002 – PM-1056 Rev 0 pH

Exelon Nuclear

ATTACHMENT 1
Design Analysis Cover Sheet

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Analysis No.	PM-1056	**Revision**	0
EC/ECR No.	PB 02-00838	**Revision**	0
Title:	Suppresion Pool pH Calculation for Alternative Source Terms		

		Component(s)	
Station(s)	Peach Bottom Atomic Power Station		
Unit No.:	2 and 3	N/A	
Discipline	SEAQ		
Description Code/ Keyword	LOCA		
Safety Class	S		
System Code	912		
Structure	N/A		

CONTROLLED DOCUMENT REFERENCES

Document No.	From/To	Document No.	From/To
PBAPS Tech. Spec. Bases B 3.6.2.2, Rev. 0	From		

Is this Design Analysis Safeguards?	Yes ☐	No ☒	
Does this Design Analysis Contain Unverified Assumptions?	Yes ☐	No ☒	ATI/AR#
Is a Supplemental Review Required?	Yes ☐	No ☒	If yes, complete Attachment 3

	Print Name	Sign Name	Date
Preparer	Lowell Yemin	P. Reubert for Lowell Yemin	3/20/2003
Reviewer	Harold Rothstein	Harold Rothstein	3/20/2003

Method of Review ☒ Detailed Review ☐ Alternate Calculations ☐ Testing

Review Notes:

	Print Name	Sign Name	Date
Approver	Harold Rothstein	Harold Rothstein	3/20/2003
(For External Analyses Only) Exelon Reviewer	Thomas J. Mscisz	[signature]	3/21/03
Approver	James Jordan	[signature]	3/28/03

Description of Revision (list affected pages for partials):

THIS DESIGN ANALYSIS SUPERCEDES: N/A

TABLE OF CONTENTS

1. Purpose and Objective

In order to prevent iodine re-evolution following an accident, the pH of the Suppression Pool should be maintained above 7.0. The chemistry of this phenomenon and methods of pH control are discussed in References 5.1 and 5.5.

The Objective of this calculation is to determine the pH of the Suppression Pool following a Loss of Coolant Accident based on the use of Alternative Source Terms as defined in References 5.4 and 5.6. The pH values are determined, as a function of time, with and without the addition of the sodium pentaborate in the Standby Liquid Control System. The conditions required to maintain the Suppression Pool at a pH above 7.0 are determined.

2. Methodology and Acceptance Criteria

This calculation is based on the methodology developed for the equivalent calculation done for the Grand Gulf Nuclear Station, Unit 1 as revised December 2000. [Ref. 5.1 & 5.2]. The calculation formulas developed in these documents are accepted without independent verification. These references are included in this calculation as Attachments F and G. The accuracy of translation of the equations in these documents into spreadsheet cell formulas is verified by duplicating the Grand Gulf calculation. This verification is presented as Attachment E and accurately duplicates all of the Grand Gulf results.

As noted in this calculation, injection of sodium pentaborate solution by the Standby Liquid Control System is a required function in order to control post-LOCA pH in the suppression pool, and prevent iodine re-evolution. Based on the worst case beginning of cycle condition, injection should be completed within about 30 hours after the start of the DBA-LOCA. Therefore, manual initiation is acceptable. Manual initiation of SBLCS is expected early in a DBA-LOCA as a result of emergency operating procedures and severe accident guidelines, particularly for events resulting in fuel damage that would be consistent with AST source terms.

Acceptance Criteria: Per the guidance of Appendix A of Regulatory Guide 1.183 [Ref. 5.6], the Suppression Pool pH should be controlled at values of 7 or greater following loss of coolant accidents.

3. Assumptions/Engineering Judgements

- The Suppression Pool is assumed to be well mixed so that the pH at any time can be represented by a single value.
- For cable parameters, the cable data presented in Attachment A is used. It includes the exposed termination length of what is in a raceway. As a conservative estimate of the cable lengths in free air, an additional 5% of the raceway's totals are assumed to be in free air. A 10% contingency on the cable surface, reported in Attachment A, is also included. Radiolysis of surface coatings on the steel and concrete surfaces in the Drywell and Containment would not be significant contributors, since the coatings utilize non-chlorinated polymers.

4. Design Input

Cable Data

Cable lengths, diameters, and average jacket thickness are developed separately and presented in Attachment A.

Temperature

Suppression Pool temperatures are taken from UFSAR, Rev.15 Figure 14.6.12A. Since this revised curve extends only to 14 hours, the older UFSAR, Rev 14 curve, Figure 14.6-12 was used to extend the data to 278 hours and extrapolate to 720 hours. The older curve gives slightly lower temperatures in the area of overlap and is therefore conservative (Lower temperatures give higher calculated pH values).

Extrapolation of the semilog plot is acceptable since the calculated pH is rather insensitive to temperature. At 30 days (720 hours) it requires a 36 F° increase to reduce the pH by 0.1.

Sodium Pentaborate mass in SBLC Tank

Per Technical Specification SR 3.1.7.7, the minimum B-10 stored in the SBLC tank is 162.7 lbs. In order to prepare this calculation, total boron is needed. The highest vendor supplied enrichment from Reference 5.7, included as attachment H, is 63.5 atom % B-10. For this calculation, 65 atom % B-10 enrichment is assumed. Since B-10 has an atomic weight of 10.01, this gives 7373 gram-atoms of B-10 and 11,342 gram atoms of total boron. Since the formula of Sodium Pentaborate is $Na_2B_{10}O_{16}X10H_2O$, there are 1134 gram-mols of the pentaborate in the SBLC Tank. This calculation is performed on the pH calculation spread sheet at the top of columns U –Y.

Suppression Pool Volume

The limiting Tech. Spec. volume [Ref.5.8] is 122,900 cu. ft. from Tech. Spec. Bases B3.6.2.2.

5. References

5.1 GGNS-98-0039, Rev. 3, "Entergy Operations Engineering Report for Suppression Pool pH and Iodine Re-Evolution Methodology", Applicable Site: Grand Gulf Nuclear Station, 12/20/00

5.2 XC-Q1111-98013, Rev. 2, Grand Gulf Design Engineering Calculation "Suppression Pool pH Analysis", 12/20/00

5.3 PBAPS UFSAR Figure 14.6.12 (Rev. 14) "LOCA – Suppression Pool Temperature Response" and Figure 14.6.12A (Rev. 15), "Long Term Suppression Pool Temperature Response – Normal ECCS Flows"

5.4 NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants", February 1995

5.5 NUREG/CR-5950, "Iodine Evolution and pH Control", December 1992

5.6 USNRC Regulatory Guide 1.183, "Alternative Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", July 2000

5.7 E-mail Memo, Mark G. Fry, Chemistry Manager-PBAPS, Exelon to Harold Rothstein WGI, "PBAPS Standby Liquid Control (SBLC) Data" (Transmission of Eagle Picher Technologies Boron-10 analysis and logs of Units 2 and 3 plant logs of pounds mass of Boron-10 in SBLC Tank), December 27, 2002 (Attachment H)

5.8 Peach Bottom Technical Specification Bases B 3.6.2.2, Rev. 0 Containment Systems – Suppression Pool Water Level (Minimum volume).

5.9 Not used

5.10 GE Report NEDC-32963A, "Prediction of the Onset of fission Gas Release From Fuel in Generic BWR", March 2000 (Allows a 121-second delay in timing of fission product release following design basis accidents)

5.11 Not used

5.12 Radioactive Decay Data Tables by David C. Kocher, Report DOE/TIC-11026 Technical Information Center U.S. DOE, Washington, D.C., 1981

6. Calculations

pH - Fundamental Relationships

$pH = -\log_{10}[H^+]$ 6-1

$[H^+]\cdot[OH^-] = K_W(T)$ 6-2

where:

$[H^+]$ = concentration of hydrogen ions in moles/liter
$[OH^-]$ = concentration of hydroxyl ions in moles/liter
$K_W(T)$ = ionization constant for water as a function of temperature T

The data for K_W for T between 77 and 212 °F can be represented by the following correlation developed in Section 3.0 of Reference 5.1:

$-\mathrm{Log}_{10}K_W(T) = 15.5129 - 2.24E\text{-}2 * T + 3.352E\text{-}5 * T^2$ **6-3**

Hydriodic Acid Production

Iodine, accompanied by Cesium, is released during the Gap Release and Early In-Vessel Release phases.

The following equation, valid during the Early Vessel Release Phase, includes the release during the Gap Release Phase. See analysis in Reference 5.1 (Section 3.1 and Equation 3-1d).

Iodine and cesium core inventories are calculated for both beginning and end of cycle (BOC and EOC) conditions (See Attachment B for a discussion of the assumed BOC conditions). Since EOC conditions result in increased inventory of both acidic (iodine) and basic (cesium) compounds, pH values are calculated for both conditions. For conservatism, the EOC radiation doses are used for the BOC calculation.

The hydriodic acid concentration is governed by the following equation:

$[HI](t) = m_I / (120 * V_{POOL}) * [t - (0.5 + t_{gap})] + m_I / (400 * V_{POOL})$ 6-4

where:

$[HI](t)$ = concentration of Hydriodic Acid at time t (moles/liter)
m_I = core iodine inventory (gram-moles)
V_{POOL} = Suppression Pool volume (liters)
t = time after start of accident (hrs) (includes t_{gap} + Gap Release [0.5 hrs] + Early In-Vessel Release [1.5 hrs] durations for a t_{max} = 2.0336 hrs) [Ref.5.6, Table 4, page 1.183-15]
t_{gap} = time of onset of gap release = 121 seconds = 0.0336 hrs [Ref. 5.6]
t_{max} = 2.0336 hrs = end of Early In-Vessel Release

[See Spreadsheet: Sheets 1 (EOC) and 5 (BOC), Col H]

Nitric Acid Production

Nitric Acid is produced by radiolysis of the water in the Suppression Pool with a G value of 0.007 molecules HNO_3 / 100 eV absorbed dose or 7.3E-6 g moles / megarad- liter [Ref. 5.1, Section 3.2, Equation 3-2b].

The nitric acid concentration is governed by the following equation:

$$[HNO_3](t) = 7.3E\text{-}6 * D(t)_{pool} \qquad 6\text{-}5$$

[See Spreadsheet Col. I]

where:

$[HNO_3](t)$ = nitric acid concentration at time t (moles/liter)
$D(t)_{pool}$ = Total accumulated dose in Suppression Pool at time t (megarad)

Hydrochloric Acid Production

Hydrochloric Acid is produced by radiolysis of chlorinated polymer cable jacketing. Radiolysis of surface coatings on the steel and concrete surfaces in the Drywell and Containment would not be significant contributors, since the coatings utilize nonchlorinated polymers.

The calculation of the resulting concentration in the Suppression Pool is based on the equations in Section 3.3 of Reference 5.1 [see Ref. 5.2, Equations 5-1, 5-2, and 5-3]. These equations are in turn based on the following G value for HCl production in Hypalon chlorinated polymer given in Reference 5.5.

G_{HCl} = 2.115 molecules/100eV = 3.512E-20 g moles HCl / MeV

The hydrochloric acid concentration is governed by the following equations:

Doses from beta and gamma radiation are calculated separately.

$$[HCl]_\beta(t) = G_{HCl} / V_{POOL} * (S_{tray} / 2 + S_{fa}) / \mu_{\beta\ air} * D_\beta(t) \quad 6\text{-}6$$

where the effective cable surface area for β dose is:

$$S_{tray} / 2 + S_{fa} = \pi * D_0 * (L_{tray} / 2 + L_{fa})$$

[See Spreadsheet Cols J & L]

$$[HCl]_\gamma(t) = G_{HCl} / V_{POOL} * (S_{tray} + S_{fa}) * (1\text{-} e^{\mu\lambda\ air * r\lambda}) / \mu_{\gamma\ air}$$

$$* (1 - e^{-\mu\lambda\ hypalon * th}) * D_\gamma(t) \qquad 6\text{-}7$$

where: $S_{tray} + S_{fa} = \pi * D_0 * (L_{tray} + L_{fa})$

[See Spreadsheet Cols K & M]

where:

$[HCl]_\beta(t)$ = HCl concentration from Beta radiation at time t (g moles/liter)
$[HCl]_\gamma(t)$ = HCl concentration from Gamma radiation at time t (g moles/liter)
D_0 = cable diameter (cm)
L_{tray} = cable length in trays (raceways) (cm)
L_{fa} = cable length in free air (cm)
$\mu_{\beta\ air}$ = linear beta absorption coefficient in air (1/cm)
$\mu_{\lambda\ air}$ = linear gamma absorption coefficient in air (1/cm)
r_λ = gamma free path (cm)
$\mu_{\lambda\ hypalon}$ = linear gamma absorption coefficient in Hypalon (1/cm)
th = Hypalon jacket thickness (cm)

$D_\beta(t)$ = accumulated beta dose per unit volume at time t (MeV/cm^3)
$D_\gamma(t)$ = accumulated gamma dose per unit volume at time t (MeV/cm^3)
G_{HCl} = 3.512E-20 (g moles HCl / MeV)
V_{POOL} = Suppression Pool volume (Liters)
S_{tray} = Cable surface area in trays (cm^2)
S_{fa} = Cable surface area in free air (cm^2)

Cesium Hydroxide Production

Cesium, accompanied by Iodine, is released during the Gap Release and Early In-Vessel Release phases. The following equation, valid during the Early Vessel Release Phase, includes the release during the Gap Release Phase. See analysis in Reference 5.1 (Section 3.4 and Equation 3-4d).

Iodine and cesium core inventories are calculated for both beginning and end of cycle (BOC and EOC) conditions (See Attachment B for a discussion of the assumed conditions). Since EOC conditions result in increased inventory of both acidic (iodine) and basic (cesium) compounds, pH values are calculated for both conditions. For conservatism, the EOC radiation doses are used for the BOC calculation.

The cesium hydroxide concentration is governed by the following equation:

$$[CsOH](t) = (0.4 * m_{Cs} - 0.475 * m_I) / 3 * V_{POOL}) * [t - (0.5 + t_{gap})] + (0.05 * m_{Cs} - 0.0475 * m_I) / V_{POOL} \qquad 6\text{-}8$$

[See Spreadsheet: *Sheets 1 (EOC) and 5 (BOC), Col O]*

$[CsOH](t)$ = concentration of Cesium Hydroxide at time t (g moles/liter)
m_I = core Iodine inventory (gram-moles)
m_{Cs} - core Cesium inventory (gram-moles)
V_{POOL} = *Suppression Pool volume (liters)*
t = time after start of accident (hrs) (includes t_{gap} + Gap Release [0.5 hrs] + Early In-Vessel Release [1.5 hrs] durations for a t_{max} = 2.0336 hrs) [Ref. 5.6, Table 4, page 1.183-15]
t_{gap} = time of onset of gap release = 121 seconds = 0.0336 hrs [Ref. 5.6]
t_{max} = 2.0336 hrs = end of Early In-Vessel Release

Final Pool pH Calculation (No SBLC Addition)

The net Suppression Pool pH can be calculated from the total of the $[H^+]$ and $[OH^-]$ concentrations using the following equations developed in Reference 5.1, Section 3.5.

$[H^+](t) = [H^+](t=0) + [HI](t) + [HNO_3](t) + [HCl](t)$

$$[H^+](t) = 10^{-pH}(t=0) + [HI](t) + [HNO_3](t) + [HCl](t) \qquad 6\text{-}9$$

[See Spreadsheet Col N]

$[OH^-](t) = [OH^-](t=0) + [CsOH](t)$

$$[OH^-](t) = 10^{-14}/10^{-pH}(t=0) + [CsOH](t) \qquad 6\text{-}10$$

[See Spreadsheet Col P]

Accounting for the concentration of neutralized ions [x]:

$([H^+] - [x]) * ([OH^-] - [x]) = K_W(T)$

$$[x] = \{ [H^+] + [OH^-] - \{([H^+]+[OH^-])^2 - 4*([H^+]*[OH^-]-K_W)\}^{1/2} \} / 2 \qquad 6\text{-}11$$

[See Spreadsheet Col R]

note: $K_W = 10^{-(-\text{Log } Kw)}$ [See Equation 6-3 and Spreadsheet Col Q]

The equation for the net $[H^+]$ becomes

$$[H^+]_{net} = [H^+] - [x] \qquad 6\text{-}12$$

[See Spreadsheet Col S]

and

$$pH = -\log_{10}([H^+]_{net}) \qquad 6\text{-}13$$

[See Spreadsheet Col T]

Effect of Sodium Pentaborate (SBLC) Addition

The pH of the suppression Pool can be increased by the addition of Sodium Pentaborate from the Standby Liquid Control (SBLC) System.

The limiting value (minimum weight) from Reference 5.7 is 210.6 lbs, but for conservative the more limiting value from Technical Specification SR 3.1.7.7 of 162.7 lbs is used. The limiting value is used since it minimizes the *number of moles available for buffering.*

Addition of Sodium Pentaborate introduces a buffer into the Suppression Pool which will maintain the pool at a pH corresponding to the following equation: [Ref. 5.1, Sec. 6.1, p. 21].

$pH = pK_a + \log_{10}\left([anion] / [acid] \right)$ 6-14

with data for K_a fitted by the equation

$K_a = (0.0585 * T + 1.309)E\text{-}10$ 6-15

[See Spreadsheet Col U]

where:
K_a = boric acid dissociation constant
pK_a = negative of the log of the boric acid dissociation constant [See Spreadsheet Col Z]
T = °F
[anion] = borate concentration of $[2B(OH)_4^-]$
[acid] = boric acid concentration of $[8H_3BO_3]$

based on the equation

$Na_2B_{10}O_{16} + 16H_2O \leftrightarrow 2Na^+ + 2B(OH)_4^- + 8H_3BO_3$

Therefore,
Borate (g-equivalents) = 2 * $Na_2B_{10}O_{16} \bullet 10\ H_20$ (g-moles)

Boric acid (g-equivalents) = 8 * $Na_2B_{10}O_{16} \bullet 10\ H_20$ (g-moles)

Using the methodology of Reference 5.1, the net strong acid equivalents $[H^+]_{net}$ calculated in Equation 5-12 are neutralized by the borate and the above equations become:

Borate (g-equivalents) = 2 * $Na_2B_{10}O_{16}$ (g-moles) – $[H^+]_{net} * V_{pool}$ 6-16

[See Spreadsheet Col X]

Boric acid (g-equivalents) = 8 * $Na_2B_{10}O_{16}$ (g-moles) + $[H^+]_{net} * V_{pool}$ 6-17

[See Spreadsheet Col Y]

And equation 6-14 becomes:

$$pH = -\log_{10}K_a + \log_{10} \frac{\left(2 * Na_2B_{10}O_{16}\,(\text{g-moles}) - [H^+]_{net} * V_{pool}\right) / V_{pool}}{(8 * Na_2B_{10}O_{16}\,(\text{g-moles}) + [H^+]_{net} * V_{pool}) / V_{pool}}$$

6-18

[See Spreadsheet Col AA]

7. *Summary of Results and Conclusions*

The post accident Suppression Pool pH is calculated as a function of time after accident initiation. The results are shown below in Figures 7-1 and 7-2 for Beginning of Cycle (BOC) and End of Cycle (EOC) conditions respectively. These graphs are based on Excel spreadsheet calculations presented in Attachment C (Sheets 1 and 5). The inputs to the pH calculation of radiation doses and the Iodine and Cesium inventories are presented in Attachment B.

The BOC (actually early cycle) condition produces the lowest pH and is therefore the limiting case.

Without addition of sodium pentaborate from the Standby Liquid Control (SBLC) System, the pH in the Suppression Pool could drop below pH 7 after 30 hours, reaching pH 3.5 at 30 days. Therefore, SBLC addition is required to prevent iodine re-evolution.

With timely SBLC addition, the Suppression Pool remains above pH 8 at 30 days (720 hours).

Figure 7-1

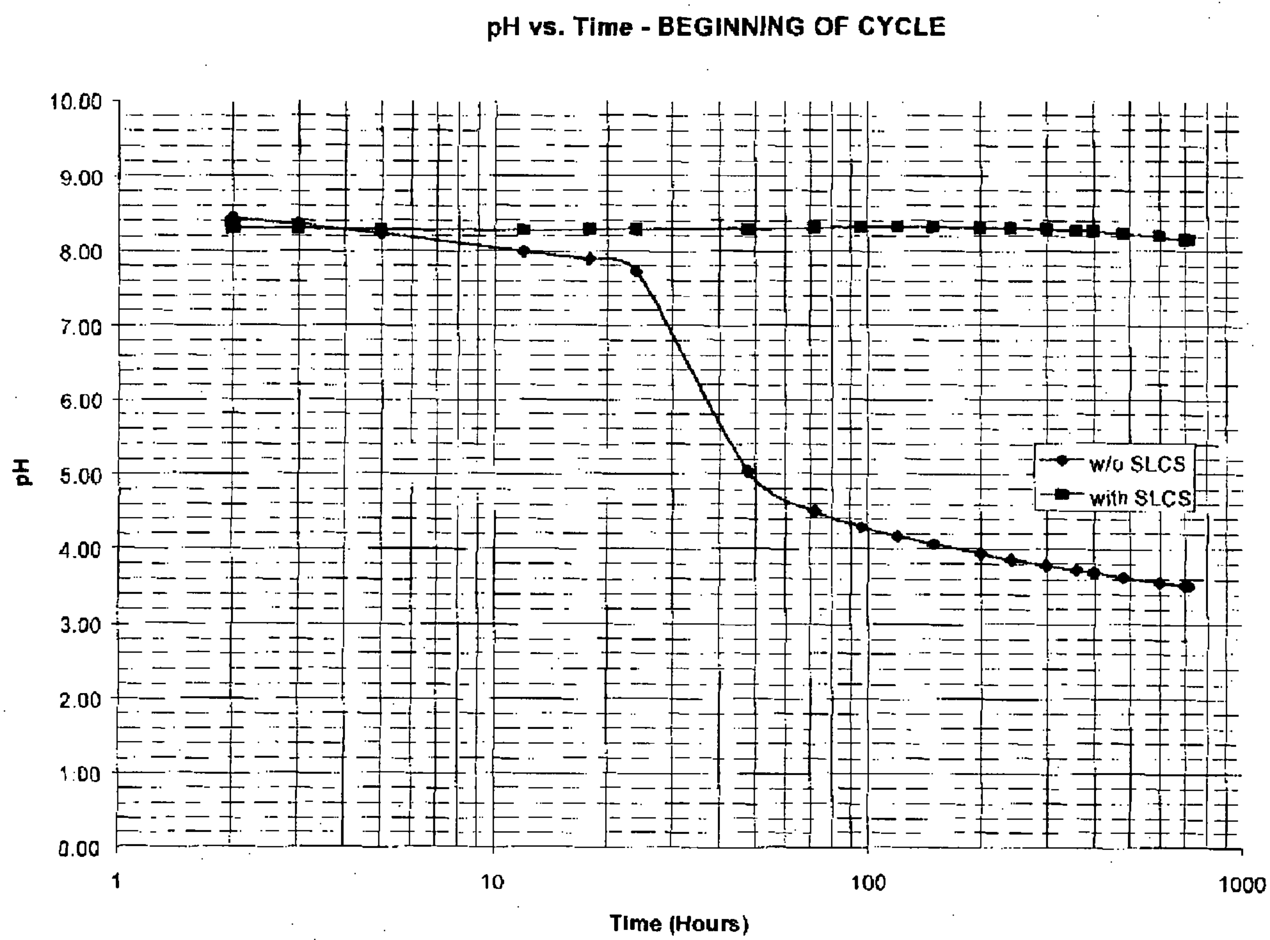
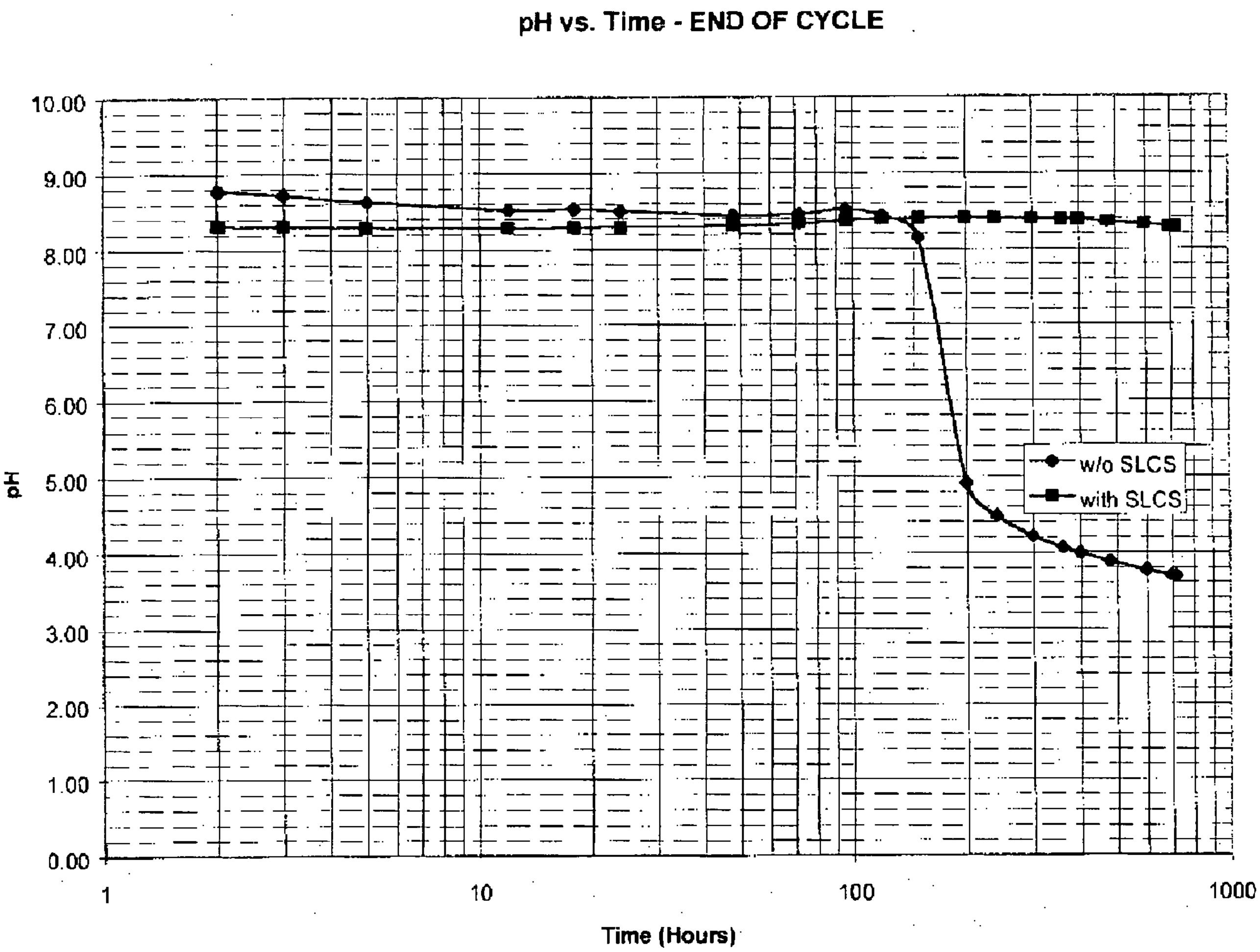

pH vs. Time - BEGINNING OF CYCLE
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
1
10
100
1000
Time (Hours)
w/o SLCS
with SLCS

