Development of EAL Threshold values from NEE-323-CALC-001

Calculated values were added to the typical background readings of these monitors, and then rounded to aid in evaluator use of the EALs.

Resulting values used in the DAEC Fission Product Barrier chart are shown below:

- **Fuel Clad Barrier**:
  - Fuel Clad Barrier LOSS 4.A = Drywell Monitor (9184A/B) reading taken from NEE-323-CALC-006 (V30) instead
  - Fuel Clad Barrier LOSS 4.B = Torus Monitor (9185A/B) reading greater than 200 R/hr.

- **RCS Barrier**:
  - • RCS Barrier LOSS 4.A = Drywell Monitor (9184A/B) reading greater than 5 R/hr after reactor shutdown. (minimum serviceable threshold value accounting for scale of monitor)
  - • Calculated Torus Monitor (9185A/B) response is below scale of monitor and not used.

- **CTMT Barrier**:
  - • CTMT Barrier LOSS 4.A = Drywell Monitor (9184A/B) reading greater than 5000 R/hr.
  - • CTMT Barrier LOSS 4.A = Torus Monitor (9185A/B) reading greater than 500 R/hr.

ENERCON Excellence—Every project. Every day.	CALCULATION COVER SHEET	CALC NO. NEE-323-CALC-001
		REV. 00
		PAGE NO. 1 of 10

Title:	Primary Containment Radiation EAL Threshold Determination	**Client:** Duane Arnold Energy Center
		Project Identifier: NEE-323

Item	Cover Sheet Items	Yes	No
1	Does this calculation contain any open assumptions, including preliminary information, that require confirmation? (If **YES**, identify the assumptions.)	☐	☒
2	Does this calculation serve as an "Alternate Calculation"? (If **YES**, identify the design verified calculation.) **Design Verified Calculation No.** _____	☐	☒
3	Does this calculation supersede an existing Calculation? (If **YES**, identify the design verified calculation.) **Superseded Calculation No.** _____	☐	☒

Scope of Revision:
Initial Issue

Revision Impact on Results:
Initial Issue

Study Calculation ☐ **Final Calculation** ☒

Safety-Related ☐ **Non-Safety-Related** ☒

(Print Name and Sign)

Originator: Aaron Holloway	**Date:** **12/12/17**
Design Verifier[1] (Reviewer if NSR): Jay Bhatt	**Date:** **12/12/17**
Approver: Zachary Rose	**Date:** **12/12/17**

Note 1: For non-safety-related calculation, design verification can be substituted by review.

ENERCON Excellence—Every project. Every day.	CALCULATION REVISION STATUS SHEET	CALC NO. NEE-323-CALC-001
		REV. 00

CALCULATION REVISION STATUS

REVISION	DATE	DESCRIPTION
00	12/12/17	Initial Issue

PAGE REVISION STATUS

PAGE NO.	REVISION	PAGE NO.	REVISION
All	00		

APPENDIX/ATTACHMENT REVISION STATUS

APPENDIX NO.	NO. OF PAGES	REVISION NO.	ATTACHMENT NO.	NO. OF PAGES	REVISION NO.
A	1	00	1	4	00
B	1	00			

1.0 Purpose and Scope

The purpose of this calculation is to determine the site-specific threshold for primary containment radiation in the event of a loss or potential loss of the three fission product barriers (fuel clad, Reactor Coolant System, containment). These site-specific values can be used to determine the Emergency Action Level (EAL) (FA1, FS1, or FG1) in accordance with Table 9-F-2 of NEI 99-01, Rev. 6. This calculation is nonsafety-related as it intended for emergency classification and not design basis purposes. There are no acceptance criteria associated with this calculation since the purpose is only to determine site-specific radiation thresholds.

2.0 Summary of Results and Conclusions

The calculated primary containment radiation readings for each of the three fission product barriers are listed below. Note that the results presented below are calculated dose rates and do not account for background radiation or any installed detector check sources.

