.702 | 0.742 | 0.859 | 0.897 | 0.990 |
|                                   | > 50                   | 0.554                  | 0.554 | 0.554 |       | -     | -     | -     | -     | -     | -     | -     |
| Two or More<br>TBVOOS DLO         | ≤ 50                   | 0.628                  | 0.628 | 0.682 | 0.644 | -     | 0.677 | -     | -     | -     | -     | 0.990 |
|                                   | > 50                   | 0.566                  | 0.566 | 0.594 |       | -     | -     | -     | -     | -     | -     | -     |

Notes for Table 5-7:

1. Linear interpolation should be used for points not listed in the table.
2. Concurrent operation with SLO and reduced feedwater heating has not been evaluated and thus is not a valid operating mode (Reference 8).

**Table 5-8**  
**Flow Dependent LHGR Multiplier LHGRFAC(F) for Base Case or PROOS/PLUOOS/TCVFASOOS**  
**(Loss of 'FULL' Feedwater Heating)<sup>1</sup>**  
(Reference 3)

| Core Flow<br>(% rated) | LHGRFAC(F) |
|------------------------|------------|
| 0.0                    | 0.438      |
| 25.0                   | 0.606      |
| 30.0                   | 0.640      |
| 82.2                   | 0.990      |
| 109.0                  | 0.990      |

**Table 5-9**  
**Flow Dependent LHGR Multiplier LHGRFAC(F) for Two or More TBVOOS**  
**(Loss of 'FULL' Feedwater Heating)<sup>1</sup>**  
(Reference 3)

| Core Flow<br>(% rated) | LHGRFAC(F) |
|------------------------|------------|
| 0.0                    | 0.139      |
| 25.0                   | 0.361      |
| 30.0                   | 0.406      |
| 40.0                   | 0.495      |
| 50.0                   | 0.624      |
| 80.0                   | 0.851      |
| 98.3                   | 0.990      |
| 109.0                  | 0.990      |

<sup>1</sup> Linear interpolation should be used for points not listed in the table.



**6.0 Reactor Protection System (RPS) Instrumentation**

6.1 Technical Specification Reference:

Section 3.3.1.1

6.2 Description:

The Average Power Range Monitor (APRM) flow biased simulated thermal power-high time constant, shall be between 5.4 seconds and 6.6 seconds (Reference 6).

**7.0 Turbine Bypass System Parameters**

7.1 Technical Specification Reference:

Section 3.7.6

7.2 Description:

The operability requirements for the Main Turbine Bypass System are governed by Technical Specification 3.7.6. If the requirements of LCO 3.7.6 cannot be met, the appropriate reactor thermal power, minimum critical power ratio (MCPR), and linear heat generation rate (LHGR) limits must be used to comply with the assumptions in the design basis transient analysis.

Table 7-1 provides the reactor thermal power limitations for an inoperable Main Turbine Bypass System as specified in Technical Specification 3.7.6 action statement A.1. The MCPR and LHGR limits for one TBVOOS are included in the Base Case, as identified in Table 9-1. The MCPR and LHGR limits for two or more TBVOOS are provided in Sections 4 and 5.

**Table 7-1**  
**Reactor Power Limitation – Turbine Bypass Valves Out of Service**  
 (References 2, 3, and 12)

| Turbine Bypass System Status                     | Maximum Reactor Thermal Power (% Rated) |
|--|---|
| One Turbine Bypass Valve Out of Service          | 100.0                                   |
| Two or More Turbine Bypass Valves Out of Service | 90.0                                    |

## 8.0 Stability Protection Setpoints

### 8.1 Technical Specification Reference:

Section 3.3.1.3

### 8.2 Description:

The OPRM Period Based Detection Algorithm (PBDA) Trip Setpoints for the OPRM System for use in Technical Specification 3.3.1.3 are found in Table 8-1. These values are based on the cycle specific analysis documented in Reference 3.

Stability-based OLMCPR is non-limiting for either PBDA setpoint in Table 8-1. The higher PBDA setpoint provides greater margin to spurious scram.