Figure 7-2


pH vs. Time - END OF CYCLE
pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1
10
100
1000
Time (Hours)
w/o SLCS
with SLCS

8. OWNER'S ACCEPTANCE REVIEW CHECKLIST FOR EXTERNAL DESIGN ANALYSIS

DESIGN ANALYSIS NO. PM-1056 REV: 0

	Yes	No	N/A
1. Do assumptions have sufficient rationale?	☒	☐	☐
2. Are assumptions compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
3. Do the design inputs have sufficient rationale?	☒	☐	☐
4. Are design inputs correct and reasonable?	☒	☐	☐
5. Are design inputs compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
6. Are Engineering Judgments clearly documented and justified?	☒	☐	☐
7. Are Engineering Judgments compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
8. Do the results and conclusions satisfy the purpose and objective of the design analysis?	☒	☐	☐
9. Are the results and conclusions compatible with the way the plant is operated and with the licensing basis?	☒	☐	☐
10. Does the design analysis include the applicable design basis documentation?	☒	☐	☐
11. Have any limitations on the use of the results been identified and transmitted to the appropriate organizations?	☒	☐	☐
12. Are there any unverified assumptions?	☐	☒	☐
13. Do all unverified assumptions have a tracking and closure mechanism in place?	☐	☐	☒

EXELON REVIEWER: T. J. Mscisz / [signature] DATE: 3/21/03
Print / Sign

9. Attachments

(Unless noted, Attachments are Calculated By and Checked By the same individuals as the Calculation)

SPREADSHEET (ATT. D) INPUTS:	CALC. BY:	CHECKED BY
Attachment A – Determination of Total Exposed Cable Quantities Inside Containment	**Dale Shallcross/ Harold Rothstein**	**Lowell Yemin**
Attachment B – Dose Assessment, Core Cs & I Inventory, and Gamma Mean Free Path Determination	Aleem Boatright	Paul Reichert

Attachment C – pH Transient Spreadsheet

Attachment D – pH Transient Spreadsheet Cell Formulas

Attachment E – pH Transient – Grand Gulf Reference Data

Attachment F – Reference 5.1

Attachment G – Reference 5.2

Attachment H – Computer Disclosure Sheet

"Suppression Pool pH Calculation for Alternative Source Term"
Attachment A
Determination of Total Exposed Cable Quantities Inside Containment
for Assessment of Impact of Radiolytic Chlorine Releases on Suppression Pool pH

1. Purpose

The purpose of this attachment is to provide a conservative basis for the calculation of Hydrochloric Acid addition to the suppression pool from radiolysis of exposed chloride-bearing materials inside the drywell during post-Loss of Coolant Accident (LOCA) conditions. The primary exposed chloride-bearing materials are the DuPont Hypalon (or Hypalon-like chlorosulfonated polyethylene rubbers from other manufacturers, such as Okonite) jackets typically used on containment power and control cable. Post-LOCA in-containment radioactivity exposure to these materials can lead to radiolytic breakdown with free chlorine radicals available for carryover as hydrochloric acid to the suppression pool by containment sprays or condensation, with resulting decreases in suppression pool pH. Cables in sealed metal conduits can be excluded from consideration, as there is no mechanism for any significant HCl produced to be released through the conduit (even if connections are assumed to leak, the HCl vapor formed is so chemically reactive that no significant amount would remain unreacted and available for release).

2. Background and Approach

PBAPS Station Electrical Engineer Dale Shallcross developed a listing of the total drywell exposed cable inventory from the INDMS database. The resulting data on cable types and codes, location and length were tabulated and provided to WGI. Following subsequent WGI discussions with Mr.Shallcross on December 26, 2002, he confirmed the data would be a conservative approximation if an additional 10% of cable area is used to account for any missed cable and if a 5% free air addition is made. He also provided by fax of that date a listing of cable codes vs. their maximum cable outer diameter. This data for each unit were listed in the following spreadsheets with the formulas shown on the last 2 pages (corresponding to the first and last page of the spreadsheets for each unit).

Mr. Shallcross also indicated that there is no cabling underwater or in the air space of the suppression pool.

Hypalon may be used not only as an external cable jacket material, but also as a filler inside the jacket. Therefore, to conservatively account for such Hypalon use and in accordance with the equivalent assumptions used by Grand Gulf in Reference 5.2 of Calculation PM-1056, an equivalent chlorine-containing material thickness of 80% of the cable radius is used, considered as 100% Hypalon. Additional conservatism is provided by inclusion of all cable types as if they are all Hypalon or Hypalon-equivalent jacketed.

3. Results

The data was used to develop individual and total cable volumes and the resulting volume-average cable radius [derived as the square root of the quantity (Total Cable Volume divided by pi and the Total Cable Length)]. The Hypalon thickness was then derived as 80% of this average cable radius. The calculations indicate that Unit 2 has the greater surface area of 1,837,364 square centimeters, and Unit 3 has the greater Hypalon average thickness of 0.70514 centimeters. For conservatism, this combination of the worst case from each unit is used.

PBAPS pH Calc., Draft Rev. 0
Attachment B
Part 1: Determination of Post-LOCA Drywell/Torus and Suppression Pool Integrated γ and β Energy, and Suppression Pool Integrated Doses for Suppression Pool pH Determination
&
Part 2: Core Cesium and Iodine Determination
&
Part 3: Drywell and Torus Gamma Mean Free Path Determination

1. Part 1 Purpose

The purpose of this analysis is to determine Post-LOCA Drywell/Containment and Suppression Pool Integrated γ and β energies, and Suppression Pool Integrated Doses for Suppression Pool pH Determination. This data is used in Attachment C of this calculation to determine the radiolytic generation of acid input to the suppression pool.

During a DBA-LOCA, analyzed using Alternative Source Terms (AST), radioactivity is released from the reactor, first during a 1/2 hour gap release period, and then during an early in-vessel release period. Activity is then removed from containment by decay only for conservatism and simplicity.

2. Approach

This attachment calculates the total integrated γ and β energy released into drywell/containment at specific points in time, and total γ plus β Dose in the Suppression Pool water. For conservatism in this calculation, all activity is instantly distributed into the drywell and containment airspaces. The data is then used by the spreadsheets in Attachment C to calculate the change in the pH of the pool water as a function of time.

Initial activity in the core is taken from Reference 5.11. Release fractions and timing are per R.G. 1.183, Table 1. For simplicity, and because of its negligible effect, no credit is taken for the 121-second minimum anticipated time before the start of gap activity. No credit is taken for natural deposition or suppression pool scrubbing. This maintains aerosols airborne to conservatively simulate theoretical plateout contributions. In general, significant amounts of plated-out material are likely to be washed into the suppression pool by condensed vapor flow or containment spray. Simultaneously, all non-noble gas releases are assumed to be instantly transported to, and uniformly mixed in, the suppression pool water.

The calculation of the dose in the pool water, and the integrated energies from radiation in drywell/containment, parallel each other, up to the point of determining the total integrated γ and β energy released into containment at the specific time-steps used by Entergy in their GGNS Suppression Pool pH Analysis Calculation (No. XC-Q1111-98013); the basis for this part of the Peach Bottom AST analysis. First, for each isotope the following list of parameters must be calculated or acquired:

Parameter	**Origin**
Decay Constant	RadTrad Standard Library Values
Release Fractions from 0 to 0.5 hours and 0.5 to 2 hours	Reg. Guide 1.183, Table 1

Initial Core Activity	Reg. Guide 1.183
Activity in Drywell/Containment due to Gap Release at 0.5 hours	Calculated Herein, see below
Time Integrated Activity through 0.5 hours of Gap Release	Calculated Herein, see below
Activity in Drywell/Containment due to Early In-vessel Release at 2 hours	Calculated Herein, see below
Time Integrated Activity through 2 hours of Early In-vessel Release	Calculated Herein, see below
Total Time Integrated Activity Released through 2 hours	Calculated Herein, see below
Total Activity in Drywell/Containment at 2 hours	Calculated Herein, see below
Gamma (Photon) Emission Energy	Radioactive Decay Data Tables, by David C. Kocher [Ref. 5.12] as compiled in RadDecay program
Beta Particle Emission Energy	Radioactive Decay Data Tables, by David C. Kocher [Ref. 5.12] as compiled in RadDecay program

Calculated Values

In order to evaluate the activity in containment, and subsequently the concentration of activity, it was necessary to develop functions that took into account the Peach Bottom conditions, while providing the necessary inputs for the analysis model of GGNS.

- Activity in Drywell/Containment up through 0.5 Hours (Due to Gap Release)

$$\alpha_G(.5) = f_{0-.5} \times \frac{0.5}{0.5}\alpha_o e^{-\lambda 0.5} = f_{0-0.5} \times \alpha_o e^{-\lambda 0.5}$$

$$\alpha_G(t) = f_{0-t} \times \frac{t}{0.5}\alpha_o e^{-\lambda t}$$

$f_{0-0.5}$= activity release fraction at 30 minutes, variable depending on isotope
α_o= initial core activity, variable depending on isotope (Ci)
e= constant
λ= decay constant, variable depending on isotope (hours^{-1})
t= time (hours)
($^t/_{0.5}$)= release fraction buildup over 0.5 hours related linearly (as done in RadTrad)

- Activity in Drywell/Containment up through 2 Hours (Due to Early In-vessel Release)

$$\alpha_E(2) = f_{.5-2} \times \frac{2-0.5}{1.5} \times \alpha_o e^{-\lambda 0.5} \times e^{-\lambda 1.5} = f_{.5-2} \times \alpha_o e^{-\lambda 2}$$

$$\alpha_E(2) = f_{.5-t} \times \frac{t}{1.5} \times \alpha_o e^{-\lambda t}$$

$f_{0.5\text{-}2}$= activity release fraction at 2 hours, variable depending on isotope
α_o= initial core activity, variable depending on isotope (Ci)
e= constant
λ= decay constant, variable depending on isotope (hours^{-1})
t= time (hours)
($^{t}/_{1.5}$)= release fraction buildup over 1.5 hours related linearly (as done in RadTrad)

- Time Integrated Activity through 0.5 Hours (from Gap Release)

$$\alpha_G(t) = \alpha_o \times f_{0-0.5} \times \left(\frac{t}{0.5}\right) \times e^{-\lambda 0.5}$$

$$A_{G0-0.5} = \int_0^{0.5} \alpha_G(t)dt = \frac{\alpha_o \times f_{0-0.5}}{0.5} \int_0^{0.5} te^{-\lambda t}dt$$

$$A_{G0-0.5} = \frac{\alpha_o \times f_{0-.5}}{0.5\lambda^2}\left[1 - e^{-0.5\lambda}(0.5\lambda + 1)\right]$$

$f_{0-0.5}$= activity release fraction at 2 hours, variable depending on isotope
($^{t}/_{0.5}$)= release fraction buildup over 0.5 hours related linearly (as done in RadTrad)
α_o= initial core activity, variable depending on isotope (Ci)
e= constant
λ= decay constant, variable depending on isotope (hours^{-1})
t= time (hours)
$\alpha_G(t)$= activity in containment as a function of time, due to gap release (Ci)
$A_{G0-0.5}$= time integrated activity though 0.5 hours due to gap release (Ci-hours)

- Time Integrated Activity through 2 Hours (from Early In-vessel Release)

$$\alpha_E(t) = \alpha_o e^{-\lambda 0.5} \times f_{0.5-2} \times \left(\frac{t}{1.5}\right) \times e^{-\lambda 1.5}$$ [Note: Here, t starts after 0.5 hour]

$$A_{E0-1.5} = \int_0^{1.5} \alpha_E(t)dt = \frac{\alpha_o e^{-0.5\lambda} \times f_{0.5-2}}{1.5} \int_0^{1.5} te^{-\lambda t}dt$$

$$A_{E0-1.5} = \frac{\alpha_o e^{-0.5\lambda} \times f_{0.5-2}}{1.5\lambda^2}\left[1 - e^{-1.5\lambda}(1.5\lambda + 1)\right]$$

$f_{0-0.5}$= activity release fraction at 2 hours, variable depending on isotope
($^{t}/_{1.5}$)= release fraction buildup over 1.5 hours related linearly (as done in RadTrad)
α_o= initial core activity, variable depending on isotope (Ci)
e= constant
λ= decay constant, variable depending on isotope (hours^{-1})
t= time (hours)
$\alpha_E(t)$= activity in containment as a function of time, due to early in-vessel release (Ci)
$A_{E0-1.5}$= time integrated activity from 0.5 to 2 hours due to early in-vessel release (Ci-hours), after shutdown

- Total Time Integrated Activity Released in Drywell/Containment through 2 Hours

$$A_{2_{total}} = A_{G0-0.5} + A_{E0-1.5}$$

$A_{G0\text{-}0.5}$= time integrated activity though 0.5 hours due to gap release (Ci-hours)
$A_{E0\text{-}1.5}$= time integrated activity from 0.5 to 2 hours due to early in-vessel release (Ci-hours), after shutdown

- Total Activity in Drywell/Containment at 2 Hours

$$\alpha(2)_{total} = \alpha(2) + \alpha(0.5) \times e^{-1.5\lambda}$$

$\alpha(0.5)$= activity present in containment at 0.5 hours
e= constant
λ= decay constant, variable depending on isotope (hours^{-1})
t= time (hours)

When the above values are obtained for each isotope, the Activity in Containment can be calculated at given times, and subsequently the energy from the activity can be calculated in the following manner:

- Total Time Integrated Activity in Drywell/Containment at Specific Times (t hours)

$$\alpha_{time} = \left(\frac{\alpha(2)_{total}}{\lambda}\right) \times (1 - e^{-\lambda(t-2)}) + A_{2_{total}}$$

$\alpha(2)_{total}$= total activity in containment at 2 hours (Ci)
$\alpha_{2_{total}}$= total time integrated activity released through 2 hours (Ci-hours)
λ= decay constant, variable depending on isotope (hours^{-1})
t= time (hours)

At this point, the above equation is used to calculate the activity at the given timesteps, due to γ and β radiation and the values are summed for all contributing sources, as used in the GGNS analysis model. Finally, the activity's radiation energy concentration is calculated by dividing over the airspace volume of containment. Subsequently, this data is input into the spreadsheet of Attachment C to calculate the concentration of HCl that results in the pool (due to the release of chlorine from the radiolysis of cables in primary containment), and its contribution to the pH transient.

Of additional concern is the formation of Nitric Acid (HNO_3), which contributes to the transient calculated in Attachment C, by serving to lower the pH in the pool. Any activity from sources found immediately in the pool water is a factor in this acid's formation; therefore a dose to the water must also be calculated. Because the noble gas sources stay gaseous and do not mix with the pool water, we need only to consider non-noble gas sources in this calculation. As stated earlier, up to the point of determining the total integrated γ and β energy released into containment at the specific time-steps, the calculation of the dose in the pool water, and the integrated energies from radiation in containment parallel each other.

As before, the activities at given timesteps are summed for all contributing sources and the radiation energy concentration is calculated. However, the Entergy designed spreadsheet used in Attachment C uses a dose value for its calculation directly to HNO_3 concentration, so it was necessary to convert the energy concentration (MeV/cm^3) to dose (Mrad). The conversion factor was determined to equal 1.60209E-14 (Mrad/(MeV/cm^3)). When all concentrations were converted to doses, the γ and β values were summed and input into Attachment C to calculate the concentration of HNO_3 formed, and its contribution to the pH transient.

Part 2: Core Cesium and Iodine Determination

Cesium and Iodine released from the core during the DBA-LOCA have an impact on suppression pool pH. Iodines can contribute to the formation of hydriodic acid, HI, and cesiums contribute to formation of Cesium Hydroxide, CsOH. There is significantly more Cesium available and released from the core than Iodine. Therefore, these materials lead the suppression pool to be basic essentially from the beginning of fission product release. The quantities of Cesium and Iodine, tabulated on page B-14, were taken from the PBAPS Loss of Coolant Accident (LOCA) calculation's attached Source Terms.

Part 3: Drywell and Containment Gamma Mean Free Path Determination

Gamma mean free paths in the drywell are used to conservatively assess the size of the contained cloud that will irradiate cable. The determination of these values is performed in a manner identical to that used for the GGNS assessment. That is, for the drywell, the entire radius of 34 feet from the reactor center to the drywell wall is used, neglecting shielding provided by the vessel and shield.

Class	Isotopic Nuclide	Decay Constant (hours)[1]	Release Fractions 0-0.5 hours	Release Fractions 0.5-2 hours	Initial Core Activity (Ci)	Gap Release Activity in Containment at 0.5 hours (Ci)	Gap Release Time Integrated Activity in Containment through 0.5 hours (Ci-hours)	Early In-vessel Release Activity in Containment at 2.0 hours (Ci)	Early In-vessel Release Time Integrated Activity in Containment through 2.0 hours (Ci-hours)	TOTAL Time Integrated Activity in Containment through 2.0 hours (Ci-hours)	TOTAL Activity in Containment at 2.0 hours (Ci)	Gamma *(Photon)* Emission Energy (MeV/decay)	Gamma *(Photon)* Emission Energy per Unit of Activity (MeV/Ci-hour)	Beta Particle Emission Energy (MeV/decay)	Beta Particle Emission Energy per Unit of Activity (MeV/Ci-hour)
1	Kr-85	7.376E-06	0.05	0.95	1.392E+06	6.96E+04	1.74E+04	1.32E+06	9.92E+05	1.01E+06	1.39E+06	2.23E-03	2.97E+11	2.51E-01	3.34E+13
1	Kr-85m	1.547E-01	0.05	0.95	2.933E+07	1.36E+06	3.48E+05	2.04E+07	1.66E+07	1.69E+07	2.15E+07	1.58E-01	2.10E+13	2.29E-01	3.05E+13
1	Kr-87	5.451E-01	0.05	0.95	5.760E+07	2.19E+06	6.02E+05	1.84E+07	1.85E+07	1.91E+07	1.94E+07	7.93E-01	1.06E+14	1.32E+00	1.76E+14
1	Kr-88	2.441E-01	0.05	0.95	8.126E+07	3.60E+06	9.37E+05	4.74E+07	4.03E+07	4.12E+07	4.99E+07	1.95E+00	2.60E+14	3.60E-01	4.79E+13
1	Xe-133	5.506E-03	0.05	0.95	1.937E+08	9.66E+06	2.42E+06	1.82E+08	1.37E+08	1.39E+08	1.92E+08	4.53E-02	6.03E+12	1.00E-01	1.34E+13
1	Xe-135	7.625E-02	0.05	0.95	7.861E+07	3.78E+06	9.58E+05	6.41E+07	5.00E+07	5.09E+07	6.75E+07	2.48E-01	3.30E+13	3.03E-01	4.03E+13
2	I-131	3.592E-03	0.05	0.25	9.479E+07	4.73E+06	1.18E+06	2.35E+07	1.77E+07	1.89E+07	2.82E+07	3.81E-01	5.08E+13	1.81E-01	2.42E+13
2	I-132	3.014E-01	0.05	0.25	1.369E+08	5.89E+06	1.55E+06	1.87E+07	1.64E+07	1.80E+07	2.25E+07	2.29E+00	3.05E+14	4.86E-01	6.47E+13
2	I-133	3.332E-02	0.05	0.25	1.960E+08	9.64E+06	2.42E+06	4.58E+07	3.50E+07	3.74E+07	5.50E+07	6.07E-01	8.08E+13	4.07E-01	5.42E+13
2	I-134	7.907E-01	0.05	0.25	2.175E+08	7.32E+06	2.10E+06	1.12E+07	1.30E+07	1.51E+07	1.34E+07	2.63E+00	3.50E+14	6.03E-01	8.03E+13
2	I-135	1.049E-01	0.05	0.25	1.832E+08	8.69E+06	2.21E+06	3.71E+07	2.94E+07	3.16E+07	4.46E+07	1.58E+00	2.10E+14	3.68E-01	4.91E+13
3	Rb-86	1.548E-03	0.05	0.20	2.300E+05	1.15E+04	2.87E+03	4.58E+04	3.44E+04	3.73E+04	5.73E+04	9.45E-02	1.26E+13	6.67E-01	8.89E+13
3	Cs-134	3.835E-05	0.05	0.20	2.569E+07	1.28E+06	3.21E+05	5.14E+06	3.85E+06	4.17E+06	6.42E+06	1.56E+00	2.07E+14	1.57E-01	2.09E+13
3	Cs-136	2.205E-03	0.05	0.20	7.150E+06	3.57E+05	8.93E+04	1.42E+06	1.07E+06	1.16E+06	1.78E+06	2.17E+00	2.89E+14	1.00E-01	1.33E+13
3	Cs-137	2.636E-06	0.05	0.20	1.601E+07	8.00E+05	2.00E+05	3.20E+06	2.40E+06	2.60E+06	4.00E+06	0.00E+00	0.00E+00	1.71E-01	2.27E+13
4	Sb-127	7.502E-03	0.00	0.05	1.022E+07	0.00E+00	0.00E+00	5.03E+05	3.79E+05	3.79E+05	5.03E+05	6.62E-01	8.82E+13	3.11E-01	4.14E+13
4	Sb-129	1.605E-01	0.00	0.05	3.047E+07	0.00E+00	0.00E+00	1.11E+06	9.00E+05	9.00E+05	1.11E+06	1.43E+00	1.90E+14	3.58E-01	4.76E+13
4	Te-127	7.413E-02	0.00	0.05	1.014E+07	0.00E+00	0.00E+00	4.37E+05	3.40E+05	3.40E+05	4.37E+05	4.84E-03	6.44E+11	2.23E-01	2.97E+13
4	Te-127m	2.650E-04	0.00	0.05	1.360E+06	0.00E+00	0.00E+00	6.80E+04	5.10E+04	5.10E+04	6.80E+04	1.12E-02	1.50E+12	4.61E-03	6.13E+11
4	Te-129	5.975E-01	0.00	0.05	2.999E+07	0.00E+00	0.00E+00	4.54E+05	4.70E+05	4.70E+05	4.54E+05	5.77E-02	7.68E+12	5.25E-01	6.99E+13
4	Te-129m	8.596E-04	0.00	0.05	4.470E+06	0.00E+00	0.00E+00	2.23E+05	1.67E+05	1.67E+05	2.23E+05	3.94E-02	5.25E+12	2.12E-01	2.82E+13
4	Te-131m	2.310E-02	0.00	0.05	1.365E+07	0.00E+00	0.00E+00	6.52E+05	4.94E+05	4.94E+05	6.52E+05	1.43E+00	1.90E+14	1.45E-01	1.92E+13
4	Te-132	8.864E-03	0.00	0.05	1.348E+08	0.00E+00	0.00E+00	6.62E+06	4.99E+06	4.99E+06	6.62E+06	2.31E-01	3.07E+13	5.94E-02	7.91E+12
5	Sr-89	5.719E-04	0.00	0.02	9.873E+07	0.00E+00	0.00E+00	1.97E+06	1.48E+06	1.48E+06	1.97E+06	1.36E-04	1.82E+10	5.83E-01	7.76E+13
5	Sr-90	2.715E-06	0.00	0.02	1.121E+07	0.00E+00	0.00E+00	2.24E+05	1.68E+05	1.68E+05	2.24E+05	0.00E+00	0.00E+00	1.96E-01	2.61E+13
5	Sr-91	7.296E-02	0.00	0.02	1.341E+08	0.00E+00	0.00E+00	2.32E+06	1.80E+06	1.80E+06	2.32E+06	6.87E-01	9.15E+13	6.53E-01	8.70E+13
5	Sr-92	2.558E-01	0.00	0.02	1.417E+08	0.00E+00	0.00E+00	1.70E+06	1.45E+06	1.45E+06	1.70E+06	1.34E+00	1.78E+14	2.00E-01	2.66E+13
6	Ba-139	5.029E-01	0.00	0.02	1.794E+08	0.00E+00	0.00E+00	1.31E+06	1.29E+06	1.29E+06	1.31E+06	3.53E-02	4.70E+12	8.97E-01	1.19E+14
6	Ba-140	2.267E-03	0.00	0.02	1.727E+08	0.00E+00	0.00E+00	3.44E+06	2.58E+06	2.58E+06	3.44E+06	1.91E-01	2.54E+13	2.71E-01	3.61E+13
7	Co-58	4.079E-04	0.00	0.0025	5.394E+06	0.00E+00	0.00E+00	1.35E+04	1.01E+04	1.01E+04	1.35E+04	9.76E-01	1.30E+14	0.00E+00	0.00E+00
7	Co-60	1.500E-05	0.00	0.0025	6.361E+06	0.00E+00	0.00E+00	1.59E+04	1.19E+04	1.19E+04	1.59E+04	2.51E+00	3.34E+14	9.58E-02	1.28E+13
7	Mo-99	1.050E-02	0.00	0.0025	1.792E+08	0.00E+00	0.00E+00	4.39E+05	3.31E+05	3.31E+05	4.39E+05	1.55E-01	2.06E+13	3.93E-01	5.24E+13
7	Tc-99m	1.151E-01	0.00	0.0025	1.569E+08	0.00E+00	0.00E+00	3.12E+05	2.48E+05	2.48E+05	3.12E+05	1.27E-01	1.69E+13	0.00E+00	0.00E+00
7	Ru-103	7.353E-04	0.00	0.0025	1.483E+08	0.00E+00	0.00E+00	3.70E+05	2.78E+05	2.78E+05	3.70E+05	4.84E-01	6.44E+13	6.75E-02	9.00E+12
7	Ru-105	1.561E-01	0.00	0.0025	1.026E+08	0.00E+00	0.00E+00	1.88E+05	1.52E+05	1.52E+05	1.88E+05	7.84E-01	1.04E+14	4.03E-01	5.36E+13
7	Ru-106	7.844E-05	0.00	0.0025	6.104E+07	0.00E+00	0.00E+00	1.53E+05	1.14E+05	1.14E+05	1.53E+05	0.00E+00	0.00E+00	1.00E-02	1.34E+12
7	Rh-105	1.960E-02	0.00	0.0025	9.709E+07	0.00E+00	0.00E+00	2.33E+05	1.77E+05	1.77E+05	2.33E+05	7.76E-02	1.03E+13	1.52E-01	2.03E+13
8	Ce-141	8.886E-04	0.00	0.0005	1.585E+08	0.00E+00	0.00E+00	7.91E+04	5.94E+04	5.94E+04	7.91E+04	7.69E-02	1.02E+13	1.45E-01	1.93E+13
8	Ce-143	2.100E-02	0.00	0.0005	1.562E+08	0.00E+00	0.00E+00	7.49E+04	5.68E+04	5.68E+04	7.49E+04	2.73E-01	3.64E+13	4.10E-01	5.46E+13
8	Ce-144	1.016E-04	0.00	0.0005	1.269E+08	0.00E+00	0.00E+00	6.34E+04	4.76E+04	4.76E+04	6.34E+04	1.93E-02	2.57E+12	8.33E-02	1.11E+13
8	Np-239	1.226E-02	0.00	0.0005	1.904E+09	0.00E+00	0.00E+00	9.29E+05	7.01E+05	7.01E+05	9.29E+05	1.72E-01	2.29E+13	1.15E-01	1.53E+13
8	Pu-238	9.012E-07	0.00	0.0005	6.336E+05	0.00E+00	0.00E+00	3.17E+02	2.38E+02	2.38E+02	3.17E+02	1.60E-03	2.13E+11	0.00E+00	0.00E+00
8	Pu-239	3.286E-09	0.00	0.0005	4.234E+04	0.00E+00	0.00E+00	2.12E+01	1.45E+02	1.45E+02	2.12E+01	6.54E-04	8.71E+10	0.00E+00	0.00E+00
8	Pu-240	1.210E-08	0.00	0.0005	4.543E+04	0.00E+00	0.00E+00	2.27E+01	1.15E+01	1.15E+01	2.27E+01	1.53E-03	2.03E+11	0.00E+00	0.00E+00
8	Pu-241	5.491E-06	0.00	0.0005	2.181E+07	0.00E+00	0.00E+00	1.09E+04	8.18E+03	8.18E+03	1.09E+04	0.00E+00	0.00E+00	5.23E-03	6.97E+11
9	Y-90	1.083E-02	0.00	0.0002	1.154E+07	0.00E+00	0.00E+00	2.26E+03	1.70E+03	1.70E+03	2.26E+03	0.00E+00	0.00E+00	9.35E-01	1.25E+14
9	Y-91	4.936E-04	0.00	0.0002	1.217E+08	0.00E+00	0.00E+00	2.43E+04	1.82E+04	1.82E+04	2.43E+04	3.61E-03	4.81E+11	6.02E-01	8.02E+13
9	Y-92	1.958E-01	0.00	0.0002	1.421E+08	0.00E+00	0.00E+00	1.92E+04	1.59E+04	1.59E+04	1.92E+04	2.52E-01	3.35E+13	1.44E+00	1.92E+14
9	Y-93	6.863E-02	0.00	0.0002	1.597E+08	0.00E+00	0.00E+00	2.78E+04	2.16E+04	2.16E+04	2.78E+04	8.91E-02	1.19E+13	1.17E+00	1.56E+14
9	Zr-95	4.514E-04	0.00	0.0002	1.584E+08	0.00E+00	0.00E+00	3.16E+04	2.37E+04	2.37E+04	3.16E+04	7.35E-01	9.79E+13	1.16E-01	1.55E+13
9	Zr-97	4.101E-02	0.00	0.0002	1.643E+08	0.00E+00	0.00E+00	3.03E+04	2.32E+04	2.32E+04	3.03E+04	1.81E-01	2.41E+13	6.97E-01	9.29E+13
9	Nb-95	8.217E-04	0.00	0.0002	1.592E+08	0.00E+00	0.00E+00	3.18E+04	2.38E+04	2.38E+04	3.18E+04	7.64E-01	1.02E+14	4.34E-02	5.79E+12
9	La-140	1.721E-02	0.00	0.0002	1.771E+08	0.00E+00	0.00E+00	3.42E+04	2.59E+04	2.59E+04	3.42E+04	2.32E+00	3.09E+14	5.27E-01	7.03E+13
9	La-141	1.764E-01	0.00	0.0002	1.637E+08	0.00E+00	0.00E+00	2.30E+04	1.89E+04	1.89E+04	2.30E+04	4.27E-02	5.69E+12	9.48E-01	1.26E+14
9	La-142	4.496E-01	0.00	0.0002	1.599E+08	0.00E+00	0.00E+00	1.30E+04	1.24E+04	1.24E+04	1.30E+04	2.72E+00	3.62E+14	8.46E-01	1.13E+14
9	Pr-143	2.130E-03	0.00	0.0002	1.515E+08	0.00E+00	0.00E+00	3.02E+04	2.26E+04	2.26E+04	3.02E+04	0.00E+00	0.00E+00	3.16E-01	4.20E+13
9	Nd-147	2.630E-03	0.00	0.0002	6.483E+07	0.00E+00	0.00E+00	1.29E+04	9.69E+03	9.69E+03	1.29E+04	1.41E-01	1.87E+13	2.33E-01	3.11E+13
9	Am-241	1.830E-07	0.00	0.0002	3.361E+04	0.00E+00	0.00E+00	6.72E+00	5.05E+00	5.05E+00	6.72E+00	2.81E-02	3.74E+12	0.00E+00	0.00E+00
9	Cm-242	1.774E-04	0.00	0.0002	8.424E+06	0.00E+00	0.00E+00	1.68E+03	1.26E+03	1.26E+03	1.68E+03	1.67E-03	2.23E+11	0.00E+00	0.00E+00
9	Cm-244	4.366E-06	0.00	0.0002	9.181E+05	0.00E+00	0.00E+00	1.84E+02	1.38E+02	1.38E+02	1.84E+02	1.49E-03	1.98E+11	0.00E+00	0.00E+00