Table 1 - Calculated Containment Atmospheric Monitoring System (CAMS) radiation readings for a release into the drywell

Failure	Drywell Monitor (9184A/B) Reading (R/hr)
Reactor Coolant System (Loss)	1.33
Fuel Clad (Loss)	2000
Containment (Potential Loss)	5130

Table 2 - Calculated CAMS radiation readings for a release into the torus

Failure	Torus Monitor (9185A/B) Reading (R/hr)
Reactor Coolant System (Loss)	0.125 (not on scale)
Fuel Clad (Loss)	188
Containment (Potential Loss)	484

3.0 References

3.1 NG-88-0966, "Nuclear Generation Division Office Memo, G.E. Fuel Damage Documentation / Dose Rate Calculations", dated 03/18/88

3.2 IPOI 8, "Outage and Refueling Operations", Rev. 91

3.3 Bech-M115, "Reactor Vessel Instrumentation P&ID", Rev. 62

3.4 Duane Arnold Energy Center Facility Operating License Appendix A - Technical Specifications, as revised through Amendment No. 297

3.5 NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors", Rev. 6

3.6 Shultis, J.K., "Fundamentals of Nuclear Science and Engineering", 2002

3.7 Lindeburg, M.R., "Mechanical Engineering Reference Manual for the PE Exam", Twelfth Edition, 2006

3.8 Federal Guidance Report (FGR) 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion", 1989

3.9 I.RIM-V115-01, "Victoreen Model 876A Containment Radiation Monitor Calibration", Rev. 10

4.0 Assumptions

4.1 Reactor Pressure Vessel (RPV) water level is 535 inches above vessel zero for the purposes of calculating the total Reactor Coolant System (RCS) water volume. This corresponds to the middle of the band between the high and low RPV water level alarm points from Table 4 (Design Input 5.7) and represents the most realistic water inventory during normal operation.

4.2 The fission product isotopic distribution in the reactor coolant will be similar to that of the fission product gap inventory. This is reasonable since, in the event of a fuel cladding failure, the isotopes of concern (iodines) would be released to the reactor coolant at the same time and distribution.

4.3 All reactor coolant mass is assumed to be released into the primary containment. This is consistent with the NEI 99-01 Rev. 6 developer notes.

5.0 Design Inputs

5.1 Duane Arnold's license thermal power limit is 1912 MW_{th}, taken from Reference 3.4.

5.2 The specific volume of saturated liquid water at 1000 psia is 0.02160 ft^3/lb_m per Appendix 23.B of Reference 3.7.

5.3 The following unit conversions are used within this calculation:

Table 3 - Applicable Unit Conversions

Base Unit	Equivalent	Reference
1 Sievert (Sv)	1.0E5 mrem	3.6
1 Curie (Ci)	3.7E10 Bq	3.6
1 Gallon	3785.4 cubic centimeters (cc)	3.7
1 lb_m/ft^3	0.016018 g/cc	3.7

5.4 The Technical Specifications limit for RCS activity is 0.2 μCi/gm Dose Equivalent I-131 (DEI) per LCO 3.4.6 of Reference 3.4.

5.5 The RCS volume at the centerline of the Main Steam lines is 72,000 gallons per Reference 3.2.

5.6 The change in RCS volume per unit change in height is 100 gallons/inch per Reference 3.2.

5.7 The following elevations are taken from Reference 3.3:

Table 4 - Pertinent RPV elevations relative to Vessel 0

Point	Height above Vessel 0 (inches)
Nozzle N3A,B,C,D (centerline of Main Steam Lines)	620.5

Point	Height above Vessel 0 (inches)
High Level Alarm	539.5
Low Level Alarm	530.5

5.8 The drywell dose rate at the CAMS monitor location for 100% gap release into the drywell of a 1691 MW_{th} core at 0.01 hours decay time is 2.27E4 R/hr, per Table 3 of Reference 3.1.

5.9 The torus dose rate at the CAMS monitor location for 100% gap release into the torus of a 1691 MW_{th} core at 0.01 hours decay time is 2.14E3 R/hr, per Table 4 of Reference 3.1.

5.10 The drywell (9184 A/B) and torus (9185 A/B) radiation monitor ranges (1 to 10^7 R/hr) are taken from Reference 3.9.

5.11 The fission product gap inventories for Iodine isotopes are taken from Table 1 of Reference 3.1. These inventories correspond to a core with a rated thermal power of 1691 MW_{th}.