**Table 8-1**  
**OPRM PBDA Trip Setpoints**  
**(Valid for All Conditions)**  
(Reference 3)

| PBDA Trip Amplitude | Corresponding Maximum Confirmation Count Trip Setting |
|---------------------|---|
| 1.10                | 13  |
| 1.12                | 14  |

9.0 Modes of Operation

The Allowed Modes of Operation with combinations of Equipment Out-of-Service (EOOS) are as described below in Table 9-1:

**Table 9-1**  
**Modes of Operation**  
 (Reference 3)

| EOOS Options <sup>2</sup>                       | Operating Region |        |     |                    |           |
|---|------------------|--------|-----|--------------------|-----------|
|   | Standard         | MELLLA | ICF | FFWTR <sup>1</sup> | Coastdown |
| Base Case DLO <sup>3</sup>                      | Yes              | Yes    | Yes | Yes                | Yes       |
| Base Case SLO <sup>1,3</sup>                    | Yes              | No     | No  | No                 | Yes       |
| PROOS/PLUOOS/<br>TCVFASOOS DLO <sup>3,5</sup>   | Yes              | Yes    | Yes | Yes                | Yes       |
| PROOS/PLUOOS/<br>TCVFASOOS SLO <sup>1,3,5</sup> | Yes              | No     | No  | No                 | Yes       |
| Two or More TBVOOS DLO <sup>4</sup>             | Yes              | Yes    | Yes | Yes                | Yes       |
| Two or More TBVOOS SLO <sup>1,4</sup>           | Yes              | No     | No  | No                 | Yes       |

Notes:

1. Concurrent operation with SLO and Loss of 'FULL' Feedwater Heating ( $\pm 10$  °F outside design NORMAL temperature, meaning changes in feedwater temperature greater than 10 °F and less than or equal to 50 °F). MELLLA, ICF, or FFWTR has not been evaluated and thus is not a valid operating mode. (Reference 8)
2. A single Main Steam Isolation Valve (MSIV) out of service is supported at or below 75% power. (Reference 3)
3. Includes 2 SRVOOS, 1 ADSOOS, 1 TCV stuck closed, 1 TSV stuck closed, 1 TBVOOS, and up to a 50°F feedwater temperature reduction (FWTR includes feedwater heater OOS or final feedwater temperature reduction) at any point in cycle operation in Dual Loop mode.
4. Includes 2 SRVOOS, 1 ADSOOS, and up to a 50°F feedwater temperature reduction (FWTR includes feedwater heater OOS or final feedwater temperature reduction) at any point in cycle operation in Dual Loop mode.
5. Concurrent operation with any or all of PROOS + PLUOOS + TCVFASOOS is allowed.

## **10.0 Methodology**

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. Global Nuclear Fuel Document, "General Electric Standard Application for Reactor Fuel", NEDE-24011-P-A-21-US, May 2015 and U.S. Supplement NEDE-24011-P-A-21-US, May 2015.

## **11.0 References**

1. Nuclear Regulatory Commission, Technical Specifications for Clinton Power Station Unit 1, Docket No. 50-461, License No. NPF-62.
2. GE Hitachi Nuclear Energy Report, 0000-0086-4634-R2-P, "Clinton Power Station One Bypass Out of Service or Turbine Bypass System Out of Service Analysis – Final", July 2010.
3. Global Nuclear Fuel Document, 000N8865 Revision 2, "Supplemental Reload Licensing Report for Clinton Power Station Unit 1 Reload 15 Cycle 16, May 2015.
4. Global Nuclear Fuel Document, 000N8866 Revision 0, "Fuel Bundle Information Report for Clinton Power Station Unit 1 Reload 15 Cycle 16", March 2015.
5. General Electric Document, GE-NE-0000-0000-7456-01P, "Option B Scram Times For Clinton Power Station", February 2002.
6. Exelon Transmittal of Design Information, TODI ES1400025 Revision 0, "Clinton Unit 1 Cycle 16 Final Resolved OPL-3 Parameters", November 21, 2014.
7. GE Hitachi Nuclear Energy Letter, CFL-EXN-LH1-12-059, "Affirmation of the Clinton Power Station Unit 1 MAPLHGR Reduction for Feedwater Riser Flow Asymmetry", April 25, 2012.
8. General Electric Document, GE-NE-0000-0026-1857-R1, "Evaluation of Operation With Equipment Out-Of-Service for the Clinton Power Station", June 28, 2004.
9. Global Nuclear Fuel Document, NEDC-33270P, Rev. 5, "GNF2 Advantage Generic Compliance with NEDE-24011-PA (GESTAR-II)", May 2013.
10. Global Nuclear Fuel Document, NEDC-32868P, Rev. 5, "GE14 Compliance with Amendment 22 of NEDE-24011-P-A (GESTAR-II)", May 2013.
11. GE Hitachi Nuclear Energy Report, 0000-0157-4599-R0, "Evaluation of Loss of Stator Water Cooling for Clinton", March 2013.
12. Exelon Technical Evaluation, EC EVAL 399725, Rev. 1, "Determination of Conservative Clinton Power Station TCV Lift Curve and TBSOOS Power Level Restriction", May 2015.