Disintegrations per Curie-hour= 1.3320E+14

Drywell (Drywell + Supp. Pool Airspace) cm^3= 1.1488E+10

Activity in Containment at Given Timesteps (Ci-hours)

1	2	2.0336	3	5	12	18	24	48	72	96	120	150	200	240	300	360	400	480	600	700	720
	1.01E+06	1.06E+06	2.40E+06	5.19E+06	1.49E+07	2.33E+07	3.16E+07	6.50E+07	9.84E+07	1.32E+08	1.65E+08	2.07E+08	2.76E+08	3.32E+08	4.15E+08	4.99E+08	5.54E+08	6.65E+08	8.32E+08	9.70E+08	9.98E+08
	1.69E+07	1.77E+07	3.69E+07	6.86E+07	1.26E+08	1.44E+08	1.51E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08	1.56E+08
	1.91E+07	1.97E+07	3.40E+07	4.77E+07	5.44E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07	5.46E+07
	4.12E+07	4.29E+07	8.55E+07	1.47E+08	2.28E+08	2.41E+08	2.45E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08	2.46E+08
	1.39E+08	1.46E+08	3.30E+08	7.09E+08	2.00E+09	3.07E+09	4.11E+09	7.93E+09	1.13E+10	1.42E+10	1.68E+10	1.95E+10	2.32E+10	2.56E+10	2.82E+10	3.01E+10	3.10E+10	3.24E+10	3.36E+10	3.42E+10	3.43E+10
	5.09E+07	5.32E+07	1.16E+08	2.32E+08	5.23E+08	6.75E+08	7.71E+08	9.10E+08	9.32E+08	9.35E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08	9.36E+08
	1.89E+07	1.98E+07	4.70E+07	1.03E+08	2.96E+08	4.58E+08	6.16E+08	1.22E+09	1.77E+09	2.27E+09	2.73E+09	3.26E+09	4.02E+09	4.54E+09	5.18E+09	5.71E+09	6.00E+09	6.47E+09	6.96E+09	7.24E+09	7.28E+09
	1.80E+07	1.87E+07	3.74E+07	6.24E+07	8.89E+07	9.20E+07	9.25E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07	9.26E+07
	3.74E+07	3.92E+07	9.15E+07	1.94E+08	5.05E+08	7.20E+08	8.95E+08	1.33E+09	1.53E+09	1.62E+09	1.66E+09	1.68E+09	1.69E+09	1.69E+09	1.69E+09	1.69E+09	1.69E+09	1.69E+09	1.69E+09	1.69E+09	1.69E+09
	1.51E+07	1.55E+07	2.44E+07	3.05E+07	3.20E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07	3.21E+07
	3.16E+07	3.31E+07	7.39E+07	1.46E+08	3.08E+08	3.77E+08	4.14E+08	4.53E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08	4.56E+08
	3.73E+04	3.92E+04	9.46E+04	2.09E+05	6.06E+05	9.43E+05	1.28E+06	2.58E+06	3.84E+06	5.05E+06	6.22E+06	7.62E+06	9.81E+06	1.14E+07	1.37E+07	1.58E+07	1.71E+07	1.94E+07	2.24E+07	2.45E+07	2.49E+07
	4.17E+06	4.39E+06	1.06E+07	2.34E+07	6.84E+07	1.07E+08	1.45E+08	2.99E+08	4.53E+08	6.07E+08	7.60E+08	9.52E+08	1.27E+09	1.53E+09	1.91E+09	2.29E+09	2.54E+09	3.05E+09	3.80E+09	4.43E+09	4.55E+09
	1.16E+06	1.22E+06	2.94E+06	6.48E+06	1.88E+07	2.91E+07	3.94E+07	7.90E+07	1.17E+08	1.52E+08	1.86E+08	2.26E+08	2.87E+08	3.31E+08	3.90E+08	4.42E+08	4.73E+08	5.27E+08	5.92E+08	6.35E+08	6.43E+08
	2.60E+06	2.74E+06	6.60E+06	1.46E+07	4.26E+07	6.66E+07	9.07E+07	1.87E+08	2.83E+08	3.79E+08	4.75E+08	5.95E+08	7.95E+08	9.55E+08	1.19E+09	1.43E+09	1.59E+09	1.91E+09	2.39E+09	2.79E+09	2.87E+09
	3.79E+05	3.96E+05	8.80E+05	1.87E+06	5.23E+06	7.97E+06	1.06E+07	2.00E+07	2.78E+07	3.43E+07	3.98E+07	4.54E+07	5.23E+07	5.62E+07	6.03E+07	6.29E+07	6.41E+07	6.56E+07	6.67E+07	6.71E+07	6.72E+07
	9.00E+05	9.37E+05	1.92E+06	3.53E+06	6.40E+06	7.26E+06	7.59E+06	7.78E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06	7.79E+06
	3.40E+05	3.55E+05	7.61E+05	1.52E+06	3.43E+06	4.44E+06	5.08E+06	6.04E+06	6.20E+06	6.23E+06	6.23E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06	6.24E+06
	5.10E+04	5.33E+04	1.19E+05	2.55E+05	7.30E+05	1.14E+06	1.54E+06	3.16E+06	4.76E+06	6.36E+06	7.95E+06	9.92E+06	1.32E+07	1.57E+07	1.95E+07	2.33E+07	2.57E+07	3.06E+07	3.76E+07	4.34E+07	4.45E+07
	4.70E+05	4.85E+05	8.11E+05	1.10E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06	1.23E+06
	1.67E+05	1.75E+05	3.90E+05	8.36E+05	2.39E+06	3.71E+06	5.03E+06	1.02E+07	1.53E+07	2.03E+07	2.52E+07	3.12E+07	4.08E+07	4.82E+07	5.88E+07	6.89E+07	7.54E+07	8.76E+07	1.04E+08	1.17E+08	1.20E+08
	4.94E+05	5.16E+05	1.14E+06	2.38E+06	6.31E+06	9.21E+06	1.17E+07	1.90E+07	2.31E+07	2.55E+07	2.69E+07	2.78E+07	2.84E+07	2.86E+07	2.87E+07	2.87E+07	2.87E+07	2.87E+07	2.87E+07	2.87E+07	2.87E+07
	4.99E+06	5.21E+06	1.16E+07	2.46E+07	6.84E+07	1.04E+08	1.37E+08	2.55E+08	3.50E+08	4.27E+08	4.90E+08	5.51E+08	6.23E+08	6.61E+08	6.99E+08	7.21E+08	7.30E+08	7.41E+08	7.48E+08	7.50E+08	7.51E+08
	1.48E+06	1.55E+06	3.45E+06	7.39E+06	2.11E+07	3.29E+07	4.46E+07	9.10E+07	1.37E+08	1.82E+08	2.27E+08	2.81E+08	3.71E+08	4.40E+08	5.42E+08	6.40E+08	7.04E+08	8.26E+08	1.00E+09	1.14E+09	1.16E+09
	1.68E+05	1.76E+05	3.92E+05	8.41E+05	2.41E+06	3.76E+06	5.10E+06	1.05E+07	1.59E+07	2.12E+07	2.66E+07	3.33E+07	4.46E+07	5.35E+07	6.70E+07	8.04E+07	8.94E+07	1.07E+08	1.34E+08	1.57E+08	1.61E+08
	1.80E+06	1.88E+06	4.04E+06	8.05E+06	1.83E+07	2.37E+07	2.72E+07	3.25E+07	3.34E+07	3.35E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07	3.36E+07
	1.45E+06	1.51E+06	2.95E+06	5.01E+06	7.58E+06	7.99E+06	8.08E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06	8.10E+06
	1.29E+06	1.33E+06	2.32E+06	3.32E+06	3.88E+06	3.89E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06	3.90E+06
	2.58E+06	2.70E+06	6.02E+06	1.29E+07	3.66E+07	5.66E+07	7.64E+07	1.53E+08	2.25E+08	2.94E+08	3.59E+08	4.35E+08	5.51E+08	6.35E+08	7.48E+08	8.46E+08	9.04E+08	1.01E+09	1.13E+09	1.21E+09	1.22E+09
	1.01E+04	1.06E+04	2.36E+04	5.05E+04	1.45E+05	2.25E+05	3.05E+05	6.24E+05	9.40E+05	1.25E+06	1.56E+06	1.95E+06	2.57E+06	3.07E+06	3.79E+06	4.50E+06	4.96E+06	5.86E+06	7.16E+06	8.20E+06	8.40E+06
	1.19E+04	1.25E+04	2.78E+04	5.96E+04	1.71E+05	2.66E+05	3.62E+05	7.43E+05	1.12E+06	1.51E+06	1.89E+06	2.36E+06	3.16E+06	3.79E+06	4.74E+06	5.69E+06	6.32E+06	7.59E+06	9.48E+06	1.11E+07	1.14E+07
	3.31E+05	3.45E+05	7.67E+05	1.63E+06	4.49E+06	6.79E+06	8.95E+06	1.63E+07	2.21E+07	2.65E+07	3.00E+07	3.33E+07	3.69E+07	3.87E+07	4.03E+07	4.11E+07	4.15E+07	4.18E+07	4.20E+07	4.21E+07	4.21E+07
	2.48E+05	2.58E+05	5.42E+05	1.04E+06	2.10E+06	2.52E+06	2.74E+06	2.94E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06	2.95E+06
	2.78E+05	2.90E+05	6.48E+05	1.39E+06	3.96E+06	6.16E+06	8.35E+06	1.70E+07	2.55E+07	3.39E+07	4.21E+07	5.22E+07	6.85E+07	8.11E+07	9.93E+07	1.17E+08	1.28E+08	1.49E+08	1.79E+08	2.02E+08	2.07E+08
	1.52E+05	1.59E+05	3.26E+05	6.02E+05	1.10E+06	1.26E+06	1.32E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06	1.35E+06
	1.14E+05	1.20E+05	2.67E+05	5.72E+05	1.64E+06	2.55E+06	3.47E+06	7.12E+06	1.08E+07	1.44E+07	1.80E+07	2.26E+07	3.01E+07	3.61E+07	4.51E+07	5.40E+07	5.99E+07	7.17E+07	8.92E+07	1.04E+08	1.07E+08
	1.77E+05	1.85E+05	4.08E+05	8.57E+05	2.30E+06	3.38E+06	4.35E+06	7.25E+06	9.06E+06	1.02E+07	1.09E+07	1.14E+07	1.18E+07	1.20E+07	1.20E+07	1.21E+07	1.21E+07	1.21E+07	1.21E+07	1.21E+07	1.21E+07
	5.94E+04	6.20E+04	1.38E+05	2.96E+05	8.47E+05	1.32E+06	1.78E+06	3.62E+06	5.43E+06	7.19E+06	8.92E+06	1.10E+07	1.44E+07	1.70E+07	2.08E+07	2.43E+07	2.66E+07	3.09E+07	3.68E+07	4.12E+07	4.20E+07
	5.68E+04	5.93E+04	1.31E+05	2.74E+05	7.32E+05	1.07E+06	1.38E+06	2.27E+06	2.80E+06	3.13E+06	3.32E+06	3.46E+06	3.57E+06	3.60E+06	3.61E+06	3.62E+06	3.62E+06	3.62E+06	3.62E+06	3.62E+06	3.62E+06
	4.76E+04	4.97E+04	1.11E+05	2.38E+05	6.81E+05	1.06E+06	1.44E+06	2.96E+06	4.47E+06	5.98E+06	7.49E+06	9.36E+06	1.25E+07	1.50E+07	1.87E+07	2.23E+07	2.48E+07	2.96E+07	3.68E+07	4.28E+07	4.40E+07
	7.01E+05	7.32E+05	1.62E+06	3.44E+06	9.44E+06	1.42E+07	1.86E+07	3.34E+07	4.43E+07	5.25E+07	5.86E+07	6.41E+07	6.98E+07	7.24E+07	7.45E+07	7.55E+07	7.59E+07	7.62E+07	7.64E+07	7.64E+07	7.64E+07
	2.38E+02	2.48E+02	5.54E+02	1.19E+03	3.41E+03	5.31E+03	7.21E+03	1.48E+04	2.24E+04	3.00E+04	3.76E+04	4.71E+04	6.30E+04	7.56E+04	9.46E+04	1.14E+05	1.26E+05	1.52E+05	1.90E+05	2.21E+05	2.28E+05
	1.45E+02	1.46E+02	1.66E+02	2.09E+02	3.57E+02	4.84E+02	6.11E+02	1.12E+03	1.63E+03	2.13E+03	2.64E+03	3.28E+03	4.34E+03	5.18E+03	6.45E+03	7.72E+03	8.57E+03	1.03E+04	1.28E+04	1.49E+04	1.53E+04
	1.15E+01	1.23E+01	3.42E+01	7.96E+01	2.39E+02	3.75E+02	5.11E+02	1.06E+03	1.60E+03	2.15E+03	2.69E+03	3.37E+03	4.51E+03	5.42E+03	6.78E+03	8.14E+03	9.05E+03	1.09E+04	1.36E+04	1.59E+04	1.63E+04
	8.18E+03	8.55E+03	1.91E+04	4.09E+04	1.17E+05	1.83E+05	2.48E+05	5.10E+05	7.71E+05	1.03E+06	1.29E+06	1.62E+06	2.17E+06	2.60E+06	3.26E+06	3.91E+06	4.34E+06	5.21E+06	6.52E+06	7.61E+06	7.82E+06
	1.70E+03	1.78E+03	3.95E+03	8.37E+03	2.31E+04	3.49E+04	4.59E+04	8.35E+04	1.13E+05	1.35E+05	1.52E+05	1.68E+05	1.86E+05	1.94E+05	2.02E+05	2.06E+05	2.07E+05	2.09E+05	2.10E+05	2.10E+05	2.10E+05
	1.82E+04	1.91E+04	4.25E+04	9.11E+04	2.61E+05	4.06E+05	5.50E+05	1.12E+06	1.69E+06	2.25E+06	2.80E+06	3.49E+06	4.60E+06	5.48E+06	6.75E+06	7.99E+06	8.80E+06	1.04E+07	1.26E+07	1.44E+07	1.47E+07
	1.59E+04	1.66E+04	3.34E+04	5.95E+04	1.00E+05	1.10E+05	1.13E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05	1.14E+05
	2.16E+04	2.26E+04	4.85E+04	9.71E+04	2.23E+05	2.92E+05	3.38E+05	4.10E+05	4.24E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05	4.27E+05
	2.37E+04	2.48E+04	5.54E+04	1.19E+05	3.40E+05	5.28E+05	7.17E+05	1.46E+06	2.20E+06	2.94E+06	3.66E+06	4.55E+06	6.02E+06	7.17E+06	8.85E+06	1.05E+07	1.16E+07	1.36E+07	1.66E+07	1.90E+07	1.94E+07
	2.32E+04	2.42E+04	5.28E+04	1.09E+05	2.72E+05	3.78E+05	4.62E+05	6.49E+05	7.19E+05	7.46E+05	7.55E+05	7.60E+05	7.61E+05	7.61E+05	7.61E+05	7.61E+05	7.61E+05	7.61E+05	7.61E+05	7.61E+05	7.61E+05
	2.38E+04	2.49E+04	5.56E+04	1.19E+05	3.40E+05	5.29E+05	7.17E+05	1.46E+06	2.19E+06	2.90E+06	3.60E+06	4.45E+06	5.83E+06	6.90E+06	8.43E+06	9.88E+06	1.08E+07	1.26E+07	1.50E+07	1.69E+07	1.73E+07
	2.59E+04	2.70E+04	5.98E+04	1.26E+05	3.40E+05	5.04E+05	6.52E+05	1.11E+06	1.42E+06	1.62E+06	1.75E+06	1.86E+06	1.95E+06	1.98E+06	2.00E+06	2.01E+06	2.01E+06	2.01E+06	2.01E+06	2.01E+06	2.01E+06
	1.89E+04	1.97E+04	4.00E+04	7.25E+04	1.27E+05	1.42E+05	1.47E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05	1.49E+05
	1.24E+04	1.28E+04	2.29E+04	3.38E+04	4.10E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04	4.13E+04
	2.26E+04	2.37E+04	5.28E+04	1.13E+05	3.21E+05	4.97E+05	6.71E+05	1.34E+06	1.98E+06	2.59E+06	3.17E+06	3.85E+06	4.90E+06	5.65E+06	6.68E+06	7.58E+06	8.12E+06	9.07E+06	1.02E+07	1.10E+07	1.11E+07
	9.69E+03	1.01E+04	2.26E+04	4.82E+04	1.37E+05	2.12E+05	2.85E+05	5.69E+05	8.34E+05	1.08E+06	1.32E+06	1.59E+06	2.00E+06	2.29E+06	2.67E+06	3.00E+06	3.19E+06	3.52E+06	3.90E+06	4.13E+06	4.17E+06
	5.05E+00	5.28E+00	1.18E+01	2.52E+01	7.23E+01	1.13E+02	1.53E+02	3.14E+02	4.76E+02	6.37E+02	7.98E+02	1.00E+03	1.34E+03	1.61E+03	2.01E+03	2.41E+03	2.68E+03	3.22E+03	4.03E+03	4.70E+03	4.83E+03
	1.26E+03	1.32E+03	2.95E+03	6.31E+03	1.81E+04	2.82E+04	3.82E+04	7.84E+04	1.18E+05	1.58E+05	1.98E+05	2.47E+05	3.29E+05	3.94E+05	4.90E+05	5.85E+05	6.48E+05	7.73E+05	9.57E+05	1.11E+06	1.14E+06
	1.38E+02	1.44E+02	3.21E+02	6.89E+02	1.97E+03	3.08E+03	4.18E+03	8.58E+03	1.30E+04	1.74E+04	2.18E+04	2.73E+04	3.65E+04	4.38E+04	5.48E+04	6.58E+04	7.32E+04	8.78E+04	1.10E+05	1.28E+05	1.32E+05

Gamma *(Photon)* Radiation Energy in Containment at Given Timesteps (MeV)