Table 5 - Iodine Gap Inventories for 1691 MW_{th} Core

Nuclide	1691 MW_{th} Gap Inventory (Ci)
I-130	7.25E+03
I-131	5.34E+05
I-132	8.45E+04
I-133	3.63E+05
I-134	8.19E+04
I-135	1.93E+05

5.12 Dose conversion factors for effective dose due to inhalation are taken from Reference 3.8, Table 2.1.

Table 6 - Dose Conversion Factors for Total Effective Dose from Inhalation

Nuclide	Dose Conversion Coefficient (Sv/Bq)
I-130	7.14E-10
I-131	8.89E-09
I-132	1.03E-10
I-133	1.58E-09
I-134	3.55E-11
I-135	3.32E-10

6.0 Methodology

The approach of this calculation is to scale the results of a previous calculation (NG-88-0966, Reference 3.1) based on the specific RCS activities as specified in NEI 99-01 Rev. 6. Scaling factors are determined for each of the fission product barrier failure thresholds specified in NEI 99-01 (i.e. Loss of RCS, Loss of Fuel Cladding, and Potential Loss of Primary Containment). The RCS activity concentrations are taken from the NEI 99-01 Rev. 6 developer notes and are listed below.

Table 7 - RCS Activities for fission product barrier failures

Failure	RCS Activity
Reactor Coolant System (Loss)	Technical Specification Limit
Fuel Clad (Loss)	300 μCi/g Dose Equivalent I-131
Containment (Potential Loss)	20% fuel cladding failure

These scaling factors are then applied to the CAMS radiation response from calculation NG-88-0966 to determine the site-specific values for the three thresholds. Additionally, the previous calculation determined the CAMS radiation monitor response for an assumed release of 100% gap activity from the core with a power level of 1691 MW_{th}. However, Duane Arnold's licensed power level is now 1912 MW_{th}. This does not impact the Reactor Coolant System and Fuel Clad barrier thresholds because the radiation responses are scaled based on the DEI levels. However, the difference in licensed power level will need to be accounted for in the Potential Loss of Containment threshold because this threshold is related to the total gap inventory. Scaling of the gap inventory based on power level is consistent with calculation NG-88-0966 as Table 1 of NG-88-0966 provides gap inventory per megawatt.

6.1 Determination of RCS water volume and mass

The NEI 99-01 Rev. 6 primary containment radiation thresholds are based on specific RCS radioactivity concentrations. However, the corresponding total RCS activity must be known in order to compare these thresholds to the gap release assumed in calculation NG-88-0966. Therefore, the total mass of water in the RCS must first be determined so that the total RCS activity can be calculated for each threshold.

The total RCS water volume at normal operation is determined by taking the RCS volume when filled to the centerline of the main steam lines, and then subtracting the difference in volume between the centerline of the main steam lines and the normal water level. This is presented in Equation 1 below:

$$V_{normal} = V_{MSL} - aH \qquad \text{[Equation 1]}$$

Where:

V_{normal} = The RCS water volume at normal operation (gallons)

V_{MSL} = The RCS water volume when filled to the centerline of the main steam lines (gallons)

a = The change in RCS water volume per inch change in vessel height (gallons/inch)

H = The distance between the centerline of the main steam lines and the normal RCS water level (inches)

It should be noted that calculating the RCS volume as shown above does not include the volume of the steam lines. However, the volume of the steam lines filled to the centerline of the nozzle is very small compared to the total RCS volume, and therefore does not significantly impact the results of the calculation.

The total mass of water in the RCS can then be determined based on the water density, as outlined in Equation 2 below:

$$M_{normal} = \frac{V_{normal}}{v} \quad \text{[Equation 2]}$$

Where:

M_{normal} = The mass of water in the RCS at normal operation (grams)

v = The specific volume of water at normal operation (grams/gallon)

6.2 Determination of Scaling Factors

The scaling factors for the fuel clad and RCS barrier thresholds are determined by comparing the corresponding dose at each RCS activity concentration to the DEI of the fission product gap inventory. This is presented in Equation 3 below:

$$F = \frac{DCF_{I-131}A_{I-131}M_{normal}}{\sum_{i=130}^{i=135} I_i DCF_i} \quad \text{[Equation 3]}$$

Where:

F = The scaling factor for a given RCS activity concentration threshold.

DCF_i= The dose conversion factor for isotope "i" in mrem/Ci. These values are developed from Table 6 above.

A_{I-131} = The I-131 concentration in the RCS for a given threshold in Ci/gram. These values are developed from Table 7 and Design Input 5.4 above.

M_{normal} = The mass of RCS water at normal operation in grams. This value is determined from Equation 2 above.

I_i = The gap inventory of iodine isotope "i" at a power level of 1691 MW_{th} in Ci. These values are taken from Table 5 above.

For the potential loss of containment threshold, NEI 99-01 specifies that 20% of fuel cladding has failed, rather than giving a specific RCS activity concentration. Therefore, the scaling factor for this case is simply 0.2 (20% of the 100% gap release case) multiplied by the ratio of the new to previous licensed power levels (1912/1691) to account for the increased gap inventory.