1	2	2.0336	3	5	12	18	24	48	72	96	120	150	200	240	300	360	400	480	600	700	720
	3.00E+17	3.14E+17	7.14E+17	1.54E+18	4.44E+18	6.92E+18	9.40E+18	1.93E+19	2.92E+19	3.92E+19	4.91E+19	6.15E+19	8.21E+19	9.87E+19	1.23E+20	1.48E+20	1.65E+20	1.98E+20	2.47E+20	2.88E+20	2.97E+20
	3.56E+20	3.71E+20	7.75E+20	1.44E+21	2.66E+21	3.03E+21	3.18E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21	3.28E+21
	2.01E+21	2.08E+21	3.59E+21	5.04E+21	5.75E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21	5.77E+21
	1.07E+22	1.12E+22	2.23E+22	3.84E+22	5.93E+22	6.29E+22	6.37E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22	6.39E+22
	8.40E+20	8.79E+20	1.99E+21	4.28E+21	1.21E+22	1.85E+22	2.48E+22	4.78E+22	6.80E+22	8.56E+22	1.01E+23	1.18E+23	1.40E+23	1.54E+23	1.70E+23	1.82E+23	1.87E+23	1.96E+23	2.03E+23	2.06E+23	2.07E+23
	1.68E+21	1.76E+21	3.83E+21	7.66E+21	1.73E+22	2.23E+22	2.55E+22	3.00E+22	3.08E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22	3.09E+22
	9.58E+20	1.01E+21	2.39E+21	5.23E+21	1.50E+22	2.32E+22	3.13E+22	6.17E+22	8.97E+22	1.15E+23	1.39E+23	1.66E+23	2.04E+23	2.30E+23	2.63E+23	2.90E+23	3.04E+23	3.28E+23	3.53E+23	3.67E+23	3.70E+23
	5.49E+21	5.72E+21	1.14E+22	1.90E+22	2.71E+22	2.81E+22	2.82E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22	2.83E+22
	3.02E+21	3.17E+21	7.39E+21	1.57E+22	4.08E+22	5.82E+22	7.23E+22	1.08E+23	1.23E+23	1.31E+23	1.34E+23	1.35E+23	1.36E+23	1.36E+23	1.36E+23	1.36E+23	1.36E+23	1.36E+23	1.36E+23	1.36E+23	1.36E+23
	5.27E+21	5.43E+21	8.52E+21	1.07E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22	1.12E+22
	6.63E+21	6.94E+21	1.55E+22	3.07E+22	6.45E+22	7.91E+22	8.69E+22	9.51E+22	9.57E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22	9.58E+22
	4.69E+17	4.94E+17	1.19E+18	2.63E+18	7.63E+18	1.19E+19	1.61E+19	3.25E+19	4.83E+19	6.36E+19	7.83E+19	9.59E+19	1.24E+20	1.44E+20	1.73E+20	1.99E+20	2.15E+20	2.44E+20	2.82E+20	3.08E+20	3.13E+20
	8.65E+20	9.09E+20	2.19E+21	4.85E+21	1.42E+22	2.21E+22	3.01E+22	6.20E+22	9.38E+22	1.26E+23	1.57E+23	1.97E+23	2.63E+23	3.16E+23	3.95E+23	4.74E+23	5.26E+23	6.31E+23	7.87E+23	9.17E+23	9.43E+23
	3.34E+20	3.52E+20	8.48E+20	1.87E+21	5.42E+21	8.41E+21	1.14E+22	2.28E+22	3.37E+22	4.40E+22	5.37E+22	6.52E+22	8.28E+22	9.55E+22	1.13E+23	1.28E+23	1.37E+23	1.52E+23	1.71E+23	1.83E+23	1.86E+23
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	3.34E+19	3.49E+19	7.76E+19	1.65E+20	4.61E+20	7.02E+20	9.33E+20	1.76E+21	2.45E+21	3.03E+21	3.51E+21	4.00E+21	4.61E+21	4.96E+21	5.32E+21	5.55E+21	5.65E+21	5.78E+21	5.88E+21	5.92E+21	5.92E+21
	1.71E+20	1.78E+20	3.66E+20	6.73E+20	1.22E+21	1.38E+21	1.45E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21	1.48E+21
	2.19E+17	2.29E+17	4.91E+17	9.77E+17	2.21E+18	2.86E+18	3.27E+18	3.89E+18	4.00E+18	4.01E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18	4.02E+18
	7.62E+16	7.96E+16	1.78E+17	3.81E+17	1.09E+18	1.70E+18	2.31E+18	4.72E+18	7.12E+18	9.51E+18	1.19E+19	1.48E+19	1.97E+19	2.35E+19	2.92E+19	3.48E+19	3.85E+19	4.57E+19	5.63E+19	6.48E+19	6.65E+19
	3.61E+18	3.72E+18	6.23E+18	8.47E+18	9.43E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18	9.44E+18
	8.79E+17	9.19E+17	2.05E+18	4.39E+18	1.25E+19	1.95E+19	2.64E+19	5.37E+19	8.05E+19	1.07E+20	1.32E+20	1.64E+20	2.14E+20	2.53E+20	3.09E+20	3.62E+20	3.96E+20	4.60E+20	5.49E+20	6.16E+20	6.29E+20
	9.39E+19	9.81E+19	2.16E+20	4.53E+20	1.20E+21	1.75E+21	2.23E+21	3.60E+21	4.39E+21	4.84E+21	5.10E+21	5.28E+21	5.40E+21	5.43E+21	5.45E+21	5.45E+21	5.45E+21	5.45E+21	5.45E+21	5.45E+21	5.45E+21
	1.53E+20	1.60E+20	3.56E+20	7.56E+20	2.10E+21	3.19E+21	4.22E+21	7.84E+21	1.08E+22	1.31E+22	1.50E+22	1.69E+22	1.91E+22	2.03E+22	2.15E+22	2.21E+22	2.24E+22	2.28E+22	2.30E+22	2.31E+22	2.31E+22
	2.69E+16	2.81E+16	6.27E+16	1.34E+17	3.84E+17	5.97E+17	8.10E+17	1.65E+18	2.49E+18	3.31E+18	4.11E+18	5.11E+18	6.73E+18	8.00E+18	9.84E+18	1.16E+19	1.28E+19	1.50E+19	1.82E+19	2.06E+19	2.11E+19
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	1.65E+20	1.72E+20	3.69E+20	7.36E+20	1.67E+21	2.17E+21	2.49E+21	2.97E+21	3.05E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21	3.07E+21
	2.59E+20	2.70E+20	5.27E+20	8.94E+20	1.35E+21	1.42E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21	1.44E+21
	6.04E+18	6.24E+18	1.09E+19	1.56E+19	1.82E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19
	6.57E+19	6.86E+19	1.53E+20	3.27E+20	9.31E+20	1.44E+21	1.94E+21	3.89E+21	5.73E+21	7.47E+21	9.12E+21	1.11E+22	1.40E+22	1.62E+22	1.90E+22	2.15E+22	2.30E+22	2.56E+22	2.87E+22	3.07E+22	3.11E+22
	1.31E+18	1.37E+18	3.06E+18	6.56E+18	1.88E+19	2.92E+19	3.97E+19	8.11E+19	1.22E+20	1.63E+20	2.03E+20	2.53E+20	3.34E+20	3.99E+20	4.93E+20	5.85E+20	6.45E+20	7.62E+20	9.31E+20	1.07E+21	1.09E+21
	3.98E+18	4.16E+18	9.29E+18	1.99E+19	5.71E+19	8.89E+19	1.21E+20	2.48E+20	3.75E+20	5.03E+20	6.30E+20	7.89E+20	1.05E+21	1.26E+21	1.58E+21	1.90E+21	2.11E+21	2.53E+21	3.16E+21	3.69E+21	3.79E+21
	6.83E+18	7.13E+18	1.58E+19	3.36E+19	9.28E+19	1.40E+20	1.85E+20	3.37E+20	4.56E+20	5.48E+20	6.19E+20	6.87E+20	7.61E+20	7.98E+20	8.31E+20	8.49E+20	8.56E+20	8.63E+20	8.67E+20	8.68E+20	8.68E+20
	4.18E+18	4.35E+18	9.14E+18	1.75E+19	3.54E+19	4.26E+19	4.62E+19	4.96E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19	4.98E+19
	1.79E+19	1.87E+19	4.17E+19	8.94E+19	2.56E+20	3.97E+20	5.38E+20	1.10E+21	1.65E+21	2.18E+21	2.71E+21	3.36E+21	4.41E+21	5.23E+21	6.40E+21	7.53E+21	8.25E+21	9.63E+21	1.16E+22	1.30E+22	1.33E+22
	1.59E+19	1.66E+19	3.41E+19	6.29E+19	1.15E+20	1.31E+20	1.37E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	1.83E+18	1.91E+18	4.22E+18	8.86E+18	2.37E+19	3.50E+19	4.50E+19	7.50E+19	9.38E+19	1.05E+20	1.13E+20	1.18E+20	1.22E+20	1.24E+20	1.25E+20	1.25E+20	1.25E+20	1.25E+20	1.25E+20	1.25E+20	1.25E+20
	6.08E+17	6.35E+17	1.42E+18	3.03E+18	8.67E+18	1.35E+19	1.82E+19	3.71E+19	5.56E+19	7.36E+19	9.13E+19	1.13E+20	1.48E+20	1.74E+20	2.13E+20	2.49E+20	2.72E+20	3.16E+20	3.76E+20	4.22E+20	4.30E+20
	2.07E+18	2.16E+18	4.76E+18	9.99E+18	2.67E+19	3.91E+19	5.01E+19	8.25E+19	1.02E+20	1.14E+20	1.21E+20	1.26E+20	1.30E+20	1.31E+20	1.32E+20	1.32E+20	1.32E+20	1.32E+20	1.32E+20	1.32E+20	1.32E+20
	1.22E+17	1.28E+17	2.85E+17	6.11E+17	1.75E+18	2.73E+18	3.70E+18	7.59E+18	1.15E+19	1.54E+19	1.92E+19	2.40E+19	3.20E+19	3.84E+19	4.79E+19	5.74E+19	6.36E+19	7.61E+19	9.46E+19	1.10E+20	1.13E+20
	1.61E+19	1.68E+19	3.72E+19	7.88E+19	2.16E+20	3.25E+20	4.27E+20	7.65E+20	1.02E+21	1.20E+21	1.34E+21	1.47E+21	1.60E+21	1.66E+21	1.71E+21	1.73E+21	1.74E+21	1.75E+21	1.75E+21	1.75E+21	1.75E+21
	5.06E+13	5.29E+13	1.18E+14	2.53E+14	7.26E+14	1.13E+15	1.54E+15	3.16E+15	4.78E+15	6.40E+15	8.02E+15	1.00E+16	1.34E+16	1.61E+16	2.02E+16	2.42E+16	2.69E+16	3.23E+16	4.04E+16	4.72E+16	4.85E+16
	1.26E+13	1.27E+13	1.45E+13	1.82E+13	3.11E+13	4.22E+13	5.32E+13	9.75E+13	1.42E+14	1.86E+14	2.30E+14	2.86E+14	3.78E+14	4.52E+14	5.62E+14	6.73E+14	7.47E+14	8.94E+14	1.12E+15	1.30E+15	1.34E+15
	2.34E+12	2.49E+12	6.95E+12	1.62E+13	4.85E+13	7.62E+13	1.04E+14	2.15E+14	3.26E+14	4.36E+14	5.47E+14	6.86E+14	9.17E+14	1.10E+15	1.38E+15	1.66E+15	1.84E+15	2.21E+15	2.76E+15	3.23E+15	3.32E+15
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	8.78E+15	9.17E+15	2.05E+16	4.39E+16	1.26E+17	1.95E+17	2.65E+17	5.41E+17	8.14E+17	1.08E+18	1.35E+18	1.68E+18	2.22E+18	2.64E+18	3.25E+18	3.85E+18	4.24E+18	4.99E+18	6.07E+18	6.92E+18	7.08E+18
	5.34E+17	5.56E+17	1.12E+18	2.00E+18	3.36E+18	3.68E+18	3.78E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18	3.82E+18
	2.57E+17	2.68E+17	5.76E+17	1.15E+18	2.65E+18	3.47E+18	4.01E+18	4.87E+18	5.03E+18	5.06E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18	5.07E+18
	2.32E+18	2.43E+18	5.42E+18	1.16E+19	3.32E+19	5.17E+19	7.01E+19	1.43E+20	2.16E+20	2.87E+20	3.58E+20	4.46E+20	5.89E+20	7.01E+20	8.66E+20	1.03E+21	1.13E+21	1.33E+21	1.63E+21	1.86E+21	1.90E+21
	5.57E+17	5.82E+17	1.27E+18	2.61E+18	6.53E+18	9.10E+18	1.11E+19	1.56E+19	1.73E+19	1.79E+19	1.82E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19	1.83E+19
	2.43E+18	2.54E+18	5.66E+18	1.21E+19	3.47E+19	5.39E+19	7.30E+19	1.49E+20	2.23E+20	2.95E+20	3.66E+20	4.53E+20	5.94E+20	7.02E+20	8.58E+20	1.01E+21	1.10E+21	1.28E+21	1.53E+21	1.72E+21	1.76E+21
	7.99E+18	8.34E+18	1.85E+19	3.88E+19	1.05E+20	1.56E+20	2.01E+20	3.43E+20	4.37E+20	5.00E+20	5.41E+20	5.73E+20	6.01E+20	6.11E+20	6.18E+20	6.20E+20	6.21E+20	6.21E+20	6.21E+20	6.21E+20	6.21E+20
	1.07E+17	1.12E+17	2.27E+17	4.12E+17	7.22E+17	8.05E+17	8.34E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17	8.49E+17
	4.48E+18	4.64E+18	8.28E+18	1.22E+19	1.48E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19	1.50E+19
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	1.82E+17	1.90E+17	4.23E+17	9.04E+17	2.57E+18	3.97E+18	5.35E+18	1.07E+19	1.56E+19	2.03E+19	2.47E+19	2.98E+19	3.75E+19	4.30E+19	5.01E+19	5.63E+19	5.98E+19	6.60E+19	7.30E+19	7.74E+19	7.82E+19
	1.89E+13	1.98E+13	4.41E+13	9.44E+13	2.71E+14	4.22E+14	5.73E+14	1.18E+15	1.78E+15	2.38E+15	2.99E+15	3.74E+15	5.00E+15	6.01E+15	7.52E+15	9.03E+15	1.00E+16	1.20E+16	1.51E+16	1.76E+16	1.81E+16
	2.82E+14	2.94E+14	6.57E+14	1.41E+15	4.03E+15	6.28E+15	8.53E+15	1.75E+16	2.64E+16	3.53E+16	4.41E+16	5.51E+16	7.33E+16	8.78E+16	1.09E+17	1.31E+17	1.45E+17	1.72E+17	2.13E+17	2.47E+17	2.53E+17
	2.73E+13	2.86E+13	6.38E+13	1.37E+14	3.92E+14	6.10E+14	8.29E+14	1.70E+15	2.58E+15	3.45E+15	4.33E+15	5.42E+15	7.24E+15	8.70E+15	1.09E+16	1.31E+16	1.45E+16	1.74E+16	2.18E+16	2.54E+16	2.62E+16
	3.92E+22	4.09E+22	8.30E+22	1.49E+23	2.85E+23	3.57E+23	4.11E+23	5.66E+23	6.82E+23	7.81E+23	8.71E+23	9.73E+23	1.13E+24	1.24E+24	1.39E+24	1.53E+24	1.61E+24	1.77E+24	1.98E+24	2.15E+24	2.18E+24

Total Integrated Gamma Energy in Containment at Given Timesteps (MeV/cm^3)

	3.42E+12	3.56E+12	7.22E+12	1.30E+13	2.48E+13	3.10E+13	3.58E+13	4.93E+13	5.94E+13	6.80E+13	7.58E+13	8.47E+13	9.80E+13	1.08E+14	1.21E+14	1.33E+14	1.40E+14	1.54E+14	1.73E+14	1.87E+14	1.90E+14

Beta Particle Radiation Energy in Containment at Given Timesteps (MeV)

1	2	2.0336	3	5	12	18	24	48	72	96	120	150	200	240	300	360	400	480	600	700	720
	3.37E+19	3.52E+19	8.01E+19	1.73E+20	4.98E+20	7.77E+20	1.06E+21	2.17E+21	3.28E+21	4.40E+21	5.51E+21	6.90E+21	9.22E+21	1.11E+22	1.39E+22	1.66E+22	1.85E+22	2.22E+22	2.78E+22	3.24E+22	3.33E+22
	5.17E+20	5.39E+20	1.12E+21	2.09E+21	3.86E+21	4.40E+21	4.62E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21	4.76E+21
	3.36E+21	3.47E+21	5.99E+21	8.40E+21	9.59E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21	9.62E+21
	1.98E+21	2.06E+21	4.10E+21	7.06E+21	1.09E+22	1.16E+22	1.17E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22	1.18E+22
	1.86E+21	1.95E+21	4.42E+21	9.49E+21	2.68E+22	4.11E+22	5.50E+22	1.06E+23	1.51E+23	1.90E+23	2.24E+23	2.61E+23	3.11E+23	3.42E+23	3.77E+23	4.02E+23	4.15E+23	4.34E+23	4.50E+23	4.57E+23	4.58E+23
	2.05E+21	2.15E+21	4.68E+21	9.36E+21	2.11E+22	2.72E+22	3.11E+22	3.67E+22	3.76E+22	3.77E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22	3.78E+22
	4.56E+20	4.79E+20	1.14E+21	2.49E+21	7.16E+21	1.11E+22	1.49E+22	2.94E+22	4.27E+22	5.49E+22	6.61E+22	7.88E+22	9.71E+22	1.10E+23	1.25E+23	1.38E+23	1.45E+23	1.56E+23	1.68E+23	1.75E+23	1.76E+23
	1.16E+21	1.21E+21	2.42E+21	4.04E+21	5.76E+21	5.95E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21	5.99E+21
	2.03E+21	2.13E+21	4.96E+21	1.05E+22	2.74E+22	3.90E+22	4.85E+22	7.22E+22	8.28E+22	8.76E+22	8.97E+22	9.09E+22	9.14E+22	9.15E+22	9.15E+22	9.15E+22	9.15E+22	9.15E+22	9.15E+22	9.15E+22	9.15E+22
	1.21E+21	1.25E+21	1.96E+21	2.45E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21	2.57E+21
	1.55E+21	1.62E+21	3.62E+21	7.17E+21	1.51E+22	1.85E+22	2.03E+22	2.22E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22	2.24E+22
	3.31E+18	3.49E+18	8.41E+18	1.86E+19	5.39E+19	8.38E+19	1.14E+20	2.30E+20	3.41E+20	4.49E+20	5.53E+20	6.77E+20	8.72E+20	1.02E+21	1.22E+21	1.40E+21	1.52E+21	1.72E+21	1.99E+21	2.18E+21	2.21E+21
	8.72E+19	9.17E+19	2.21E+20	4.90E+20	1.43E+21	2.23E+21	3.04E+21	6.25E+21	9.46E+21	1.27E+22	1.59E+22	1.99E+22	2.65E+22	3.19E+22	3.98E+22	4.78E+22	5.31E+22	6.36E+22	7.94E+22	9.25E+22	9.51E+22
	1.54E+19	1.62E+19	3.91E+19	8.64E+19	2.50E+20	3.88E+20	5.25E+20	1.05E+21	1.55E+21	2.03E+21	2.48E+21	3.01E+21	3.82E+21	4.41E+21	5.20E+21	5.89E+21	6.30E+21	7.02E+21	7.90E+21	8.46E+21	8.56E+21
	5.92E+19	6.22E+19	1.50E+20	3.32E+20	9.69E+20	1.52E+21	2.06E+21	4.25E+21	6.43E+21	8.62E+21	1.08E+22	1.35E+22	1.81E+22	2.17E+22	2.72E+22	3.26E+22	3.63E+22	4.35E+22	5.45E+22	6.35E+22	6.54E+22
	1.57E+19	1.64E+19	3.65E+19	7.75E+19	2.17E+20	3.30E+20	4.39E+20	8.27E+20	1.15E+21	1.42E+21	1.65E+21	1.88E+21	2.17E+21	2.33E+21	2.50E+21	2.61E+21	2.65E+21	2.72E+21	2.76E+21	2.78E+21	2.78E+21
	4.29E+19	4.46E+19	9.15E+19	1.68E+20	3.05E+20	3.46E+20	3.61E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20	3.71E+20
	1.01E+19	1.05E+19	2.26E+19	4.50E+19	1.02E+20	1.32E+20	1.51E+20	1.79E+20	1.84E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20	1.85E+20
	3.13E+16	3.27E+16	7.30E+16	1.56E+17	4.48E+17	6.97E+17	9.46E+17	1.94E+18	2.92E+18	3.90E+18	4.87E+18	6.08E+18	8.07E+18	9.65E+18	1.20E+19	1.43E+19	1.58E+19	1.87E+19	2.31E+19	2.66E+19	2.73E+19
	3.28E+19	3.39E+19	5.67E+19	7.71E+19	8.58E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19	8.59E+19
	4.72E+18	4.94E+18	1.10E+19	2.36E+19	6.74E+19	1.05E+20	1.42E+20	2.89E+20	4.33E+20	5.73E+20	7.11E+20	8.80E+20	1.15E+21	1.36E+21	1.66E+21	1.95E+21	2.13E+21	2.47E+21	2.95E+21	3.31E+21	3.38E+21
	9.52E+18	9.94E+18	2.19E+19	4.59E+19	1.22E+20	1.77E+20	2.26E+20	3.65E+20	4.45E+20	4.91E+20	5.17E+20	5.35E+20	5.47E+20	5.50E+20	5.52E+20	5.52E+20	5.52E+20	5.52E+20	5.52E+20	5.52E+20	5.52E+20
	3.95E+19	4.12E+19	9.16E+19	1.95E+20	5.41E+20	8.21E+20	1.09E+21	2.02E+21	2.77E+21	3.38E+21	3.87E+21	4.36E+21	4.93E+21	5.23E+21	5.53E+21	5.70E+21	5.78E+21	5.86E+21	5.92E+21	5.94E+21	5.94E+21
	1.15E+20	1.20E+20	2.68E+20	5.74E+20	1.64E+21	2.55E+21	3.46E+21	7.07E+21	1.06E+22	1.41E+22	1.76E+22	2.18E+22	2.88E+22	3.42E+22	4.21E+22	4.97E+22	5.46E+22	6.42E+22	7.77E+22	8.82E+22	9.03E+22
	4.39E+18	4.58E+18	1.02E+19	2.19E+19	6.29E+19	9.80E+19	1.33E+20	2.73E+20	4.14E+20	5.54E+20	6.94E+20	8.70E+20	1.16E+21	1.40E+21	1.75E+21	2.10E+21	2.33E+21	2.80E+21	3.50E+21	4.08E+21	4.20E+21
	1.57E+20	1.64E+20	3.51E+20	7.00E+20	1.59E+21	2.06E+21	2.37E+21	2.82E+21	2.90E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21	2.92E+21
	3.87E+19	4.03E+19	7.87E+19	1.34E+20	2.02E+20	2.13E+20	2.15E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20	2.16E+20
	1.54E+20	1.59E+20	2.77E+20	3.96E+20	4.63E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20	4.65E+20
	9.33E+19	9.75E+19	2.17E+20	4.65E+20	1.32E+21	2.05E+21	2.76E+21	5.52E+21	8.14E+21	1.06E+22	1.30E+22	1.57E+22	1.99E+22	2.29E+22	2.70E+22	3.06E+22	3.27E+22	3.64E+22	4.08E+22	4.36E+22	4.41E+22
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	1.52E+17	1.59E+17	3.55E+17	7.61E+17	2.18E+18	3.40E+18	4.62E+18	9.48E+18	1.43E+19	1.92E+19	2.41E+19	3.01E+19	4.03E+19	4.84E+19	6.05E+19	7.26E+19	8.07E+19	9.68E+19	1.21E+20	1.41E+20	1.45E+20
	1.73E+19	1.81E+19	4.02E+19	8.52E+19	2.35E+20	3.56E+20	4.69E+20	8.56E+20	1.16E+21	1.39E+21	1.57E+21	1.74E+21	1.93E+21	2.03E+21	2.11E+21	2.15E+21	2.17E+21	2.19E+21	2.20E+21	2.20E+21	2.20E+21
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	2.50E+18	2.61E+18	5.83E+18	1.25E+19	3.57E+19	5.55E+19	7.52E+19	1.53E+20	2.30E+20	3.05E+20	3.79E+20	4.69E+20	6.16E+20	7.29E+20	8.93E+20	1.05E+21	1.15E+21	1.34E+21	1.61E+21	1.82E+21	1.86E+21
	8.17E+18	8.51E+18	1.75E+19	3.23E+19	5.91E+19	6.73E+19	7.06E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19	7.26E+19
	1.53E+17	1.60E+17	3.57E+17	7.64E+17	2.19E+18	3.41E+18	4.63E+18	9.51E+18	1.44E+19	1.92E+19	2.41E+19	3.01E+19	4.02E+19	4.82E+19	6.02E+19	7.21E+19	8.00E+19	9.58E+19	1.19E+20	1.39E+20	1.42E+20
	3.58E+18	3.74E+18	8.27E+18	1.74E+19	4.65E+19	6.86E+19	8.81E+19	1.47E+20	1.84E+20	2.07E+20	2.21E+20	2.32E+20	2.40E+20	2.43E+20	2.44E+20	2.45E+20	2.45E+20	2.45E+20	2.45E+20	2.45E+20	2.45E+20
	1.14E+18	1.20E+18	2.67E+18	5.71E+18	1.63E+19	2.54E+19	3.44E+19	6.99E+19	1.05E+20	1.39E+20	1.72E+20	2.13E+20	2.78E+20	3.28E+20	4.00E+20	4.69E+20	5.12E+20	5.95E+20	7.08E+20	7.94E+20	8.10E+20
	3.10E+18	3.23E+18	7.14E+18	1.50E+19	4.00E+19	5.86E+19	7.51E+19	1.24E+20	1.53E+20	1.71E+20	1.81E+20	1.89E+20	1.95E+20	1.96E+20	1.97E+20	1.98E+20	1.98E+20	1.98E+20	1.98E+20	1.98E+20	1.98E+20
	5.28E+17	5.51E+17	1.23E+18	2.64E+18	7.56E+18	1.18E+19	1.60E+19	3.28E+19	4.96E+19	6.63E+19	8.30E+19	1.04E+20	1.38E+20	1.66E+20	2.07E+20	2.48E+20	2.75E+20	3.29E+20	4.09E+20	4.75E+20	4.88E+20
	1.07E+19	1.12E+19	2.49E+19	5.27E+19	1.45E+20	2.18E+20	2.85E+20	5.12E+20	6.80E+20	8.06E+20	8.99E+20	9.83E+20	1.07E+21	1.11E+21	1.14E+21	1.16E+21	1.16E+21	1.17E+21	1.17E+21	1.17E+21	1.17E+21
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	5.70E+15	5.95E+15	1.33E+16	2.85E+16	8.17E+16	1.27E+17	1.73E+17	3.55E+17	5.37E+17	7.20E+17	9.02E+17	1.13E+18	1.51E+18	1.81E+18	2.27E+18	2.72E+18	3.03E+18	3.63E+18	4.54E+18	5.30E+18	5.45E+18
	2.12E+17	2.22E+17	4.92E+17	1.04E+18	2.88E+18	4.34E+18	5.72E+18	1.04E+19	1.40E+19	1.68E+19	1.89E+19	2.10E+19	2.31E+19	2.42E+19	2.52E+19	2.56E+19	2.58E+19	2.60E+19	2.61E+19	2.62E+19	2.62E+19
	1.46E+18	1.53E+18	3.41E+18	7.31E+18	2.09E+19	3.25E+19	4.41E+19	9.02E+19	1.36E+20	1.81E+20	2.25E+20	2.80E+20	3.69E+20	4.39E+20	5.42E+20	6.41E+20	7.06E+20	8.32E+20	1.01E+21	1.15E+21	1.18E+21
	3.07E+18	3.19E+18	6.42E+18	1.15E+19	1.93E+19	2.11E+19	2.17E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19	2.20E+19
	3.38E+18	3.52E+18	7.58E+18	1.52E+19	3.49E+19	4.56E+19	5.28E+19	6.41E+19	6.62E+19	6.67E+19	6.67E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19	6.68E+19
	3.67E+17	3.84E+17	8.57E+17	1.83E+18	5.25E+18	8.17E+18	1.11E+19	2.27E+19	3.41E+19	4.54E+19	5.66E+19	7.05E+19	9.31E+19	1.11E+20	1.37E+20	1.62E+20	1.79E+20	2.11E+20	2.57E+20	2.93E+20	3.01E+20
	2.15E+18	2.25E+18	4.91E+18	1.01E+19	2.52E+19	3.51E+19	4.29E+19	6.03E+19	6.68E+19	6.93E+19	7.02E+19	7.06E+19	7.07E+19	7.07E+19	7.07E+19	7.07E+19	7.07E+19	7.07E+19	7.07E+19	7.07E+19	7.07E+19
	1.38E+17	1.44E+17	3.22E+17	6.89E+17	1.97E+18	3.06E+18	4.15E+18	8.44E+18	1.26E+19	1.68E+19	2.08E+19	2.58E+19	3.37E+19	3.99E+19	4.87E+19	5.72E+19	6.26E+19	7.28E+19	8.70E+19	9.78E+19	9.99E+19
	1.82E+18	1.90E+18	4.20E+18	8.85E+18	2.39E+19	3.54E+19	4.58E+19	7.82E+19	9.96E+19	1.14E+20	1.23E+20	1.31E+20	1.37E+20	1.39E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20	1.41E+20
	2.39E+18	2.48E+18	5.05E+18	9.16E+18	1.60E+19	1.79E+19	1.85E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19	1.89E+19
	1.39E+18	1.44E+18	2.57E+18	3.81E+18	4.62E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18	4.65E+18
	9.52E+17	9.95E+17	2.22E+18	4.74E+18	1.35E+19	2.09E+19	2.82E+19	5.65E+19	8.34E+19	1.09E+20	1.33E+20	1.62E+20	2.06E+20	2.38E+20	2.81E+20	3.19E+20	3.41E+20	3.81E+20	4.30E+20	4.62E+20	4.67E+20
	3.01E+17	3.15E+17	7.02E+17	1.50E+18	4.26E+18	6.59E+18	8.88E+18	1.77E+19	2.59E+19	3.37E+19	4.10E+19	4.95E+19	6.22E+19	7.13E+19	8.32E+19	9.33E+19	9.93E+19	1.09E+20	1.21E+20	1.28E+20	1.30E+20
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	1.72E+22	1.79E+22	3.66E+22	6.74E+22	1.41E+23	1.87E+23	2.24E+23	3.38E+23	4.23E+23	4.95E+23	5.57E+23	6.25E+23	7.21E+23	7.86E+23	8.68E+23	9.36E+23	9.75E+23	1.04E+24	1.12E+24	1.18E+24	1.19E+24