6.3 Determination of CAMS Detector Response

Once the scaling factors have been determined for each of the three RCS activity concentration thresholds, they can be applied to the results of calculation NG-88-0966 to determine the CAMS detector response for each threshold. Specifically, the CAMS detector response can be obtained from Equation 3 below:

$$D_j = F_j D_{GAP}$$ [Equation 3]

Where:

D_j = The dose rate at the CAMS detector for an RCS activity concentration of "j" in R/hr

F_j = The scaling factor for an RCS activity concentration of "j", determined from Equation 2 above

D_{GAP} = The dose rate at the CAMS monitor location for 100% gap release of a 1691 MWth core in R/hr

7.0 Calculation

All calculations were completed using Microsoft Excel. The calculation results and spreadsheet formulas are presented in Appendix A and B, respectively.

8.0 Impact Assessment

This calculation is based on "realistic" assumptions for the purpose of declaring EALs, rather than typical conservative "bounding" type design basis analyses. The calculation results are intended to provide order of magnitude dose rates to assist Operations and Emergency Response personnel in determining the state of the three fission product barriers in accordance with NEI 99-01 Rev. 6.

	A	B	C	D	E
1	1 Sievert	100000	mrem		
2	1 Ci	3.70E+10	Bq		
3					
4	Isotope	DCF (Sv/Bq)	DCF (mrem/Ci)	1691 MW Gap Inventory (Ci)	Dose (mrem)
5	I-130	7.14E-10	2.64E+06	7.25E+03	1.92E+10
6	I-131	8.89E-09	3.29E+07	5.34E+05	1.76E+13
7	I-132	1.03E-10	3.81E+05	8.45E+04	3.22E+10
8	I-133	1.58E-09	5.85E+06	3.63E+05	2.12E+12
9	I-134	3.55E-11	1.31E+05	8.19E+04	1.08E+10
10	I-135	3.32E-10	1.23E+06	1.93E+05	2.37E+11
11					
12				Total	2.00E+13
13	V_{MSL}	72000.0	gal		
14	a	100.0	gal/inch		
15	Elevation of the Main Steam Lines	620.5	inches above vessel 0		
16	Elevation of the Normal Water Level	535.0	inches above vessel 0		
17	H	85.5	inches		
18	V_{Normal}	63450	gal		
19	V_{Normal}	240184264.5	cc		
20	Specific Volume @ 1000 psia	0.0216	ft^3/lbm		
21	water density @ 1000 psia	0.7416	g/cc		
22	M_{Normal}	178114424	grams		
23					
24	Drywell Dose Rate for 100% Gap Release (1691 MWth)	2.27E+04	R/hr		
25	Torus Dose Rate for 100% Gap Release (1691 MWth)	2.14E+03	R/hr		
26					
27	**Threshold**	**Scaling Factors (F)**	**Drywell Dose Rate (R/hr)**	**Torus Dose Rate (R/hr)**	
28	**0.2 µCi/gm (TS Limit)**	**5.86E-05**	**1.33E+00**	**1.25E-01**	
29	**300 µCi/gm**	**8.79E-02**	**2.00E+03**	**1.88E+02**	
30	**20% Failed Fuel**	**2.26E-01**	**5.13E+03**	**4.84E+02**	

	A	B	C	D	E
1	1 Sievert	100000	mrem		
2	1 Ci	37000000000	Bq		
3					
4	Isotope	DCF (Sv/Bq)	DCF (mrem/Ci)	1691 MW Gap Inventory (Ci)	Dose (mrem)
5	I-130	0.000000000714	=B5*$B$1*$B$2	7250	=D5*C5
6	I-131	0.00000000889	=B6*$B$1*$B$2	534000	=D6*C6
7	I-132	0.000000000103	=B7*$B$1*$B$2	84500	=D7*C7
8	I-133	0.00000000158	=B8*$B$1*$B$2	363000	=D8*C8
9	I-134	0.0000000000355	=B9*$B$1*$B$2	81900	=D9*C9
10	I-135	0.000000000332	=B10*$B$1*$B$2	193000	=D10*C10
11					
12				Total	=SUM(E5:E10)
13	V_{MSL}	72000	gal		
14	a	100	gal/inch		
15	Elevation of the Main Steam Lines	620.5	inches above vessel 0		
16	Elevation of the Normal Water Level	535	inches above vessel 0		
17	H	=B15-B16	inches		
18	V_{Normal}	=B13-B14*B17	gal		
19	V_{Normal}	=B18*3785.41	cc		
20	Specific Volume @ 1000 psia	0.0216	ft^3/lbm		
21	water density @ 1000 psia	=0.016018/B20	g/cc		
22	M_{Normal}	=B19*B21	grams		
23					
24	Drywell Dose Rate for 100% Gap Release (1691 MWth)	22700	R/hr		
25	Torus Dose Rate for 100% Gap Release (1691 MWth)	2140	R/hr		
26					
27	**Threshold**	**Scaling Factors (F)**	**Drywell Dose Rate (R/hr)**	**Torus Dose Rate (R/hr)**	
28	**0.2 µCi/gm (TS Limit)**	**=$C$6*0.0000002*$B$22/($E$12)**	**=B28*$B$24**	**=B28*$B$25**	
29	**300 µCi/gm**	**=$C$6*0.0003*$B$22/($E$12)**	**=B29*$B$24**	**=B29*$B$25**	
30	**20% Failed Fuel**	**=0.2*1912/1691**	**=B30*$B$24**	**=B30*$B$25**	

CHECKLIST ITEMS[1]		YES	NO	N/A
GENERAL REQUIREMENTS				
1.	If the calculation is being performed to a client procedure, is the procedure being used the latest revision?	☐	☐	☒
The calculation is being prepared to ENERCON's procedures.				
2.	Are the proper forms being used and are they the latest revision?	☒	☐	☐
3.	Have the appropriate client review forms/checklists been completed?	☐	☐	☒
The calculation is being prepared to ENERCON's procedures.				
4.	Are all pages properly identified with a calculation number, calculation revision and page number consistent with the requirements of the client's procedure?	☒	☐	☐
5.	Is all information legible and reproducible?	☒	☐	☐
6.	Is the calculation presented in a logical and orderly manner?	☒	☐	☐
7.	Is there an existing calculation that should be revised or voided?	☐	☒	☐
This is a new calculation to support implementing NEI 99-01 Rev. 6				
8.	Is it possible to alter an existing calculation instead of preparing a new calculation for this situation?	☐	☒	☐
9.	If an existing calculation is being used for design inputs, are the key design inputs, assumptions and engineering judgments used in that calculation valid and do they apply to the calculation revision being performed.	☒	☐	☐
10.	Is the format of the calculation consistent with applicable procedures and expectations?	☒	☐	☐
11.	Were design input/output documents properly updated to reference this calculation?	☐	☐	☒
12.	Can the calculation logic, methodology and presentation be properly understood without referring back to the originator for clarification?	☒	☐	☐
OBJECTIVE AND SCOPE				
13.	Does the calculation provide a clear concise statement of the problem and objective of the calculation?	☒	☐	☐
14.	Does the calculation provide a clear statement of quality classification?	☒	☐	☐
15.	Is the reason for performing and the end use of the calculation understood?	☒	☐	☐
16.	Does the calculation provide the basis for information found in the plant's license basis?	☒	☐	☐
17.	If so, is this documented in the calculation?	☒	☐	☐
18.	Does the calculation provide the basis for information found in the plant's design basis documentation?	☐	☒	☐

CHECKLIST ITEMS[1]		YES	NO	N/A
19.	If so, is this documented in the calculation?	☐	☐	☒
20.	Does the calculation otherwise support information found in the plant's design basis documentation?	☐	☒	☐
21.	If so, is this documented in the calculation?	☐	☐	☒
22.	Has the appropriate design or license basis documentation been revised, or has the change notice or change request documents being prepared for submittal?	☐	☐	☒
DESIGN INPUTS				
23.	Are design inputs clearly identified?	☒	☐	☐
24.	Are design inputs retrievable or have they been added as attachments?	☒	☐	☐
25.	If Attachments are used as design inputs or assumptions are the Attachments traceable and verifiable?	☐	☐	☒
26.	Are design inputs clearly distinguished from assumptions?	☒	☐	☐
27.	Does the calculation rely on Attachments for design inputs or assumptions? If yes, are the attachments properly referenced in the calculation?	☐	☒	☐
28.	Are input sources (including industry codes and standards) appropriately selected and are they consistent with the quality classification and objective of the calculation?	☒	☐	☐
29.	Are input sources (including industry codes and standards) consistent with the plant's design and license basis?	☒	☐	☐
30.	If applicable, do design inputs adequately address actual plant conditions?	☒	☐	☐
31.	Are input values reasonable and correctly applied?	☒	☐	☐
32.	Are design input sources approved?	☒	☐	☐
33.	Does the calculation reference the latest revision of the design input source?	☒	☐	☐
34.	Were all applicable plant operating modes considered?	☒	☐	☐
ASSUMPTIONS				
35.	Are assumptions reasonable/appropriate to the objective?	☒	☐	☐
36.	Is adequate justification/basis for all assumptions provided?	☒	☐	☐
37.	Are any engineering judgments used?	☐	☒	☐
38.	Are engineering judgments clearly identified as such?	☐	☐	☒
39.	If engineering judgments are utilized as design inputs, are they reasonable and can they be quantified or substantiated by reference to site or industry standards, engineering principles, physical laws or other appropriate criteria?	☐	☐	☒

CHECKLIST ITEMS[1]		YES	NO	N/A
METHODOLOGY				
40.	Is the methodology used in the calculation described or implied in the plant's licensing basis?	☐	☒	☐
41.	If the methodology used differs from that described in the plant's licensing basis, has the appropriate license document change notice been initiated?	☐	☐	☒
42.	Is the methodology used consistent with the stated objective?	☒	☐	☐
43.	Is the methodology used appropriate when considering the quality classification of the calculation and intended use of the results?	☒	☐	☐
BODY OF CALCULATION				
44.	Are equations used in the calculation consistent with recognized engineering practice and the plant's design and license basis?	☒	☐	☐
45.	Is there reasonable justification provided for the use of equations not in common use?	☐	☐	☒
46.	Are the mathematical operations performed properly and documented in a logical fashion?	☒	☐	☐
47.	Is the math performed correctly?	☒	☐	☐
48.	Have adjustment factors, uncertainties and empirical correlations used in the analysis been correctly applied?	☒	☐	☐
49.	Has proper consideration been given to results that may be overly sensitive to very small changes in input?	☒	☐	☐
SOFTWARE/COMPUTER CODES				
50.	Are computer codes or software languages used in the preparation of the calculation?	☐	☒	☐
51.	Have the requirements of CSP 3.09 for use of computer codes or software languages, including verification of accuracy and applicability been met?	☐	☐	☒
52.	Are the codes properly identified along with source vendor, organization, and revision level?	☐	☐	☒
53.	Is the computer code applicable for the analysis being performed?	☐	☐	☒
54.	If applicable, does the computer model adequately consider actual plant conditions?	☐	☐	☒
55.	Are the inputs to the computer code clearly identified and consistent with the inputs and assumptions documented in the calculation?	☐	☐	☒
56.	Is the computer output clearly identified?	☐	☐	☒
57.	Does the computer output clearly identify the appropriate units?	☐	☐	☒

CHECKLIST ITEMS[1]		YES	NO	N/A
58.	Are the computer outputs reasonable when compared to the inputs and what was expected?	☐	☐	☒
59.	Was the computer output reviewed for ERROR or WARNING messages that could invalidate the results?	☐	☐	☒
RESULTS AND CONCLUSIONS				
60.	Is adequate acceptance criteria specified?	☒	☐	☐
61.	Are the stated acceptance criteria consistent with the purpose of the calculation, and intended use?	☒	☐	☐
62.	Are the stated acceptance criteria consistent with the plant's design basis, applicable licensing commitments and industry codes, and standards?	☒	☐	☐
63.	Do the calculation results and conclusions meet the stated acceptance criteria?	☒	☐	☐
64.	Are the results represented in the proper units with an appropriate tolerance, if applicable?	☒	☐	☐
65.	Are the calculation results and conclusions reasonable when considered against the stated inputs and objectives?	☒	☐	☐
66.	Is sufficient conservatism applied to the outputs and conclusions?	☒	☐	☐
67.	Do the calculation results and conclusions affect any other calculations?	☐	☒	☐
68.	If so, have the affected calculations been revised?	☐	☐	☒
69.	Does the calculation contain any conceptual, unconfirmed or open assumptions requiring later confirmation?	☐	☒	☐
70.	If so, are they properly identified?	☐	☐	☒
DESIGN REVIEW				
71.	Have alternate calculation methods been used to verify calculation results?	☐	☐	☒
No, a Design Review was performed.				

Note:

1. Where required, provide clarification/justification for answers to the questions in the space provided below each question. An explanation is required for any questions answered as "No' or "N/A".

Originator: Aaron Holloway 12/12/17

Print Name and Sign Date