Total Integrated Beta Energy in Containment at Given Timesteps (MeV/cm^3)

1	2	2.0336	3	5	12	18	24	48	72	96	120	150	200	240	300	360	400	480	600	700	720
	1.49E+12	1.56E+12	3.18E+12	5.87E+12	1.23E+13	1.62E+13	1.95E+13	2.94E+13	3.69E+13	4.31E+13	4.85E+13	5.44E+13	6.28E+13	6.84E+13	7.56E+13	8.15E+13	8.49E+13	9.07E+13	9.78E+13	1.03E+14	1.04E+14

Class	Isotopic Nuclide	24 Hours	96 Hours	720 Hours	24 Hours	96 Hours
9	Am-241	1.31E-02	5.47E-02	4.15E-01	1.10E+02	4.56E+02
6	Ba-139	4.41E+02	4.41E+02	4.41E+02	3.68E+06	3.68E+06
6	Ba-140	9.05E+03	3.48E+04	1.45E+05	7.55E+07	2.90E+08
8	Ce-141	2.11E+02	8.52E+02	4.98E+03	1.76E+06	7.11E+06
8	Ce-143	1.53E+02	3.48E+02	4.03E+02	1.28E+06	2.90E+06
8	Ce-144	1.81E+02	7.49E+02	5.51E+03	1.51E+06	6.25E+06
9	Cm-242	5.96E+00	2.47E+01	1.77E+02	4.97E+04	2.06E+05
9	Cm-244	1.15E+00	4.79E+00	3.63E+01	9.59E+03	3.99E+04
7	Co-58	3.63E+00	1.49E+01	9.98E+01	3.03E+04	1.24E+05
7	Co-60	4.36E+00	1.82E+01	1.37E+02	3.64E+04	1.52E+05
3	Cs-134	1.14E+04	4.75E+04	3.56E+05	9.49E+07	3.96E+08
3	Cs-136	3.38E+03	1.31E+04	5.51E+04	2.82E+07	1.09E+08
3	Cs-137	1.01E+04	4.24E+04	3.21E+05	8.46E+07	3.53E+08
2	I-131	7.24E+04	2.67E+05	8.56E+05	6.04E+08	2.23E+09
2	I-132	1.11E+04	1.11E+04	1.11E+04	9.22E+07	9.23E+07
2	I-133	1.05E+05	1.90E+05	1.99E+05	8.79E+08	1.59E+09
2	I-134	3.76E+03	3.76E+03	3.76E+03	3.13E+07	3.13E+07
2	I-135	4.96E+04	5.47E+04	5.47E+04	4.14E+08	4.56E+08
1	Kr-85	3.56E+03	1.48E+04	1.12E+05	2.97E+07	1.24E+08
1	Kr-85m	1.45E+04	1.49E+04	1.49E+04	1.21E+08	1.25E+08
1	Kr-87	5.34E+03	5.34E+03	5.34E+03	4.45E+07	4.45E+07
1	Kr-88	2.35E+04	2.36E+04	2.36E+04	1.96E+08	1.97E+08
9	La-140	7.85E+01	1.95E+02	2.42E+02	6.55E+05	1.63E+06
9	La-141	1.66E+01	1.69E+01	1.69E+01	1.39E+05	1.41E+05
9	La-142	4.68E+00	4.68E+00	4.68E+00	3.91E+04	3.91E+04
7	Mo-99	1.04E+03	3.10E+03	4.91E+03	8.71E+06	2.58E+07
9	Nb-95	8.70E+01	3.52E+02	2.10E+03	7.26E+05	2.94E+06
9	Nd-147	3.32E+01	1.26E+02	4.86E+02	2.77E+05	1.05E+06
8	Np-239	2.72E+03	7.68E+03	1.12E+04	2.27E+07	6.40E+07
9	Pr-143	7.51E+01	2.90E+02	1.24E+03	6.26E+05	2.42E+06
8	Pu-238	1.22E+00	5.09E+00	3.86E+01	1.02E+04	4.25E+04
8	Pu-239	5.86E-02	2.05E-01	1.47E+00	4.89E+02	1.71E+03
8	Pu-240	1.26E-01	5.28E-01	4.01E+00	1.05E+03	4.40E+03
8	Pu-241	2.45E+01	1.02E+02	7.71E+02	2.04E+05	8.49E+05
3	Rb-86	1.11E+02	4.39E+02	2.16E+03	9.26E+05	3.66E+06
7	Rh-105	4.93E+02	1.16E+03	1.37E+03	4.11E+06	9.64E+06
7	Ru-103	9.89E+02	4.01E+03	2.45E+04	8.25E+06	3.35E+07
7	Ru-105	1.52E+02	1.57E+02	1.57E+02	1.27E+06	1.31E+06
7	Ru-106	3.71E+02	1.54E+03	1.14E+04	3.10E+06	1.29E+07
4	Sb-127	9.90E+02	3.21E+03	6.28E+03	8.26E+06	2.68E+07
4	Sb-129	8.88E+02	9.12E+02	9.12E+02	7.41E+06	7.61E+06
5	Sr-89	4.94E+03	2.02E+04	1.29E+05	4.12E+07	1.68E+08
5	Sr-90	6.29E+02	2.62E+03	1.98E+04	5.25E+06	2.18E+07
5	Sr-91	2.77E+03	3.42E+03	3.43E+03	2.31E+07	2.86E+07
5	Sr-92	8.28E+02	8.30E+02	8.30E+02	6.90E+06	6.92E+06
7	Tc-99m	3.24E+02	3.50E+02	3.50E+02	2.70E+06	2.92E+06
4	Te-127	4.72E+02	5.78E+02	5.79E+02	3.94E+06	4.83E+06
4	Te-127m	1.81E+02	7.45E+02	5.21E+03	1.51E+06	6.22E+06

4	Te-129	1.39E+02	1.39E+02	1.39E+02		1.16E+06	1.16E+06
4	Te-129m	7.73E+02	3.12E+03	1.84E+04		6.45E+06	2.61E+07
4	Te-131m	1.89E+03	4.11E+03	4.63E+03		1.58E+07	3.43E+07
4	Te-132	1.63E+04	5.08E+04	8.93E+04		1.36E+08	4.24E+08
1	Xe-133	4.81E+05	1.66E+06	4.01E+06		4.02E+09	1.39E+10
1	Xe-135	5.97E+04	7.24E+04	7.25E+04		4.98E+08	6.04E+08
9	Y-90	5.68E+00	1.67E+01	2.60E+01		4.74E+04	1.39E+05
9	Y-91	6.42E+01	2.63E+02	1.72E+03		5.36E+05	2.19E+06
9	Y-92	1.16E+01	1.18E+01	1.18E+01		9.71E+04	9.82E+04
9	Y-93	2.36E+01	2.98E+01	2.98E+01		1.97E+05	2.48E+05
9	Zr-95	8.68E+01	3.56E+02	2.35E+03		7.24E+05	2.97E+06
9	Zr-97	5.10E+01	8.23E+01	8.40E+01		4.25E+05	6.86E+05

720 Hours	
3.46E+03	
3.68E+06	
1.21E+09	
4.16E+07	
3.36E+06	
4.60E+07	
1.48E+06	
3.03E+05	**8.343E+03**
8.33E+05	
1.14E+06	
2.97E+09	
4.60E+08	
2.68E+09	
7.14E+09	
9.23E+07	
1.66E+09	
3.13E+07	
4.56E+08	
9.37E+08	
1.25E+08	
4.45E+07	
1.97E+08	
2.02E+06	
1.41E+05	
3.91E+04	
4.10E+07	
1.75E+07	
4.05E+06	
9.32E+07	
1.04E+07	
3.22E+05	
1.23E+04	
3.35E+04	
6.43E+06	
1.80E+07	
1.14E+07	
2.04E+08	
1.31E+06	
9.52E+07	
5.24E+07	
7.61E+06	
1.08E+09	
1.66E+08	
2.86E+07	
6.92E+06	
2.92E+06	
4.83E+06	
4.35E+07	

1.16E+06
1.54E+08
3.86E+07
7.45E+08
3.35E+10
6.05E+08
2.17E+05
1.43E+07
9.82E+04
2.49E+05
1.96E+07
7.01E+05

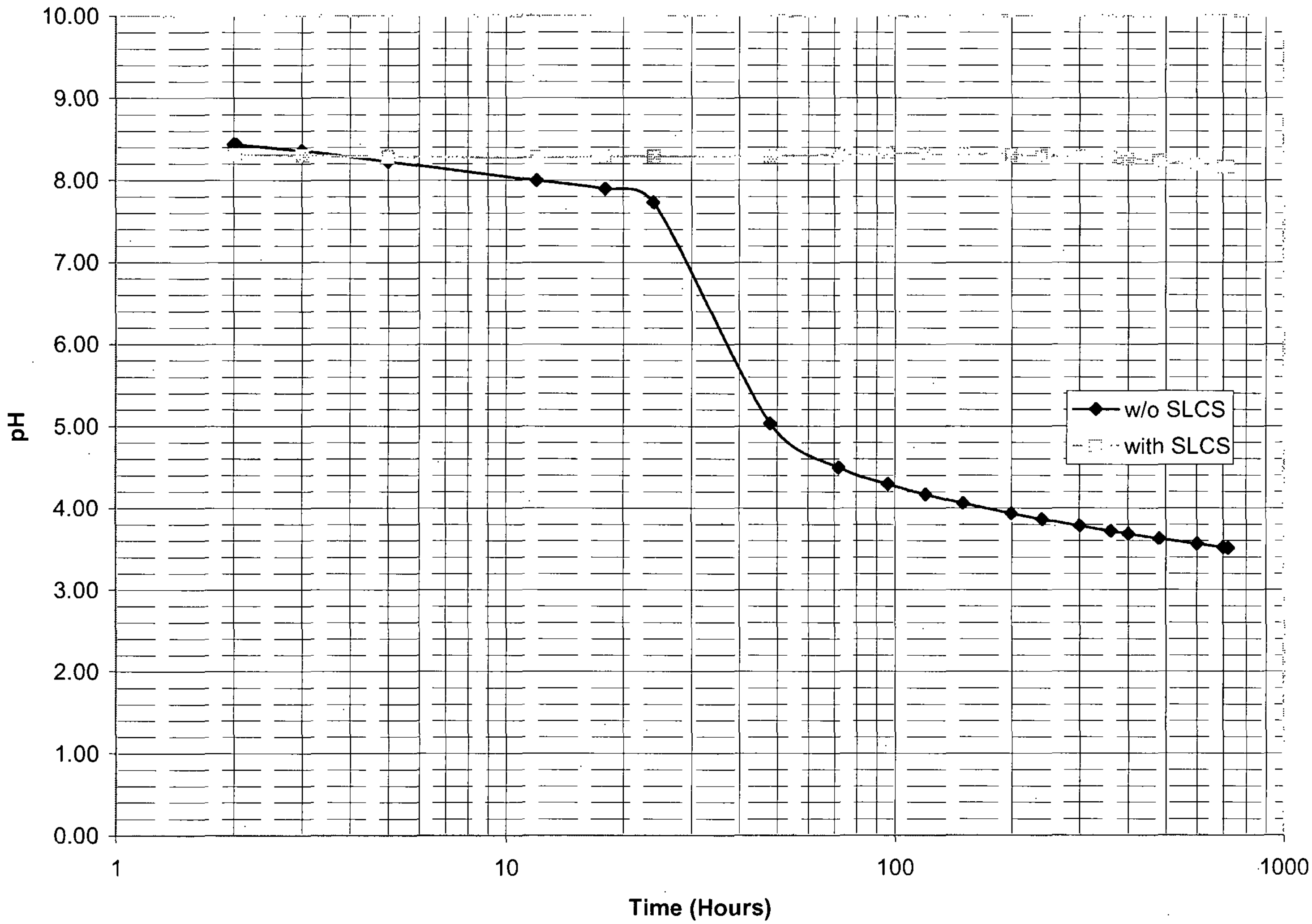
Class	Isotopic Nuclide	24 Hours	96 Hours	720 Hours	24 Hours	96 Hours
9	Am-241	3.19E-02	1.33E-01	1.01E+00	1.10E+02	4.56E+02
6	Ba-139	1.07E+03	1.07E+03	1.07E+03	3.68E+06	3.68E+06
6	Ba-140	2.20E+04	8.46E+04	3.52E+05	7.55E+07	2.90E+08
8	Ce-141	5.14E+02	2.07E+03	1.21E+04	1.76E+06	7.11E+06
8	Ce-143	3.72E+02	8.46E+02	9.80E+02	1.28E+06	2.90E+06
8	Ce-144	4.39E+02	1.82E+03	1.34E+04	1.51E+06	6.25E+06
9	Cm-242	1.45E+01	6.00E+01	4.31E+02	4.97E+04	2.06E+05
9	Cm-244	2.80E+00	1.16E+01	8.82E+01	9.59E+03	3.99E+04
7	Co-58	8.83E+00	3.62E+01	2.43E+02	3.03E+04	1.24E+05
7	Co-60	1.06E+01	4.42E+01	3.34E+02	3.64E+04	1.52E+05
3	Cs-134	2.77E+04	1.16E+05	8.67E+05	9.49E+07	3.96E+08
3	Cs-136	8.22E+03	3.18E+04	1.34E+05	2.82E+07	1.09E+08
3	Cs-137	2.47E+04	1.03E+05	7.82E+05	8.46E+07	3.53E+08
2	I-131	1.76E+05	6.50E+05	2.08E+06	6.04E+08	2.23E+09
2	I-132	2.69E+04	2.69E+04	2.69E+04	9.22E+07	9.23E+07
2	I-133	2.56E+05	4.63E+05	4.83E+05	8.79E+08	1.59E+09
2	I-134	9.14E+03	9.14E+03	9.14E+03	3.13E+07	3.13E+07
2	I-135	1.21E+05	1.33E+05	1.33E+05	4.14E+08	4.56E+08
9	La-140	1.91E+02	4.74E+02	5.89E+02	6.55E+05	1.63E+06
9	La-141	4.04E+01	4.12E+01	4.12E+01	1.39E+05	1.41E+05
9	La-142	1.14E+01	1.14E+01	1.14E+01	3.91E+04	3.91E+04
7	Mo-99	2.54E+03	7.54E+03	1.20E+04	8.71E+06	2.58E+07
9	Nb-95	2.12E+02	8.57E+02	5.10E+03	7.26E+05	2.94E+06
9	Nd-147	8.09E+01	3.07E+02	1.18E+03	2.77E+05	1.05E+06
8	Np-239	6.62E+03	1.87E+04	2.72E+04	2.27E+07	6.40E+07
9	Pr-143	1.83E+02	7.06E+02	3.03E+03	6.26E+05	2.42E+06
8	Pu-238	2.97E+00	1.24E+01	9.39E+01	1.02E+04	4.25E+04
8	Pu-239	1.42E-01	4.98E-01	3.58E+00	4.89E+02	1.71E+03
8	Pu-240	3.06E-01	1.28E+00	9.76E+00	1.05E+03	4.40E+03
8	Pu-241	5.95E+01	2.48E+02	1.88E+03	2.04E+05	8.49E+05
3	Rb-86	2.70E+02	1.07E+03	5.26E+03	9.26E+05	3.66E+06
7	Rh-105	1.20E+03	2.81E+03	3.33E+03	4.11E+06	9.64E+06
7	Ru-103	2.41E+03	9.76E+03	5.95E+04	8.25E+06	3.35E+07
7	Ru-105	3.70E+02	3.81E+02	3.81E+02	1.27E+06	1.31E+06
7	Ru-106	9.03E+02	3.75E+03	2.78E+04	3.10E+06	1.29E+07
4	Sb-127	2.41E+03	7.81E+03	1.53E+04	8.26E+06	2.68E+07
4	Sb-129	2.16E+03	2.22E+03	2.22E+03	7.41E+06	7.61E+06
5	Sr-89	1.20E+04	4.91E+04	3.14E+05	4.12E+07	1.68E+08
5	Sr-90	1.53E+03	6.37E+03	4.83E+04	5.25E+06	2.18E+07
5	Sr-91	6.75E+03	8.33E+03	8.34E+03	2.31E+07	2.86E+07
5	Sr-92	2.01E+03	2.02E+03	2.02E+03	6.90E+06	6.92E+06
7	Tc-99m	7.89E+02	8.51E+02	8.51E+02	2.70E+06	2.92E+06
4	Te-127	1.15E+03	1.41E+03	1.41E+03	3.94E+06	4.83E+06
4	Te-127m	4.40E+02	1.81E+03	1.27E+04	1.51E+06	6.22E+06
4	Te-129	3.38E+02	3.38E+02	3.38E+02	1.16E+06	1.16E+06
4	Te-129m	1.88E+03	7.60E+03	4.48E+04	6.45E+06	2.61E+07
4	Te-131m	4.60E+03	1.00E+04	1.13E+04	1.58E+07	3.43E+07
4	Te-132	3.97E+04	1.24E+05	2.17E+05	1.36E+08	4.24E+08

9	Y-90	1.38E+01	4.06E+01	6.33E+01		4.74E+04	1.39E+05
9	Y-91	1.56E+02	6.40E+02	4.18E+03		5.36E+05	2.19E+06
9	Y-92	2.83E+01	2.86E+01	2.86E+01		9.71E+04	9.82E+04
9	Y-93	5.73E+01	7.24E+01	7.25E+01		1.97E+05	2.48E+05
9	Zr-95	2.11E+02	8.66E+02	5.73E+03		7.24E+05	2.97E+06
9	Zr-97	1.24E+02	2.00E+02	2.04E+02		4.25E+05	6.86E+05

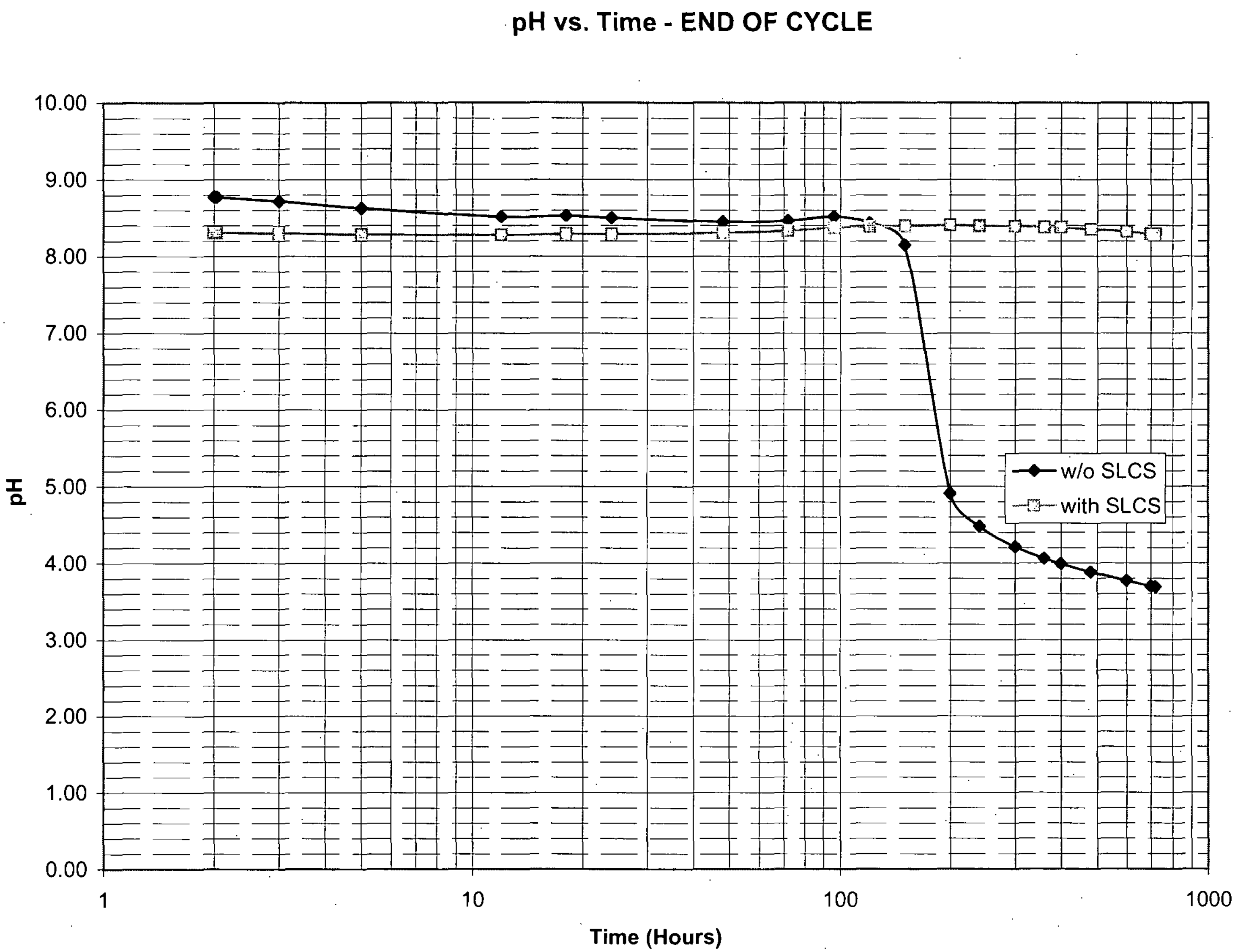
720 Hours	
3.46E+03	
3.68E+06	
1.21E+09	
4.16E+07	
3.36E+06	3.43E+03
4.60E+07	
1.48E+06	
3.03E+05	
8.33E+05	
1.14E+06	
2.97E+09	
4.60E+08	
2.68E+09	
7.14E+09	
9.23E+07	
1.66E+09	
3.13E+07	
4.56E+08	
2.02E+06	
1.41E+05	
3.91E+04	
4.10E+07	
1.75E+07	
4.05E+06	
9.32E+07	
1.04E+07	
3.22E+05	
1.23E+04	
3.35E+04	
6.43E+06	
1.80E+07	
1.14E+07	
2.04E+08	
1.31E+06	
9.52E+07	
5.24E+07	
7.61E+06	
1.08E+09	
1.66E+08	
2.86E+07	
6.92E+06	
2.92E+06	
4.83E+06	
4.35E+07	
1.16E+06	
1.54E+08	
3.86E+07	
7.45E+08	

2.17E+05
1.43E+07
9.82E+04
2.49E+05
1.96E+07
7.01E+05

pH vs. Time - BEGINNING OF CYCLE



(PBAPS) PM-1056 Rev 0 AST pH Attachments C, D, E Main Calc Spreadsheets BOC Graph



(PBAPS) PM-1056 Rev 0 AST pH Attachments C, D, E Main Calc Spreadsheets EOC Graph

PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**PEACH BOTTOM pH CALCULATION**					pH TRANSIENT	BEGINNING OF CYCLE				**Cable Data** [22]				
2							Linear Absorption Coefficients [4]			$S_{A\ tray}$ [cm²]	2,021,100	Cable Surface [trays]- Drywell + 10% contingency			
3	V_{POOL}	3.480E+06	Liters. [122900 ft³] [13]				$u_{beta\ air}$	1.980E-02	1/cm	$S_{A\ fa}$ [cm²]	101,055	Cable Surface [free air]- Drywell + 10% contingency			
4	m_I	1.700E+02	Iodine inventory [g-atoms] EOC[19]				$u_{beta\ hypalon}$	52.08	1/cm	$S_{B\ tray}$ [cm²]	0	Cable Surface [trays] - TORUS + 10% contingency			
5	m_{Cs}	1.600E+03	Cesium inventory [g-atoms] EOC[19]				$u_{gamma\ air}$	3.75E-05	1/cm	$S_{B\ fa}$ [cm²]	0	Cable Surface [free air] - TORUS + 10% contingency			
6	t_{gap}	3.361E-02	Onset of Gap release [hrs] [20]				$u_{gamma\ hypalon}$	0 099	1/cm						
7							$r_{[gamma\ free\ path-DRYWELL]}$ [16]	1036.32	cm	th [cm]	0 70514	Hypalon Jacket Thickness [22]			
8							$r_{[gamma\ free\ path-TORUS\ AIR]}$ [16]	464.82	cm						
9				INTEGRATED DOSES											
10			Beta+Gamma[18]	Gamma[18]	Beta[18]	Gamma[18]	Beta[18]			From Beta	From Gamma	From Beta	From Gamma		
11	TIME	POOL Temp	POOL	DRYWELL	DRYWELL	TORUS AIR	TORUS AIR	[HI] [1]	$[HNO_3]$ [2]	[HCL] -DRYWELL [5]	[HCL] -DRYWELL [6]	[HCL] -CONTAIN[5]	[HCL] -CONTAIN[6]	Total [H+] [7]	[CsOH] [3]
12	Hours	Deg F [17]	Mrad	MeV/cm³	MeV/cm³	MeV/cm³	MeV/cm³	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-ions/liter	g-mols/liter
13	0	80						0 00E+00						5.012E-06	0.000E+00
14	1	175						3 120E-07						5.324E-06	4.565E-05
15	2	187	1.435E-01	3 415E+12	1.494E+12	6.783E+12	2 113E+12	7.190E-07	1.048E-06	8.077E-07	4.774E-06	0.000E+00	0.000E+00	1.236E-05	9 922E-05
16	2.0336	188	1.496E-01	3.557E+12	1.556E+12	7 071E+12	2.205E+12	7.327E-07	1.092E-06	8.414E-07	4.973E-06	0.000E+00	0.000E+00	1.265E-05	1.010E-04
17	3	192	3.093E-01	7.224E+12	3.184E+12	1.452E+13	4.654E+12	7.327E-07	2 258E-06	1.722E-06	1.010E-05	0.000E+00	0.000E+00	1.982E-05	1.010E-04
18	5	199	5.717E-01	1.299E+13	5.868E+12	2.658E+13	8.862E+12	7.327E-07	4.174E-06	3.173E-06	1.816E-05	0.000E+00	0.000E+00	3.125E-05	1.010E-04
19	12	204	1.189E+00	2.485E+13	1.227E+13	5.412E+13	1.958E+13	7.327E-07	8 680E-06	6 633E-06	3.473E-05	0.000E+00	0.000E+00	5.579E-05	1.010E-04
20	18	198	1.557E+00	3.103E+13	1.624E+13	7.012E+13	2.639E+13	7.327E-07	1.136E-05	8.782E-06	4.338E-05	0 000E+00	0.000E+00	6.927E-05	1.010E-04
21	24	197	1.852E+00	3.578E+13	1.953E+13	8.281E+13	3.199E+13	7 327E-07	1.352E-05	1.056E-05	5.002E-05	0.000E+00	0.000E+00	7.985E-05	1.010E-04
22	48	190	2.700E+00	4.929E+13	2.943E+13	1.194E+14	4 801E+13	7.327E-07	1.971E-05	1.592E-05	6.890E-05	0.000E+00	0.000E+00	1.103E-04	1.010E-04
23	72	177	3.319E+00	5.937E+13	3.686E+13	1.466E+14	5 910E+13	7.327E-07	2.423E-05	1.993E-05	8.300E-05	0.000E+00	0.000E+00	1.329E-04	1.010E-04
24	96	160	3.839E+00	6 801E+13	4.306E+13	1.700E+14	6.796E+13	7.327E-07	2 802E-05	2.329E-05	9.506E-05	0.000E+00	0.000E+00	1.521E-04	1 010E-04
25	120	153	4.304E+00	7 578E+13	4.847E+13	1.912E+14	7.562E+13	7.327E-07	3.142E-05	2 621E-05	1 059E-04	0 000E+00	0.000E+00	1.693E-04	1.010E-04
26	150	149	4 839E+00	8.466E+13	5.441E+13	2.157E+14	8.420E+13	7.327E-07	3 532E-05	2.943E-05	1.183E-04	0.000E+00	0.000E+00	1 888E-04	1.010E-04
27	200	142	5.651E+00	9.801E+13	6 279E+13	2.534E+14	9.696E+13	7.327E-07	4.125E-05	3.396E-05	1.370E-04	0 000E+00	0 000E+00	2.180E-04	1.010E-04
28	240	138	6.250E+00	1.077E+14	6.844E+13	2.813E+14	1.062E+14	7 327E-07	4.562E-05	3.701E-05	1.505E-04	0.000E+00	0 000E+00	2.389E-04	1.010E-04
29	300	132	7.081E+00	1.209E+14	7.557E+13	3.202E+14	1.188E+14	7.327E-07	5.169E-05	4.087E-05	1.689E-04	0.000E+00	0.000E+00	2.672E-04	1.010E-04
30	360	127	7.847E+00	1.328E+14	8.146E+13	3.563E+14	1 301E+14	7.327E-07	5.729E-05	4.406E-05	1.856E-04	0.000E+00	0.000E+00	2.927E-04	1.010E-04
31	400	124	8.328E+00	1.402E+14	8.486E+13	3.791E+14	1 371E+14	7.327E-07	6.079E-05	4.589E-05	1.960E-04	0.000E+00	0.000E+00	3.084E-04	1.010E-04
32	480	123	9.230E+00	1 540E+14	9.071E+13	4.221E+14	1.500E+14	7.327E-07	6.738E-05	4.905E-05	2.152E-04	0.000E+00	0.000E+00	3.374E-04	1 010E-04
33	600	120	1.047E+01	1.727E+14	9 780E+13	4.817E+14	1.672E+14	7.327E-07	7.642E-05	5.289E-05	2.413E-04	0.000E+00	0.000E+00	3 764E-04	1.010E-04
34	700	119	1 142E+01	1.870E+14	1.027E+14	5.280E+14	1.801E+14	7.327E-07	8.338E-05	5.556E-05	2.613E-04	0.000E+00	0.000E+00	4 060E-04	1 010E-04
35	720	117	1.161E+01	1.897E+14	1.036E+14	5.369E+14	1.825E+14	7.327E-07	8 472E-05	5.605E-05	2.652E-04	0.000E+00	0.000E+00	4.117E-04	1.010E-04
36															
37	NOTES						14	Acid dissociation constant from: Entergy Eng. Report GGNS-98-0039 Rev.3, Sect.6.1,p.21							
38	1	Entergy Eng. Report GGNS-98-0039 Rev.3 , Equation 3-1d [30+90 min release duration]					15	Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7							
39	2	Ibid, Equation 3-2b					16	See attachment B for gamma free paths							
40	3	Ibid, Equation 3-4d [30+90 min release duration]					17	PBAPS UFSAR Fig. 14.6.12 (Rev.14) and Fig. 14.6.12A (Rev. 15)							
41	4	Ibid, Table A-1					18	Attachment B							
42	5	Ibid, Equation 3-3a					19	Attachment B							
43	6	Ibid, Equation 3-3b					20	USNRC Reg. Guide 1 183							
44	7	Ibid, Equation 3-5a; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7					21	Tech Spec SR 3.1 7.7 minimum B-10 stored in SBLC tank of 162.7 lbs, conservatively less than from							
45	8	Ibid, Equation 3-5b; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7						plant chemistry data transmitted via E-mail by Mark G. Fry on 12/27/2002,							
46	9	Ibid, Equation 3-0a; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7						included as Attachment H. 65 atom % B-10 enrichment used, bounding							
47	10	Ibid, Equation 3-5d, Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7						the highest 63 5 atom% B-10 from Attachment H							
48	11	Ibid, Equation 3-5d; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7					22	Cable Data from Attachment A.							
49	12	Ibid, Equation 3-5e; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7													
50	13	Min. Suppression Pool volume from PBAPS Tech. Spec. Bases B 3.6.2.2													

PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOl. pH CALCULATION

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1				**pH TRANSIENT**	**BEGINNING OF CYCLE**								
2	**Cable Data** [22]						1134.24	g. mols $Na_2B_{10}O_{16}*10H_2O$ Added					
3	1,837,364	Cable Surface [Trays] - DRYWELL [cm2]				162.7	73799.09	lb /grams B-10[21]	10.01	atomic wt. B-10			
4	91,868	Cable Surface [Free air] - DRYWELL [cm2]					65.00	atom % B-10[21]	7372.54	g. atoms B-10			
5	0	Cable Surface [Free air] - TORUS [cm2]					11342.36	g.atoms total boron					
6	0	Cable Surface [Trays] - TORUS [cm2]											
7													
8						**pH EFFECT OF ADDITION OF SODIUM PENTABORATE STANDBY LIQUID CONTROL [SLC] SOLUTION**							
9													
10							Strong Acid						
11	Total [OH+] [8]	-LOG(Kw) [9]	Root x [10]	Net [H+] [11]	pH [12]	K_a	g-equiv.	$Na_2B_{10}O_{16}*10H_2O$	Borate	Boric Acid	pK_a	**pH**	
12	g-ions/liter			g-ions/liter	Before SLC	[14]	Net [H+] * V_{POOL}	g-mols	g-equiv.	g-equiv.	$-log_{10}K_a$	[15]	
13	1.995E-09	1.394E+01	-3.197E-10	5 012E-06	5.30	5 989E-10	1.744E+01	1134.2	2251	9091	9.22	**8.62**	
14	4.565E-05	1 262E+01	5.318E-06	5 955E-09	8.23	1.155E-09	2 072E-02	1134.2	2268	9074	8.94	**8.34**	
15	9.922E-05	1.250E+01	1.236E-05	3.672E-09	8.44	1.225E-09	1.278E-02	1134.2	2268	9074	8.91	**8.31**	
16	1.010E-04	1.249E+01	1.265E-05	3.692E-09	8.43	1.231E-09	1.285E-02	1134.2	2268	9074	8.91	**8.31**	
17	1.010E-04	1.245E+01	1 982E-05	4.392E-09	8.36	1.254E-09	1.528E-02	1134.2	2268	9074	8.90	**8.30**	
18	1.010E-04	1.238E+01	3.125E-05	5.938E-09	8.23	1.295E-09	2.066E-02	1134.2	2268	9074	8.89	**8.29**	
19	1.010E-04	1.234E+01	5.578E-05	1 014E-08	7.99	1.324E-09	3.530E-02	1134.2	2268	9074	8.88	**8.28**	
20	1.010E-04	1.239E+01	6.926E-05	1.277E-08	7.89	1.289E-09	4 445E-02	1134.2	2268	9074	8.89	**8.29**	
21	1.010E-04	1.240E+01	7.983E-05	1.875E-08	7.73	1.283E-09	6.524E-02	1134.2	2268	9074	8.89	**8.29**	
22	1.010E-04	1.247E+01	1.010E-04	9.289E-06	5 03	1.242E-09	3.233E+01	1134.2	2236	9106	8.91	**8.30**	
23	1.010E-04	1.260E+01	1.010E-04	3.189E-05	4 50	1.166E-09	1.110E+02	1134.2	2157	9185	8 93	**8.30**	
24	1.010E-04	1.279E+01	1.010E-04	5 111E-05	4.29	1.067E-09	1 779E+02	1134 2	2091	9252	8.97	**8.33**	
25	1.010E-04	1 287E+01	1.010E-04	6 829E-05	4.17	1.026E-09	2.377E+02	1134.2	2031	9312	8 99	**8.33**	
26	1 010E-04	1.292E+01	1.010E-04	8.782E-05	4.06	1.003E-09	3.056E+02	1134.2	1963	9380	9.00	**8.32**	
27	1.010E-04	1.301E+01	1.010E-04	1.169E-04	3.93	9.616E-10	4.070E+02	1134.2	1862	9481	9.02	**8.31**	
28	1.010E-04	1.306E+01	1.010E-04	1.379E-04	3.86	9.382E-10	4.798E+02	1134.2	1789	9554	9.03	**8.30**	
29	1.010E-04	1.314E+01	1.010E-04	1:662E-04	3.78	9.031E-10	5.785E+02	1134.2	1690	9652	9.04	**8.29**	
30	1.010E-04	1.321E+01	1.010E-04	1.917E-04	3 72	8.739E-10	6.672E+02	1134.2	1601	9741	9.06	**8.27**	
31	1.010E-04	1.325E+01	1 010E-04	2.074E-04	3.68	8.563E-10	7.218E+02	1134.2	1547	9796	9.07	**8.27**	
32	1.010E-04	1.326E+01	1.010E-04	2 364E-04	3.63	8.505E-10	8 227E+02	1134 2	1446	9897	9 07	**8.23**	
33	1.010E-04	1.331E+01	1.010E-04	2.754E-04	3.56	8.329E-10	9.584E+02	1134.2	1310	10032	9.08	**8.20**	
34	1.010E-04	1.332E+01	1.010E-04	3.050E-04	3.52	8.271E-10	1.061E+03	1134.2	1207	10135	9.08	**8.16**	
35	1.010E-04	1.335E+01	1.010E-04	3.107E-04	3.51	8.154E-10	1.081E+03	1134.2	1187	10155	9.09	**8.16**	
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**PEACH BOTTOM pH CALCULATION**					**pH TRANSIENT**	**END OF CYCLE**				**Cable Data** [22]				
2							Linear Absorption Coefficients [4]			$S_{A\,tray}$ [cm^2]	2,021,100	Cable Surface [trays]- Drywell + 10% contingency			
3	V_{POOL}	3.480E+06	Liters [122900 ft^3] [13]				$u_{beta\ air}$	1.980E-02	1/cm	$S_{A\,fa}$ [cm^2]	101,055	Cable Surface [free air]- Drywell + 10% contingency			
4	m_I	2.900E+02	Iodine inventory [g-atoms] EOC[19]				$u_{beta\ hypalon}$	52.08	1/cm	$S_{B\,tray}$ [cm^2]	0	Cable Surface [trays] - TORUS + 10% contingency			
5	m_{Cs}	3.200E+03	Cesium inventory [g-atoms] EOC[19]				$u_{gamma\ air}$	3.75E-05	1/cm	$S_{B\,fa}$ [cm^2]	0	Cable Surface [free air] - TORUS + 10% contingency			
6	t_{gap}	3.361E-02	Onset of Gap release [hrs] [20]				$u_{gamma\ hypalon}$	0 099	1/cm						
7							$r_{[gamma\ free\ path-DRYWELL]}$ [16]	1036.32	cm	th [cm]	0.70514	Hypalon Jacket Thickness [22]			
8							$r_{[gamma\ free\ path-TORUS\ AIR]}$ [16]	464.82	cm						
9				INTEGRATED DOSES											
10			Beta+Gamma[18]	Gamma[18]	Beta[18]	Gamma[18]	Beta[18]			From Beta	From Gamma	From Beta	From Gamma		
11	TIME	POOL Temp	POOL	DRYWELL	DRYWELL	TORUS AIR	TORUS AIR	[HI] [1]	[HNO_3] [2]	[HCL] -DRYWELL [5]	[HCL] -DRYWELL [6]	[HCL] -CONTAIN [5]	[HCL] -CONTAIN [6]	Total [H+] [7]	[CsOH] [3]
12	Hours	Deg F [17]	Mrad	MeV/cm^3	MeV/cm^3	MeV/cm^3	MeV/cm^3	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-ions/liter	g-mols/liter
13	0	80						0.00E+00						5.012E-06	0.000E+00
14	1	175						5.322E-07						5.544E-06	9.304E-05
15	2	187	1.435E-01	3.415E+12	1.494E+12	6.783E+12	2.113E+12	1.227E-06	1.048E-06	8.077E-07	4.774E-06	0 000E+00	0.000E+00	1.287E-05	2.024E-04
16	2.0336	188	1.496E-01	3.557E+12	1.556E+12	7.071E+12	2.205E+12	1.250E-06	1.092E-06	8.414E-07	4.973E-06	0.000E+00	0.000E+00	1.317E-05	2.061E-04
17	3	192	3.093E-01	7.224E+12	3.184E+12	1.452E+13	4.654E+12	1.250E-06	2.258E-06	1.722E-06	1.010E-05	0.000E+00	0.000E+00	2.034E-05	2.061E-04
18	5	199	5.717E-01	1.299E+13	5.868E+12	2 658E+13	8.862E+12	1.250E-06	4.174E-06	3.173E-06	1.816E-05	0.000E+00	0.000E+00	3.177E-05	2.061E-04
19	12	204	1.189E+00	2.485E+13	1.227E+13	5.412E+13	1.958E+13	1.250E-06	8 680E-06	6.633E-06	3 473E-05	0.000E+00	0.000E+00	5.631E-05	2.061E-04
20	18	198	1.557E+00	3.103E+13	1.624E+13	7.012E+13	2.639E+13	1.250E-06	1.136E-05	8.782E-06	4 338E-05	0 000E+00	0.000E+00	6.979E-05	2.061E-04
21	24	197	1 852E+00	3.578E+13	1.953E+13	8.281E+13	3.199E+13	1.250E-06	1.352E-05	1.056E-05	5.002E-05	0.000E+00	0.000E+00	8 037E-05	2 061E-04
22	48	190	2.700E+00	4.929E+13	2 943E+13	1.194E+14	4.801E+13	1.250E-06	1.971E-05	1.592E-05	6.890E-05	0 000E+00	0.000E+00	1.108E-04	2.061E-04
23	72	177	3.319E+00	5.937E+13	3 686E+13	1.466E+14	5.910E+13	1.250E-06	2.423E-05	1.993E-05	8.300E-05	0.000E+00	0 000E+00	1.334E-04	2.061E-04
24	96	160	3.839E+00	6.801E+13	4.306E+13	1.700E+14	6.796E+13	1.250E-06	2.802E-05	2.329E-05	9.506E-05	0.000E+00	0.000E+00	1.526E-04	2.061E-04
25	120	153	4.304E+00	7 578E+13	4.847E+13	1.912E+14	7.562E+13	1.250E-06	3 142E-05	2 621E-05	1.059E-04	0.000E+00	0.000E+00	1.698E-04	2.061E-04
26	150	149	4 839E+00	8.466E+13	5.441E+13	2.157E+14	8.420E+13	1.250E-06	3.532E-05	2.943E-05	1.183E-04	0.000E+00	0.000E+00	1.894E-04	2.061E-04
27	200	142	5.651E+00	9.801E+13	6 279E+13	2.534E+14	9 696E+13	1.250E-06	4.125E-05	3.396E-05	1 370E-04	0.000E+00	0.000E+00	2.185E-04	2.061E-04
28	240	138	6.250E+00	1.077E+14	6 844E+13	2.813E+14	1.062E+14	1.250E-06	4.562E-05	3.701E-05	1.505E-04	0 000E+00	0.000E+00	2.394E-04	2.061E-04
29	300	132	7.081E+00	1.209E+14	7.557E+13	3.202E+14	1.188E+14	1.250E-06	5.169E-05	4.087E-05	1.689E-04	0.000E+00	0.000E+00	2.678E-04	2.061E-04
30	360	127	7.847E+00	1.328E+14	8.146E+13	3 563E+14	1.301E+14	1 250E-06	5.729E-05	4.406E-05	1.856E-04	0.000E+00	0.000E+00	2 932E-04	2.061E-04
31	400	124	8.328E+00	1.402E+14	8.486E+13	3.791E+14	1.371E+14	1 250E-06	6.079E-05	4.589E-05	1.960E-04	0.000E+00	0 000E+00	3 089E-04	2.061E-04
32	480	123	9.230E+00	1.540E+14	9.071E+13	4.221E+14	1.500E+14	1.250E-06	6 738E-05	4.905E-05	2 152E-04	0.000E+00	0.000E+00	3.379E-04	2.061E-04
33	600	120	1.047E+01	1.727E+14	9.780E+13	4.817E+14	1.672E+14	1.250E-06	7 642E-05	5.289E-05	2.413E-04	0.000E+00	0.000E+00	3.769E-04	2.061E-04
34	700	119	1.142E+01	1.870E+14	1.027E+14	5.280E+14	1.801E+14	1.250E-06	8.338E-05	5.556E-05	2.613E-04	0.000E+00	0.000E+00	4.065E-04	2.061E-04
35	720	117	1.161E+01	1.897E+14	1.036E+14	5.369E+14	1.825E+14	1.250E-06	8.472E-05	5.605E-05	2.652E-04	0.000E+00	0.000E+00	4.122E-04	2 061E-04
36															
37	NOTES						14	Acid dissociation constant from: Entergy Eng. Report GGNS-98-0039 Rev.3, Sect.6.1,p.21							
38	1	Entergy Eng. Report GGNS-98-0039 Rev.3 . Equation 3-1d [30+90 min release duration]					15	Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7							
39	2	Ibid, Equation 3-2b					16	See attachment B for gamma free paths							
40	3	Ibid, Equation 3-4d [30+90 min release duration]					17	PBAPS UFSAR Fig. 14.6.12 (Rev.14) and Fig. 14.6.12A (Rev. 15)							
41	4	Ibid, Table A-1					18	Attachment B							
42	5	Ibid, Equation 3-3a					19	Attachment B							
43	6	Ibid, Equation 3-3b					20	USNRC Reg Guide 1.183							
44	7	Ibid, Equation 3-5a; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7					21	Tech Spec SR 3 1.7.7 minimum B-10 stored in SBLC tank of 162.7 lbs. conservatively less than from							
45	8	Ibid, Equation 3-5b; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7						plant chemistry data transmitted via E-mail by Mark G. Fry on 12/27/2002,							
46	9	Ibid, Equation 3-0a; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7						included as Attachment H. 65 atom % B-10 enrichment used, bounding							
47	10	Ibid, Equation 3-5d; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7						the highest 63.5 atom% B-10 from Attachment H							
48	11	Ibid, Equation 3-5d; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7					22	Cable Data from Attachment A.							
49	12	Ibid, Equation 3-5e; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5-7													
50	13	Min Suppression Pool volume from PBAPS Tech. Spec. Bases B 3.6.2.2													

PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1				**pH TRANSIENT**		**END OF CYCLE**							
2	**Cable Data** [22]						1134.24	g. mols $Na_2B_{10}O_{16}*10H_2O$ Added					
3	1,837,364	Cable Surface [Trays] - DRYWELL [cm2]				162.7	73799.09	lb./grams B-10[21]	10.01	atomic wt. B-10			
4	91,868	Cable Surface [Free air] - DRYWELL [cm2]					65.00	atom % B-10[21]	7372.54	g. atoms B-10			
5	0	Cable Surface [Free air] - TORUS [cm2]					11342.36	g atoms total boron					
6	0	Cable Surface [Trays] - TORUS [cm2]											
7													
8						**pH EFFECT OF ADDITION OF SODIUM PENTABORATE STANDBY LIQUID CONTROL [SLC] SOLUTION**							
9													
10							Strong Acid						
11	Total [OH+] [8]	-LOG(Kw) [9]	Root x [10]	Net [H+] [11]	pH [12]	K_a	g-equiv.	$Na_2B_{10}O_{16}*10H_2O$	Borate	Boric Acid	pK_a	**pH**	
12	g-ions/liter			g-ions/liter	Before SLC	[14]	Net [H+] * V_{POOL}	g-mols	g-equiv.	g-equiv.	$-log_{10}K_a$	[15]	
13	1.995E-09	1.394E+01	-3.197E-10	5.012E-06	5.30	5.989E-10	1.744E+01	1134.2	2251	9091	9.22	**8.62**	
14	9.305E-05	1.262E+01	5.541E-06	2.745E-09	8.56	1.155E-09	9.553E-03	1134.2	2268	9074	8.94	**8.34**	
15	2.025E-04	1.250E+01	1 287E-05	1.682E-09	8 77	1.225E-09	5.855E-03	1134 2	2268	9074	8.91	**8.31**	
16	2 061E-04	1.249E+01	1.317E-05	1 691E-09	8.77	1.231E-09	5.884E-03	1134.2	2268	9074	8.91	**8.31**	
17	2.061E-04	1.245E+01	2.034E-05	1.920E-09	8 72	1.254E-09	6 680E-03	1134.2	2268	9074	8 90	**8.30**	
18	2.061E-04	1 238E+01	3.177E-05	2.376E-09	8.62	1.295E-09	8.268E-03	1134.2	2268	9074	8 89	**8.29**	
19	2.061E-04	1.234E+01	5.630E-05	3.063E-09	8.51	1.324E-09	1.066E-02	1134.2	2268	9074	8.88	**8.28**	
20	2.061E-04	1.239E+01	6.979E-05	2.975E-09	8.53	1.289E-09	1.035E-02	1134.2	2268	9074	8.89	**8.29**	
21	2.061E-04	1.240E+01	8.036E-05	3.158E-09	8.50	1.283E-09	1.099E-02	1134.2	2268	9074	8.89	**8.29**	
22	2.061E-04	1.247E+01	1.108E-04	3.579E-09	8.45	1.242E-09	1.245E-02	1134.2	2268	9074	8.91	**8.30**	
23	2.061E-04	1.260E+01	1.334E-04	3.469E-09	8.46	1.166E-09	1.207E-02	1134.2	2268	9074	8.93	**8.33**	
24	2.061E-04	1.279E+01	1.526E-04	3.053E-09	8 52	1.067E-09	1 062E-02	1134 2	2268	9074	8.97	**8.37**	
25	2.061E-04	1.287E+01	1.698E-04	3 712E-09	8.43	1.026E-09	1 292E-02	1134 2	2268	9074	8.99	**8.39**	
26	2 061E-04	1.292E+01	1 894E-04	7.174E-09	8.14	1 003E-09	2.497E-02	1134.2	2268	9074	9 00	**8.40**	
27	2.061E-04	1 301E+01	2.061E-04	1 235E-05	4.91	9.616E-10	4.299E+01	1134.2	2225	9117	9.02	**8.40**	
28	2.061E-04	1 306E+01	2.061E-04	3.328E-05	4.48	9.382E-10	1.158E+02	1134.2	2153	9190	9.03	**8.40**	
29	2.061E-04	1.314E+01	2.061E-04	6.164E-05	4.21	9.031E-10	2.145E+02	1134.2	2054	9288	9.04	**8.39**	
30	2.061E-04	1.321E+01	2.061E-04	8.711E-05	4.06	8.739E-10	3.032E+02	1134.2	1965	9377	9.06	**8.38**	
31	2.061E-04	1.325E+01	2.061E-04	1.028E-04	3.99	8.563E-10	3.578E+02	1134.2	1911	9432	9.07	**8.37**	
32	2.061E-04	1.326E+01	2.061E-04	1.318E-04	3.88	8.505E-10	4.587E+02	1134.2	1810	9533	9.07	**8.35**	
33	2.061E-04	1.331E+01	2.061E-04	1.708E-04	3.77	8.329E-10	5.944E+02	1134.2	1674	9668	9.08	**8.32**	
34	2.061E-04	1.332E+01	2 061E-04	2.004E-04	3 70	8.271E-10	6 974E+02	1134.2	1571	9771	9.08	**8.29**	
35	2.061E-04	1.335E+01	2 061E-04	2.061E-04	3 69	8.154E-10	7 172E+02	1134 2	1551	9791	9.09	**8.29**	
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	A	B	C	D	E	F	G	H	I
1	**PEACH BO**					**pH TRANSIENT**	**BEGINNING OF CYCLE**		
2							Linear Absorption (		
3	V_{POOL}	=122900*28.3168	Liters [122900 ft^3] [13]				$u_{beta\ air}$	0.0198	1/cm
4	m_I	=170	Iodine inventory [g-atoms]				$u_{beta\ hypalon}$	52.08	1/cm
5	m_{Cs}	=1600	Cesium inventory [g-atom				$u_{gamma\ air}$	0.0000375	1/cm
6	t_{gap}	=121/3600	Onset of Gap release [hrs				$u_{gamma\ hypalon}$	0.099	1/cm
7							$r_{(gamma\ free\ path\text{-}DRYWELL)}$ [16]	=34*30.48	cm
8							$r_{(gamma\ free\ path\text{-}TORUS\ AIR)}$ [16]	=15.25*30.48	cm
9				INTEGRATED D(					
10			Beta+Gamma [18]	Gamma [18]	Beta [18]	Gamma [18]	Beta [18]		
11	TIME	POOL Temp	POOL	DRYWELL	DRYWELL	TORUS AIR	TORUS AIR	[HI] [1]	$[HNO_3]$ [2]
12	Hours	Deg F [17]	Mrad	MeV/cm^3	MeV/cm^3	MeV/cm^3	MeV/cm^3	g-mols/liter	g-mols/liter
13	0	80						0	
14	1	175						=$B$4/(120*$B$3)*($A14-(0.5+$B$6))+$B$4/(400*$B$3)	
15	2	187	0.143500086508842	3415252526559.5	1493516901702.39	6782790405603.09	2112853924362.65	=$B$4/(120*$B$3)*($A15-(0.5+$B$6))+$B$4/(400*$B$3)	=0.0000073*$C15
16	=0.5+1.5+B6	188	0.149634733015881	3557433766582.65	1555848397608.08	7070702227895.83	2205232001151.76	=$B$4/(120*$B$3)*($A16-(0.5+$B$6))+$B$4/(400*$B$3)	=0.0000073*$C16
17	3	192	0.309341836086142	7223665685898.47	3184466482938.89	14522270407907.7	4653989461673.07	=H$16	=0.0000073*$C17
18	5	199	0.571714238137557	12993742725588.9	5867592321860.4	26579195436675.8	8861664876224.85	=H$16	=0.0000073*$C18
19	12	204	1.18897340652801	24846754835583.8	12265274440332.4	54124658556267.7	19580415772096.5	=H$16	=0 0000073*$C19
20	18	198	1.55683327582913	31033162634725.7	16238511537328.7	70115732616255	26393164623873.5	=H$16	=0.0000073*$C20
21	24	197	1.85191915601109	35783878087763.8	19532321678811.2	82812650068300.5	31988772986659.7	=H$16	=0.0000073*$C21
22	48	190·	2.69999350899574	49289591172808.2	29429378072763.1	119362761252454	48011228084913.2	=H$16	=0.0000073*$C22
23	72	177	3.31896426382511	59373911524643.9	36857885649250	146641045030486	59103260447932.9	=H$16	=0.0000073*$C23
24	96	160	3.83902585927095	68006216910072.3	43061765946118.8	170021885936274	67961305910172.6	=H$16	=0.0000073*$C24
25	120	153	4.30449745517556	75777204350529.3	48469947167744.3	191216585122999	75621430881437	=H$16	=0.0000073*$C25
26	150	149	4.83863042922377	84663108071843.2	54411194958229.2	215749512205084	84199682180048.8	=H$16	=0.0000073*$C26
27	200	142	5.65123374775693	98005925381916.4	62794391540543.6	253363489030894	96959403927412.6	=H$16	=0 0000073*$C27
28	240	138	6.24993554889672	107669540194174	68442614993399.4	281251300182045	106185426030441	=H$16	=0.0000073*$C28
29	300	132	7.08123504117198	120857131002314	75570313182062.1	320201031278407	118768378954490	=H$16	=0.0000073*$C29
30	360	127	7.84729286641128	132800350275133	81462258405056.5	356330536069072	130127193615785	=H$16	=0.0000073*$C30
31	400	124	8.32796771895153	140208197049268	84862166864990.9	379118949506557	137136062051670	=H$16	=0.0000073*$C31
32	480	123	9.23016582533999	153971254659635	90707083398776.2	422140895644603	150041841567683	=H$16	=0.0000073*$C32
33	600	120	10.4680366999075	172651749035525	97804662138577.5	481694348263629	167224642525045	=H$16	=0.0000073*$C33
34	700	119	11.4213133856566	186955852261398	102732737437929	527952520751998	180060583153812	=H$16	=0.0000073*$C34
35	720	117	11.6052404151638	189712487101709	103642526077636	536915254530628	182499580739728	=H$16	=0.0000073*$C35
36									
37	NOTES						14	Acid dissociation constant from: Entergy Eng. Report GGNS-98-00	
38	1	Entergy Eng. Report (					15	Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7	
39	2	Ibid, Equation 3-2b					16	See attachment B for gamma free paths	
40	3	Ibid, Equation 3-4d [3					17	PBAPS UFSAR Fig. 14.6.12 (Rev.14) and Fig. 14.6.12A (Rev. 15)	
41	4	Ibid, Table A-1					18	Attachment B	
42	5	Ibid, Equation 3-3a					19	Attachment B	
43	6	Ibid, Equation 3-3b					20	USNRC Reg. Guide 1.183	
44	7	Ibid, Equation 3-5a; E					21	Tech Spec SR 3.1.7.7 minimum B-10 stored in SBLC tank of 162.7	
45	8	Ibid, Equation 3-5b; E						plant chemistry data transmitted via E-mail by Mark G. Fry on 12/27	
46	9	Ibid, Equation 3-0a; E						included as Attachment H. 65 atom % B-10 enrichment used, bou	
47	10	Ibid, Equation 3-5d; E						the highest 63.5 atom% B-10 from Attachment H	
48	11	Ibid, Equation 3-5d; E					22	Cable Data from Attachment A. Assume 5% of Tray cable surface	
49	12	Ibid, Equation 3-5e; E							
50	13	Min. Suppression Poo							

PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	J	K	L
1		**Cable Data** [22]	
2	$S_{A\,tray}$ $[cm^2]$	=$P$3*1.1	Cable Surface [trays]- Drywell + 10% contingency
3	$S_{A\,fa}$ $[cm^2]$	=$P$4*1.1	Cable Surface [free air]- Drywell + 10% contingency
4	$S_{B\,tray}$ $[cm^2]$	=$P$6*0.95*1.1	Cable Surface [trays] - TORUS + 10% contingency
5	$S_{B\,fa}$ $[cm^2]$	=P6*1.1*0.05	Cable Surface [free air] - TORUS + 10% contingency
6			
7	th [cm]	0.61865	Hypalon Jacket Thickness [22]
8			
9			
10	From Beta	From Gamma	From Beta
11	[HCL] -DRYWELL [5]	[HCL] -DRYWELL [6]	[HCL] -CONTAIN [5]
12	g-mols/liter	g-mols/liter	g-mols/liter
13			
14			
15	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E15	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D15	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E15
16	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E16	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D16	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E16
17	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E17	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D17	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E17
18	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E18	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D18	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E18
19	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E19	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D19	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E19
20	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E20	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D20	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E20
21	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E21	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D21	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E21
22	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E22	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D22	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E22
23	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E23	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D23	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E23
24	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E24	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D24	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E24
25	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E25	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D25	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E25
26	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E26	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D26	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E26
27	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E27	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D27	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E27
28	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E28	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D28	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E28
29	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E29	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D29	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E29
30	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E30	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D30	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E30
31	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E31	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D31	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E31
32	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E32	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D32	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E32
33	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E33	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D33	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E33
34	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E34	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D34	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E34
35	=3.512E-20/$B$3*($K$2*0.95/2+$K$3)/$H$3*$E35	=3.512E-20/$B$3*($K$2*0.95+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D35	=3.512E-20/$B$3*($K$4*0.95/2+$K$5)/$H$3*$E35
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	M	N
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10	From Gamma	
11	[HCL] -CONTAIN[6]	Total [H+] [7]
12	g-mols/liter	g-ions/liter
13		=POWER(10,-$T$13)+$H13+$I13+$J13+$K13+$L13+$M13
14		=POWER(10,-$T$13)+$H14+$I14+$J14+$K14+$L14+$M14
15	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D15	=POWER(10,-$T$13)+$H15+$I15+$J15+$K15+$L15+$M15
16	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D16	=POWER(10,-$T$13)+$H16+$I16+$J16+$K16+$L16+$M16
17	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D17	=POWER(10,-$T$13)+$H17+$I17+$J17+$K17+$L17+$M17
18	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D18	=POWER(10,-$T$13)+$H18+$I18+$J18+$K18+$L18+$M18
19	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D19	=POWER(10,-$T$13)+$H19+$I19+$J19+$K19+$L19+$M19
20	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D20	=POWER(10,-$T$13)+$H20+$I20+$J20+$K20+$L20+$M20
21	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D21	=POWER(10,-$T$13)+$H21+$I21+$J21+$K21+$L21+$M21
22	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D22	=POWER(10,-$T$13)+$H22+$I22+$J22+$K22+$L22+$M22
23	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D23	=POWER(10,-$T$13)+$H23+$I23+$J23+$K23+$L23+$M23
24	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D24	=POWER(10,-$T$13)+$H24+$I24+$J24+$K24+$L24+$M24
25	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D25	=POWER(10,-$T$13)+$H25+$I25+$J25+$K25+$L25+$M25
26	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D26	=POWER(10,-$T$13)+$H26+$I26+$J26+$K26+$L26+$M26
27	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D27	=POWER(10,-$T$13)+$H27+$I27+$J27+$K27+$L27+$M27
28	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D28	=POWER(10,-$T$13)+$H28+$I28+$J28+$K28+$L28+$M28
29	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D29	=POWER(10,-$T$13)+$H29+$I29+$J29+$K29+$L29+$M29
30	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D30	=POWER(10,-$T$13)+$H30+$I30+$J30+$K30+$L30+$M30
31	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D31	=POWER(10,-$T$13)+$H31+$I31+$J31+$K31+$L31+$M31
32	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D32	=POWER(10,-$T$13)+$H32+$I32+$J32+$K32+$L32+$M32
33	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D33	=POWER(10,-$T$13)+$H33+$I33+$J33+$K33+$L33+$M33
34	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D34	=POWER(10,-$T$13)+$H34+$I34+$J34+$K34+$L34+$M34
35	=3.512E-20/$B$3*($K$4*0.95+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$D35	=POWER(10,-$T$13)+$H35+$I35+$J35+$K35+$L35+$M35
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	O	P	Q
1			
2		**Cable Data** [22]	
3		1837364	Cable Surface [Trays] - DRYWELL [cm2]
4		=$P$3*0.05	Cable Surface [Free air] - DRYWELL [cm2]
5		=P6*0.05	Cable Surface [Free air] - TORUS [cm2]
6		0	Cable Surface [Trays] - TORUS [cm2]
7			
8			
9			
10			
11	[CsOH] [3]	Total [OH+] [8]	-LOG(Kw) [9]
12	g-mols/liter	g-ions/liter	
13	0	=POWER(10,-14)/POWER(10,-$T$13)+$O13	=15.5129-0.0224*$B13+0.00003352*POWER(B13,2)
14	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A14-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3	=POWER(10,-14)/POWER(10,-$T$13)+$O14	=15.5129-0.0224*$B14+0.00003352*POWER(B14,2)
15	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A15-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3	=POWER(10,-14)/POWER(10,-$T$13)+$O15	=15.5129-0.0224*$B15+0.00003352*POWER(B15,2)
16	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A16-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3	=POWER(10,-14)/POWER(10,-$T$13)+$O16	=15.5129-0.0224*$B16+0.00003352*POWER(B16,2)
17	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O17	=15.5129-0.0224*$B17+0.00003352*POWER(B17,2)
18	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O18	=15.5129-0.0224*$B18+0.00003352*POWER(B18,2)
19	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O19	=15.5129-0.0224*$B19+0.00003352*POWER(B19,2)
20	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O20	=15.5129-0.0224*$B20+0.00003352*POWER(B20,2)
21	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O21	=15.5129-0.0224*$B21+0.00003352*POWER(B21,2)
22	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O22	=15.5129-0.0224*$B22+0.00003352*POWER(B22,2)
23	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O23	=15.5129-0.0224*$B23+0.00003352*POWER(B23,2)
24	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O24	=15.5129-0.0224*$B24+0.00003352*POWER(B24,2)
25	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O25	=15.5129-0.0224*$B25+0.00003352*POWER(B25,2)
26	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O26	=15.5129-0.0224*$B26+0.00003352*POWER(B26,2)
27	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O27	=15.5129-0.0224*$B27+0.00003352*POWER(B27,2)
28	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O28	=15.5129-0.0224*$B28+0.00003352*POWER(B28,2)
29	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O29	=15.5129-0.0224*$B29+0.00003352*POWER(B29,2)
30	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O30	=15.5129-0.0224*$B30+0.00003352*POWER(B30,2)
31	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O31	=15.5129-0.0224*$B31+0.00003352*POWER(B31,2)
32	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O32	=15.5129-0.0224*$B32+0.00003352*POWER(B32,2)
33	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O33	=15.5129-0.0224*$B33+0.00003352*POWER(B33,2)
34	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O34	=15.5129-0.0224*$B34+0.00003352*POWER(B34,2)
35	=$O$16	=POWER(10,-14)/POWER(10,-$T$13)+$O35	=15.5129-0.0224*$B35+0.00003352*POWER(B35,2)
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	R	S	T	U	V	W	X	Y
1		**pH TRANSIENT**		**BEGINNING OF CYCLE**				
2					=V5/10	g. mols Na₂		
3				162.7	=U3*453 59	lb./grams B-	10.01	atomic wt. B-10
4					65	atom % B-1	=V3/X3	g. atoms B-10
5					=X4/V4*100	g.atoms tota		
6								
7								
8				**pH EFFECT OF ADDITION OF SODIUM PENTABORATE STANDBY**				
9								
10					Strong Acid			
11	Root x [10]	Net [H+] [11]	pH [12]	K_a	g-equiv.	$_2B_{10}O_{16}$*10H	Borate	Boric Acid
12		g-ions/liter	Before SLC	[14]	Net [H+] * V_{POOL}	g-mols	g-equiv.	g-equiv.
13	=(N13+P13-SQRT(POWER(($N13+$P13),2)-(4*(N13*P13-POWER(10,-$Q13)))))/2	=$N13-$R13	5.3	=(0.0585*B13+1.309)/10000000000	=S13*$B$3	=$V$2	=W13*2-V13	=W13*8+V13
14	=(N14+P14-SQRT(POWER(($N14+$P14),2)-(4*(N14*P14-POWER(10,-$Q14)))))/2	=$N14-$R14	=-LOG10($S14)	=(0.0585*B14+1.309)/10000000000	=S14*$B$3	=$V$2	=W14*2-V14	=W14*8+V14
15	=(N15+P15-SQRT(POWER(($N15+$P15),2)-(4*(N15*P15-POWER(10,-$Q15)))))/2	=$N15-$R15	=-LOG10($S15)	=(0.0585*B15+1.309)/10000000000	=S15*$B$3	=$V$2	=W15*2-V15	=W15*8+V15
16	=(N16+P16-SQRT(POWER(($N16+$P16),2)-(4*(N16*P16-POWER(10,-$Q16)))))/2	=$N16-$R16	=-LOG10($S16)	=(0.0585*B16+1.309)/10000000000	=S16*$B$3	=$V$2	=W16*2-V16	=W16*8+V16
17	=(N17+P17-SQRT(POWER(($N17+$P17),2)-(4*(N17*P17-POWER(10,-$Q17)))))/2	=$N17-$R17	=-LOG10($S17)	=(0.0585*B17+1.309)/10000000000	=S17*$B$3	=$V$2	=W17*2-V17	=W17*8+V17
18	=(N18+P18-SQRT(POWER(($N18+$P18),2)-(4*(N18*P18-POWER(10,-$Q18)))))/2	=$N18-$R18	=-LOG10($S18)	=(0.0585*B18+1.309)/10000000000	=S18*$B$3	=$V$2	=W18*2-V18	=W18*8+V18
19	=(N19+P19-SQRT(POWER(($N19+$P19),2)-(4*(N19*P19-POWER(10,-$Q19)))))/2	=$N19-$R19	=-LOG10($S19)	=(0.0585*B19+1.309)/10000000000	=S19*$B$3	=$V$2	=W19*2-V19	=W19*8+V19
20	=(N20+P20-SQRT(POWER(($N20+$P20),2)-(4*(N20*P20-POWER(10,-$Q20)))))/2	=$N20-$R20	=-LOG10($S20)	=(0.0585*B20+1.309)/10000000000	=S20*$B$3	=$V$2	=W20*2-V20	=W20*8+V20
21	=(N21+P21-SQRT(POWER(($N21+$P21),2)-(4*(N21*P21-POWER(10,-$Q21)))))/2	=$N21-$R21	=-LOG10($S21)	=(0.0585*B21+1.309)/10000000000	=S21*$B$3	=$V$2	=W21*2-V21	=W21*8+V21
22	=(N22+P22-SQRT(POWER(($N22+$P22),2)-(4*(N22*P22-POWER(10,-$Q22)))))/2	=$N22-$R22	=-LOG10($S22)	=(0.0585*B22+1.309)/10000000000	=S22*$B$3	=$V$2	=W22*2-V22	=W22*8+V22
23	=(N23+P23-SQRT(POWER(($N23+$P23),2)-(4*(N23*P23-POWER(10,-$Q23)))))/2	=$N23-$R23	=-LOG10($S23)	=(0.0585*B23+1.309)/10000000000	=S23*$B$3	=$V$2	=W23*2-V23	=W23*8+V23
24	=(N24+P24-SQRT(POWER(($N24+$P24),2)-(4*(N24*P24-POWER(10,-$Q24)))))/2	=$N24-$R24	=-LOG10($S24)	=(0.0585*B24+1.309)/10000000000	=S24*$B$3	=$V$2	=W24*2-V24	=W24*8+V24
25	=(N25+P25-SQRT(POWER(($N25+$P25),2)-(4*(N25*P25-POWER(10,-$Q25)))))/2	=$N25-$R25	=-LOG10($S25)	=(0.0585*B25+1.309)/10000000000	=S25*$B$3	=$V$2	=W25*2-V25	=W25*8+V25
26	=(N26+P26-SQRT(POWER(($N26+$P26),2)-(4*(N26*P26-POWER(10,-$Q26)))))/2	=$N26-$R26	=-LOG10($S26)	=(0.0585*B26+1.309)/10000000000	=S26*$B$3	=$V$2	=W26*2-V26	=W26*8+V26
27	=(N27+P27-SQRT(POWER(($N27+$P27),2)-(4*(N27*P27-POWER(10,-$Q27)))))/2	=$N27-$R27	=-LOG10($S27)	=(0.0585*B27+1.309)/10000000000	=S27*$B$3	=$V$2	=W27*2-V27	=W27*8+V27
28	=(N28+P28-SQRT(POWER(($N28+$P28),2)-(4*(N28*P28-POWER(10,-$Q28)))))/2	=$N28-$R28	=-LOG10($S28)	=(0.0585*B28+1.309)/10000000000	=S28*$B$3	=$V$2	=W28*2-V28	=W28*8+V28
29	=(N29+P29-SQRT(POWER(($N29+$P29),2)-(4*(N29*P29-POWER(10,-$Q29)))))/2	=$N29-$R29	=-LOG10($S29)	=(0.0585*B29+1.309)/10000000000	=S29*$B$3	=$V$2	=W29*2-V29	=W29*8+V29
30	=(N30+P30-SQRT(POWER(($N30+$P30),2)-(4*(N30*P30-POWER(10,-$Q30)))))/2	=$N30-$R30	=-LOG10($S30)	=(0.0585*B30+1.309)/10000000000	=S30*$B$3	=$V$2	=W30*2-V30	=W30*8+V30
31	=(N31+P31-SQRT(POWER(($N31+$P31),2)-(4*(N31*P31-POWER(10,-$Q31)))))/2	=$N31-$R31	=-LOG10($S31)	=(0.0585*B31+1.309)/10000000000	=S31*$B$3	=$V$2	=W31*2-V31	=W31*8+V31
32	=(N32+P32-SQRT(POWER(($N32+$P32),2)-(4*(N32*P32-POWER(10,-$Q32)))))/2	=$N32-$R32	=-LOG10($S32)	=(0.0585*B32+1.309)/10000000000	=S32*$B$3	=$V$2	=W32*2-V32	=W32*8+V32
33	=(N33+P33-SQRT(POWER(($N33+$P33),2)-(4*(N33*P33-POWER(10,-$Q33)))))/2	=$N33-$R33	=-LOG10($S33)	=(0.0585*B33+1.309)/10000000000	=S33*$B$3	=$V$2	=W33*2-V33	=W33*8+V33
34	=(N34+P34-SQRT(POWER(($N34+$P34),2)-(4*(N34*P34-POWER(10,-$Q34)))))/2	=$N34-$R34	=-LOG10($S34)	=(0.0585*B34+1.309)/10000000000	=S34*$B$3	=$V$2	=W34*2-V34	=W34*8+V34
35	=(N35+P35-SQRT(POWER(($N35+$P35),2)-(4*(N35*P35-POWER(10,-$Q35)))))/2	=$N35-$R35	=-LOG10($S35)	=(0.0585*B35+1.309)/10000000000	=S35*$B$3	=$V$2	=W35*2-V35	=W35*8+V35
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	Z	AA	A
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3			
4			
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7			
8	**LIQUID CONTROL [SLC] SOLUTIOI**		
9			
10			
11	pK_a	**pH**	
12	$-log_{10}K_a$	[15]	
13	=-LOG10(U13)	**=Z13+LOG10((X13/$B$3)/(Y13/$B$3))**	
14	=-LOG10(U14)	**=Z14+LOG10((X14/$B$3)/(Y14/$B$3))**	
15	=-LOG10(U15)	**=Z15+LOG10((X15/$B$3)/(Y15/$B$3))**	
16	=-LOG10(U16)	**=Z16+LOG10((X16/$B$3)/(Y16/$B$3))**	
17	=-LOG10(U17)	**=Z17+LOG10((X17/$B$3)/(Y17/$B$3))**	
18	=-LOG10(U18)	**=Z18+LOG10((X18/$B$3)/(Y18/$B$3))**	
19	=-LOG10(U19)	**=Z19+LOG10((X19/$B$3)/(Y19/$B$3))**	
20	=-LOG10(U20)	**=Z20+LOG10((X20/$B$3)/(Y20/$B$3))**	
21	=-LOG10(U21)	**=Z21+LOG10((X21/$B$3)/(Y21/$B$3))**	
22	=-LOG10(U22)	**=Z22+LOG10((X22/$B$3)/(Y22/$B$3))**	
23	=-LOG10(U23)	**=Z23+LOG10((X23/$B$3)/(Y23/$B$3))**	
24	=-LOG10(U24)	**=Z24+LOG10((X24/$B$3)/(Y24/$B$3))**	
25	=-LOG10(U25)	**=Z25+LOG10((X25/$B$3)/(Y25/$B$3))**	
26	=-LOG10(U26)	**=Z26+LOG10((X26/$B$3)/(Y26/$B$3))**	
27	=-LOG10(U27)	**=Z27+LOG10((X27/$B$3)/(Y27/$B$3))**	
28	=-LOG10(U28)	**=Z28+LOG10((X28/$B$3)/(Y28/$B$3))**	
29	=-LOG10(U29)	**=Z29+LOG10((X29/$B$3)/(Y29/$B$3))**	
30	=-LOG10(U30)	**=Z30+LOG10((X30/$B$3)/(Y30/$B$3))**	
31	=-LOG10(U31)	**=Z31+LOG10((X31/$B$3)/(Y31/$B$3))**	
32	=-LOG10(U32)	**=Z32+LOG10((X32/$B$3)/(Y32/$B$3))**	
33	=-LOG10(U33)	**=Z33+LOG10((X33/$B$3)/(Y33/$B$3))**	
34	=-LOG10(U34)	**=Z34+LOG10((X34/$B$3)/(Y34/$B$3))**	
35	=-LOG10(U35)	**=Z35+LOG10((X35/$B$3)/(Y35/$B$3))**	
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PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	A	B	C	D	E	F	G
1	**PEACH BOT**					**pH TRANSIENT**	**END OF CYCLE**
2							Linear Absorption Coef
3	V_{POOL}	=122900*28.3168	Liters [122900 ft³] [13]				$u_{beta\ air}$
4	m_I	=290	Iodine inventory [g-atom				$u_{beta\ hypalon}$
5	m_{Cs}	=3200	Cesium inventory [g-ator				$u_{gamma\ air}$
6	t_{gap}	=121/3600	Onset of Gap release [h				$u_{gamma\ hypalon}$
7							$r_{[gamma\ free\ path\text{-}DRYWELL]}$ [16]
8							$r_{[gamma\ free\ path\text{-}TORUS\ AIR]}$ [16]
9				INTEGRATED DO			
10			Beta+Gamma[18]	Gamma[18]	Beta[18]	Gamma[18]	Beta[18]
11	TIME	POOL Temp	POOL	DRYWELL	DRYWELL	TORUS AIR	TORUS AIR
12	Hours	Deg F [17]	Mrad	MeV/cm³	MeV/cm³	MeV/cm³	MeV/cm³
13	0	80					
14	1	175					
15	2	187	0.143500086508842	3415252526559.5	1493516901702.39	6782790405603.09	2112853924362.65
16	=0.5+1.5+B6	188	0.149634733015881	3557433766582.65	1555848397608.08	7070702227895.83	2205232001151.76
17	3	192	0.309341836086142	7223665685898.47	3184466482938.89	14522270407907.7	4653989461673.07
18	5	199	0.571714238137557	12993742725588.9	5867592321860.4	26579195436675.8	8861664876224.85
19	12	204	1.18897340652801	24846754835583.8	12265274440332.4	54124658556267.7	19580415772096.5
20	18	198	1.55683327582913	31033162634725.7	16238511537328.7	70115732616255	26393164623873.5
21	24	197	1.85191915601109	35783878087763.8	19532321678811.2	82812650068300.5	31988772986659.7
22	48	190	2.69999350899574	49289591172808.2	29429378072763.1	119362761252454	48011228084913 2
23	72	177	3.31896426382511	59373911524643.9	36857885649250	146641045030486	59103260447932.9
24	96	160	3.83902585927095	68006216910072.3	43061765946118.8	170021885936274	67961305910172.6
25	120	153	4.30449745517556	75777204350529.3	48469947167744.3	191216585122999	75621430881437
26	150	149	4.83863042922377	84663108071843.2	54411194958229.2	215749512205084	84199682180048.8
27	200	142	5.65123374775693	98005925381916.4	62794391540543.6	253363489030894	96959403927412.6
28	240	138	6.24993554889672	107669540194174	68442614993399.4	281251300182045	106185426030441
29	300	132	7.08123504117198	120857131002314	75570313182062.1	320201031278407	118768378954490
30	360	127	7.84729286641128	132800350275133	81462258405056.5	356330536069072	130127193615785
31	400	124	8.32796771895153	140208197049268	84862166864990.9	379118949506557	137136062051670
32	480	123	9.23016582533999	153971254659635	90707083398776.2	422140895644603	150041841567683
33	600	120	10.4680366999075	172651749035525	97804662138577.5	481694348263629	167224642525045
34	700	119	11.4213133856566	186955852261398	102732737437929	527952520751998	180060583153812
35	720	117	11.6052404151638	189712487101709	10364252607763€	536915254530628	182499580739728
36							
37	NOTES						14
38	1	Entergy Eng. Report (					15
39	2	Ibid, Equation 3-2b					16
40	3	Ibid, Equation 3-4d [3					17
41	4	Ibid, Table A-1					18
42	5	Ibid, Equation 3-3a					19
43	6	Ibid, Equation 3-3b					20
44	7	Ibid, Equation 3-5a; E					21
45	8	Ibid, Equation 3-5b; E					
46	9	Ibid, Equation 3-0a; E					
47	10	Ibid, Equation 3-5d; E					22
48	11	Ibid, Equation 3-5d; E					
49	12	Ibid, Equation 3-5e; E					
50	13	Min. Suppression Poo					

PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	H	I	N	O
1				
2				
3	0.0198	1/cm		
4	52.08	1/cm		
5	0.0000375	1/cm		
6	0.099	1/cm		
7	=34*30.48	cm		
8	=15.25*30.48	cm		
9				
10				
11	[HI] [1]	[HNO_3] [2]	Total [H+] [7]	[CsOH] [3]
12	g-mols/liter	g-mols/liter	g-ions/liter	g-mols/liter
13	0		=POWER(10,-$T$13)+$H13+$I13+$J13+$K13+$L13+$M13	0
14	=$B$4/(120*$B$3)*($A14-(0.5+$B$6))+$B$4/(400*$B$3)		=POWER(10,-$T$13)+$H14+$I14+$J14+$K14+$L14+$M14	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A14-(0.5+$B$6))+(0 05*$B$5-0.0475*$B$4)/$B$3
15	=$B$4/(120*$B$3)*($A15-(0.5+$B$6))+$B$4/(400*$B$3)	=0.0000073*$C15	=POWER(10,-$T$13)+$H15+$I15+$J15+$K15+$L15+$M15	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A15-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3
16	=$B$4/(120*$B$3)*($A16-(0.5+$B$6))+$B$4/(400*$B$3)	=0.0000073*$C16	=POWER(10,-$T$13)+$H16+$I16+$J16+$K16+$L16+$M16	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A16-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3
17	=H$16	=0.0000073*$C17	=POWER(10,-$T$13)+$H17+$I17+$J17+$K17+$L17+$M17	=$O$16
18	=H$16	=0.0000073*$C18	=POWER(10,-$T$13)+$H18+$I18+$J18+$K18+$L18+$M18	=$O$16
19	=H$16	=0.0000073*$C19	=POWER(10;-$T$13)+$H19+$I19+$J19+$K19+$L19+$M19	=$O$16
20	=H$16	=0 0000073*$C20	=POWER(10,-$T$13)+$H20+$I20+$J20+$K20+$L20+$M20	=$O$16
21	=H$16	=0.0000073*$C21	=POWER(10,-$T$13)+$H21+$I21+$J21+$K21+$L21+$M21	=$O$16
22	=H$16	=0.0000073*$C22	=POWER(10,-$T$13)+$H22+$I22+$J22+$K22+$L22+$M22	=$O$16
23	=H$16	=0.0000073*$C23	=POWER(10,-$T$13)+$H23+$I23+$J23+$K23+$L23+$M23	=$O$16
24	=H$16	=0.0000073*$C24	=POWER(10,-$T$13)+$H24+$I24+$J24+$K24+$L24+$M24	=$O$16
25	=H$16	=0.0000073*$C25	=POWER(10,-$T$13)+$H25+$I25+$J25+$K25+$L25+$M25	=$O$16
26	=H$16	=0.0000073*$C26	=POWER(10,-$T$13)+$H26+$I26+$J26+$K26+$L26+$M26	=$O$16
27	=H$16	=0.0000073*$C27	=POWER(10,-$T$13)+$H27+$I27+$J27+$K27+$L27+$M27	=$O$16
28	=H$16	=0.0000073*$C28	=POWER(10,-$T$13)+$H28+$I28+$J28+$K28+$L28+$M28	=$O$16
29	=H$16	=0.0000073*$C29	=POWER(10,-$T$13)+$H29+$I29+$J29+$K29+$L29+$M29	=$O$16
30	=H$16	=0.0000073*$C30	=POWER(10,-$T$13)+$H30+$I30+$J30+$K30+$L30+$M30	=$O$16
31	=H$16	=0.0000073*$C31	=POWER(10,-$T$13)+$H31+$I31+$J31+$K31+$L31+$M31	=$O$16
32	=H$16	=0.0000073*$C32	=POWER(10,-$T$13)+$H32+$I32+$J32+$K32+$L32+$M32	=$O$16
33	=H$16	=0.0000073*$C33	=POWER(10,-$T$13)+$H33+$I33+$J33+$K33+$L33+$M33	=$O$16
34	=H$16	=0.0000073*$C34	=POWER(10,-$T$13)+$H34+$I34+$J34+$K34+$L34+$M34	=$O$16
35	=H$16	=0.0000073*$C35	=POWER(10,-$T$13)+$H35+$I35+$J35+$K35+$L35+$M35	=$O$16
36				
37	Acid dissociation constant from: Entergy Eng. Report GGNS-98-0			
38	Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7			
39	See attachment B for gamma free paths			
40	PBAPS UFSAR Fig. 14.6.12 (Rev.14) and Fig. 14.6.12A (Rev. 15			
41	Attachment B			
42	Attachment B			
43	USNRC Reg. Guide 1.183			
44	Plant chemistry data transmitted via E-mail by Mark G. Fry 12/27/			
45	minimum lbs. mass of boron-10 used (PBAPS Unit 2 - 12/07/1			
46	atom% B-10 from Eagle Picher Report of Analysis Job #00-077			
47	Cable Data from Attachment A. Assume 5% of Tray cable surfac			
48				
49				
50				

PEACH BOTTOM
ATOMIC POWER STATION
TRANSIENT POOL pH CALCULATION

	P	Q	R	S	T
1				**pH TRANSIENT**	
2	**Cable Data** [22]				
3	1837364	Cable Surface [Trays] - DRYWELL [cm2]			
4	=$P$3*0.05	Cable Surface [Free air] - DRYWELL [cm2]			
5	=P6*0.05	Cable Surface [Free air] - TORUS [cm2]			
6	0	Cable Surface [Trays] - TORUS [cm2]			
7					
8					
9					
10					
11	Total [OH+] [8]	-LOG(Kw) [9]	Root x [10]	Net [H+] [11]	pH [12]
12	g-ions/liter			g-ions/liter	Before SLC
13	=POWER(10,-14)/POWER(10,-$T$13)+$O13	=15.5129-0.0224*$B13+0.00003352*POWER(B13,2)	=(N13+P13-SQRT(POWER(($N13+$P13),2)-(4*(N13*P13-POWER(10,-$Q13)))))/2	=$N13-$R13	5.3
14	=POWER(10,-14)/POWER(10,-$T$13)+$O14	=15.5129-0.0224*$B14+0.00003352*POWER(B14,2)	=(N14+P14-SQRT(POWER(($N14+$P14),2)-(4*(N14*P14-POWER(10,-$Q14)))))/2	=$N14-$R14	=-LOG10($S14)
15	=POWER(10,-14)/POWER(10,-$T$13)+$O15	=15.5129-0.0224*$B15+0.00003352*POWER(B15,2)	=(N15+P15-SQRT(POWER(($N15+$P15),2)-(4*(N15*P15-POWER(10,-$Q15)))))/2	=$N15-$R15	=-LOG10($S15)
16	=POWER(10,-14)/POWER(10,-$T$13)+$O16	=15.5129-0.0224*$B16+0.00003352*POWER(B16,2)	=(N16+P16-SQRT(POWER(($N16+$P16),2)-(4*(N16*P16-POWER(10,-$Q16)))))/2	=$N16-$R16	=-LOG10($S16)
17	=POWER(10,-14)/POWER(10,-$T$13)+$O17	=15.5129-0.0224*$B17+0.00003352*POWER(B17,2)	=(N17+P17-SQRT(POWER(($N17+$P17),2)-(4*(N17*P17-POWER(10,-$Q17)))))/2	=$N17-$R17	=-LOG10($S17)
18	=POWER(10,-14)/POWER(10,-$T$13)+$O18	=15.5129-0.0224*$B18+0.00003352*POWER(B18,2)	=(N18+P18-SQRT(POWER(($N18+$P18),2)-(4*(N18*P18-POWER(10,-$Q18)))))/2	=$N18-$R18	=-LOG10($S18)
19	=POWER(10,-14)/POWER(10,-$T$13)+$O19	=15.5129-0.0224*$B19+0.00003352*POWER(B19,2)	=(N19+P19-SQRT(POWER(($N19+$P19),2)-(4*(N19*P19-POWER(10,-$Q19)))))/2	=$N19-$R19	=-LOG10($S19)
20	=POWER(10,-14)/POWER(10,-$T$13)+$O20	=15.5129-0.0224*$B20+0.00003352*POWER(B20,2)	=(N20+P20-SQRT(POWER(($N20+$P20),2)-(4*(N20*P20-POWER(10,-$Q20)))))/2	=$N20-$R20	=-LOG10($S20)
21	=POWER(10,-14)/POWER(10,-$T$13)+$O21	=15.5129-0.0224*$B21+0.00003352*POWER(B21,2)	=(N21+P21-SQRT(POWER(($N21+$P21),2)-(4*(N21*P21-POWER(10,-$Q21)))))/2	=$N21-$R21	=-LOG10($S21)
22	=POWER(10,-14)/POWER(10,-$T$13)+$O22	=15.5129-0.0224*$B22+0.00003352*POWER(B22,2)	=(N22+P22-SQRT(POWER(($N22+$P22),2)-(4*(N22*P22-POWER(10,-$Q22)))))/2	=$N22-$R22	=-LOG10($S22)
23	=POWER(10,-14)/POWER(10,-$T$13)+$O23	=15.5129-0.0224*$B23+0.00003352*POWER(B23,2)	=(N23+P23-SQRT(POWER(($N23+$P23),2)-(4*(N23*P23-POWER(10,-$Q23)))))/2	=$N23-$R23	=-LOG10($S23)
24	=POWER(10,-14)/POWER(10,-$T$13)+$O24	=15.5129-0.0224*$B24+0.00003352*POWER(B24,2)	=(N24+P24-SQRT(POWER(($N24+$P24),2)-(4*(N24*P24-POWER(10,-$Q24)))))/2	=$N24-$R24	=-LOG10($S24)
25	=POWER(10,-14)/POWER(10,-$T$13)+$O25	=15.5129-0.0224*$B25+0.00003352*POWER(B25,2)	=(N25+P25-SQRT(POWER(($N25+$P25),2)-(4*(N25*P25-POWER(10,-$Q25)))))/2	=$N25-$R25	=-LOG10($S25)
26	=POWER(10,-14)/POWER(10,-$T$13)+$O26	=15.5129-0.0224*$B26+0.00003352*POWER(B26,2)	=(N26+P26-SQRT(POWER(($N26+$P26),2)-(4*(N26*P26-POWER(10,-$Q26)))))/2	=$N26-$R26	=-LOG10($S26)
27	=POWER(10,-14)/POWER(10,-$T$13)+$O27	=15.5129-0.0224*$B27+0.00003352*POWER(B27,2)	=(N27+P27-SQRT(POWER(($N27+$P27),2)-(4*(N27*P27-POWER(10,-$Q27)))))/2	=$N27-$R27	=-LOG10($S27)
28	=POWER(10,-14)/POWER(10,-$T$13)+$O28	=15.5129-0.0224*$B28+0.00003352*POWER(B28,2)	=(N28+P28-SQRT(POWER(($N28+$P28),2)-(4*(N28*P28-POWER(10,-$Q28)))))/2	=$N28-$R28	=-LOG10($S28)
29	=POWER(10,-14)/POWER(10,-$T$13)+$O29	=15.5129-0.0224*$B29+0.00003352*POWER(B29,2)	=(N29+P29-SQRT(POWER(($N29+$P29),2)-(4*(N29*P29-POWER(10,-$Q29)))))/2	=$N29-$R29	=-LOG10($S29)
30	=POWER(10,-14)/POWER(10,-$T$13)+$O30	=15.5129-0.0224*$B30+0.00003352*POWER(B30,2)	=(N30+P30-SQRT(POWER(($N30+$P30),2)-(4*(N30*P30-POWER(10,-$Q30)))))/2	=$N30-$R30	=-LOG10($S30)
31	=POWER(10,-14)/POWER(10,-$T$13)+$O31	=15.5129-0.0224*$B31+0.00003352*POWER(B31,2)	=(N31+P31-SQRT(POWER(($N31+$P31),2)-(4*(N31*P31-POWER(10,-$Q31)))))/2	=$N31-$R31	=-LOG10($S31)
32	=POWER(10,-14)/POWER(10,-$T$13)+$O32	=15.5129-0.0224*$B32+0.00003352*POWER(B32,2)	=(N32+P32-SQRT(POWER(($N32+$P32),2)-(4*(N32*P32-POWER(10,-$Q32)))))/2	=$N32-$R32	=-LOG10($S32)
33	=POWER(10,-14)/POWER(10,-$T$13)+$O33	=15.5129-0.0224*$B33+0.00003352*POWER(B33,2)	=(N33+P33-SQRT(POWER(($N33+$P33),2)-(4*(N33*P33-POWER(10,-$Q33)))))/2	=$N33-$R33	=-LOG10($S33)
34	=POWER(10,-14)/POWER(10,-$T$13)+$O34	=15.5129-0.0224*$B34+0.00003352*POWER(B34,2)	=(N34+P34-SQRT(POWER(($N34+$P34),2)-(4*(N34*P34-POWER(10,-$Q34)))))/2	=$N34-$R34	=-LOG10($S34)
35	=POWER(10,-14)/POWER(10,-$T$13)+$O35	=15.5129-0.0224*$B35+0.00003352*POWER(B35,2)	=(N35+P35-SQRT(POWER(($N35+$P35),2)-(4*(N35*P35-POWER(10,-$Q35)))))/2	=$N35-$R35	=-LOG10($S35)
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	U	V	W	X	Y	Z	AA	AB
1	**END OF CYCLE**							
2		=V5/10	g. mols $Na_2B_{10}O_{16}$*10H_2O A					
3	210.6	=U3*453.59	lb./grams B-10[21]	10.01	atomic wt. B-10			
4		62.98	atom % B-10[21]	=V3/X3	g. atoms B-10			
5		=X4/V4*100	g.atoms total boron					
6								
7								
8	**pH EFFECT OF ADDITION OF SODIUM PENTABORATE STANDBY LIQUID CONTROL [SLC] SOLUTION**							
9								
10		Strong Acid						
11	K_a	g-equiv.	$Na_2B_{10}O_{16}$*10H_2O	Borate	Boric Acid	pK_a	pH	
12	[14]	Net [H+] * V_{POOL}	g-mols	g-equiv.	g-equiv.	$-log_{10}K_a$	[15]	
13	=(0.0585*B13+1.309)/10000000000	=S13*$B$3	=$V$2	=W13*2-V13	=W13*8+V13	=-LOG10(U13)	**=Z13+LOG10((X13/$B$3)/(Y13/$B$3))**	
14	=(0.0585*B14+1.309)/10000000000	=S14*$B$3	=$V$2	=W14*2-V14	=W14*8+V14	=-LOG10(U14)	**=Z14+LOG10((X14/$B$3)/(Y14/$B$3))**	
15	=(0.0585*B15+1.309)/10000000000	=S15*$B$3	=$V$2	=W15*2-V15	=W15*8+V15	=-LOG10(U15)	**=Z15+LOG10((X15/$B$3)/(Y15/$B$3))**	
16	=(0.0585*B16+1.309)/10000000000	=S16*$B$3	=$V$2	=W16*2-V16	=W16*8+V16	=-LOG10(U16)	**=Z16+LOG10((X16/$B$3)/(Y16/$B$3))**	
17	=(0.0585*B17+1.309)/10000000000	=S17*$B$3	=$V$2	=W17*2-V17	=W17*8+V17	=-LOG10(U17)	**=Z17+LOG10((X17/$B$3)/(Y17/$B$3))**	
18	=(0.0585*B18+1.309)/10000000000	=S18*$B$3	=$V$2	=W18*2-V18	=W18*8+V18	=-LOG10(U18)	**=Z18+LOG10((X18/$B$3)/(Y18/$B$3))**	
19	=(0.0585*B19+1.309)/10000000000	=S19*$B$3	=$V$2	=W19*2-V19	=W19*8+V19	=-LOG10(U19)	**=Z19+LOG10((X19/$B$3)/(Y19/$B$3))**	
20	=(0.0585*B20+1.309)/10000000000	=S20*$B$3	=$V$2	=W20*2-V20	=W20*8+V20	=-LOG10(U20)	**=Z20+LOG10((X20/$B$3)/(Y20/$B$3))**	
21	=(0.0585*B21+1.309)/10000000000	=S21*$B$3	=$V$2	=W21*2-V21	=W21*8+V21	=-LOG10(U21)	**=Z21+LOG10((X21/$B$3)/(Y21/$B$3))**	
22	=(0.0585*B22+1.309)/10000000000	=S22*$B$3	=$V$2	=W22*2-V22	=W22*8+V22	=-LOG10(U22)	**=Z22+LOG10((X22/$B$3)/(Y22/$B$3))**	
23	=(0.0585*B23+1.309)/10000000000	=S23*$B$3	=$V$2	=W23*2-V23	=W23*8+V23	=-LOG10(U23)	**=Z23+LOG10((X23/$B$3)/(Y23/$B$3))**	
24	=(0.0585*B24+1.309)/10000000000	=S24*$B$3	=$V$2	=W24*2-V24	=W24*8+V24	=-LOG10(U24)	**=Z24+LOG10((X24/$B$3)/(Y24/$B$3))**	
25	=(0.0585*B25+1.309)/10000000000	=S25*$B$3	=$V$2	=W25*2-V25	=W25*8+V25	=-LOG10(U25)	**=Z25+LOG10((X25/$B$3)/(Y25/$B$3))**	
26	=(0.0585*B26+1.309)/10000000000	=S26*$B$3	=$V$2	=W26*2-V26	=W26*8+V26	=-LOG10(U26)	**=Z26+LOG10((X26/$B$3)/(Y26/$B$3))**	
27	=(0.0585*B27+1.309)/10000000000	=S27*$B$3	=$V$2	=W27*2-V27	=W27*8+V27	=-LOG10(U27)	**=Z27+LOG10((X27/$B$3)/(Y27/$B$3))**	
28	=(0.0585*B28+1.309)/10000000000	=S28*$B$3	=$V$2	=W28*2-V28	=W28*8+V28	=-LOG10(U28)	**=Z28+LOG10((X28/$B$3)/(Y28/$B$3))**	
29	=(0.0585*B29+1.309)/10000000000	=S29*$B$3	=$V$2	=W29*2-V29	=W29*8+V29	=-LOG10(U29)	**=Z29+LOG10((X29/$B$3)/(Y29/$B$3))**	
30	=(0.0585*B30+1.309)/10000000000	=S30*$B$3	=$V$2	=W30*2-V30	=W30*8+V30	=-LOG10(U30)	**=Z30+LOG10((X30/$B$3)/(Y30/$B$3))**	
31	=(0.0585*B31+1.309)/10000000000	=S31*$B$3	=$V$2	=W31*2-V31	=W31*8+V31	=-LOG10(U31)	**=Z31+LOG10((X31/$B$3)/(Y31/$B$3))**	
32	=(0.0585*B32+1.309)/10000000000	=S32*$B$3	=$V$2	=W32*2-V32	=W32*8+V32	=-LOG10(U32)	**=Z32+LOG10((X32/$B$3)/(Y32/$B$3))**	
33	=(0.0585*B33+1.309)/10000000000	=S33*$B$3	=$V$2	=W33*2-V33	=W33*8+V33	=-LOG10(U33)	**=Z33+LOG10((X33/$B$3)/(Y33/$B$3))**	
34	=(0.0585*B34+1.309)/10000000000	=S34*$B$3	=$V$2	=W34*2-V34	=W34*8+V34	=-LOG10(U34)	**=Z34+LOG10((X34/$B$3)/(Y34/$B$3))**	
35	=(0.0585*B35+1.309)/1000000000C	=S35*$B$3	=$V$2	=W35*2-V35	=W35*8+V35	=-LOG10(U35)	**=Z35+LOG10((X35/$B$3)/(Y35/$B$3))**	
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GRAND GULF REFERENCE CALCULATION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	CASE 1	GRAND GULF REFERENCE DATA			pH TRANSIENT												
2							Linear Absorption Coefficients [4]			$L_{A\,tray}$ [lb]	873.65	Cable Length [trays]- Zone A				SLC [lbs]	5800
3	V_{POOL}	4.841E+06	Liters [Min.Tech Spec Basis B 3.6.2.2]				$u_{beta\ air}$	1.980E-02	1/cm	$L_{A\,fa}$ [lb]	873.65	Cable Length [free air]- Zone A					
4	m_I	325	Iodine inventory [g-atoms]				$u_{beta\ hypalon}$	52.08	1/cm	$L_{B\,tray}$ [lb]	14049.27	Cable Length [trays] - Zone B					
5	m_{Cs}	2400	Cesium inventory [g-atoms]				$u_{gamma\ air}$	3.75E-05	1/cm	$L_{B\,fa}$ [lb]	1561.03	Cable Length [free air] - Zone B					
6	t_{gap}	0.0336	Onset of Gap release [hrs]				$u_{gamma\ hypalon}$	0.099	1/cm	R_0 [cm^2]/lb	800	Cable Area					
7							$r_{[gamma\ free\ path-A]}$	1112.5	cm	th [cm]	0.7112	Hypalon Jacket Thickness [13]					
8							$r_{[gamma\ free\ path-B]}$	1384	cm								
9				INTEGRATED DOSES						CONCENTRATIONS							
10			Beta+Gamma	Gamma	Beta	Gamma	Beta			From Beta	From Gamma	From Beta	From Gamma				
11	TIME	POOL Temp	POOL	DRYWELL	DRYWELL	CONTAINMEN	CONTAINMENT	[HI] [1]	[HNO_3] [2]	[HCL] -A [5]	[HCL] -A [6]	[HCL] -B [5]	[HCL] -B [6]	Total [H+] [7]	[CsOH] [3]	Total [OH+] [8]	-LOG(Kw) [9]
12	Hours	Deg F	Mrad	MeV/cm^3	MeV/cm^3	MeV/cm^3	MeV/cm^3	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter	g-ions/liter	g-mols/liter	g-ions/liter	
13	0	77						0.00E+00						5.012E-06	0.0000E+00	2.00E-09	1.399E+01
14	1	160						4.288E-07						5.441E-06	4.7472E-05	4.75E-05	1.279E+01
15	2	160	1.3783E+00	1.4200E+12	2.8733E+12	0.0000E+00	1.1220E+12	9.8825E-07	1.006E-05	1.104E-06	1.067E-06	2.824E-06	0.000E+00	2.106E-05	1.0295E-04	1.03E-04	1.279E+01
16	2.0336	160	1.3792E+00	1.4506E+12	2.8784E+12	0.0000E+00	1.2148E+12	1.0071E-06	1.007E-05	1.106E-06	1.090E-06	3.057E-06	0.000E+00	2.134E-05	1.0481E-04	1.05E-04	1.279E+01
17	3	159.1	1.4049E+00	2.1630E+12	3.0235E+12	6.6925E+10	1.2908E+12	1.0071E-06	1.026E-05	1.161E-06	1.625E-06	3.249E-06	5.560E-07	2.287E-05	1.0481E-04	1.05E-04	1.280E+01
18	5	155.5	1.4581E+00	3.0991E+12	3.3208E+12	6.4671E+11	1.4468E+12	1.0071E-06	1.064E-05	1.276E-06	2.328E-06	3.641E-06	5.373E-06	2 928E-05	1.0481E-04	1.05E-04	1.284E+01
19	12	149.2	1.6425E+00	4.7032E+12	4.3312E+12	1.6404E+12	1.9789E+12	1.0071E-06	1.199E-05	1.664E-06	3.533E-06	4.980E-06	1.363E-05	4.181E-05	1.0481E-04	1.05E-04	1.292E+01
20	18	146.4	1.7985E+00	5.4462E+12	5.1609E+12	2.1006E+12	2.4183E+12	1.0071E-06	1.313E-05	1.982E-06	4.091E-06	6.086E-06	1.745E-05	4.876E-05	1.0481E-04	1.05E-04	1.295E+01
21	24	144.3	1.9526E+00	5.9733E+12	5.9584E+12	2.4271E+12	2.8430E+12	1.0071E-06	1.425E-05	2.289E-06	4.487E-06	7.155E-06	2.016E-05	5.437E-05	1 0481E-04	1.05E-04	1.298E+01
22	48	139.4	2.5509E+00	7.2434E+12	8.8503E+12	3.2138E+12	4.4038E+12	1.0071E-06	1.862E-05	3.400E-06	5.442E-06	1.108E-05	2.670E-05	7.126E-05	1.0481E-04	1.05E-04	1 304E+01
23	72	136.5	3.1213E+00	7.9863E+12	1.1319E+13	3.6740E+12	5.7649E+12	1.0071E-06	2.279E-05	4.348E-06	6.000E-06	1.451E-05	3.052E-05	8.418E-05	1.0481E-04	1.05E-04	1.308E+01
24	96	134.4	3.6648E+00	8.5135E+12	1.3425E+13	4.0005E+12	6.9521E+12	1.0071E-06	2.675E-05	5.157E-06	6.396E-06	1.750E-05	3 323E-05	9 506E-05	1.0481E-04	1.05E-04	1.311E+01
25	120	132.8	4.1830E+00	8.9224E+12	1.5224E+13	4.2538E+12	7.9874E+12	1.0071E-06	3.054E-05	5.848E-06	6.703E-06	2.010E-05	3.534E-05	1.045E-04	1.0481E-04	1.05E-04	1.313E+01
26	150	131.3	4.7966E+00	9.3312E+12	1.7105E+13	4.5071E+12	9.0975E+12	1.0071E-06	3.502E-05	6.571E-06	7.010E-06	2.290E-05	3.744E-05	1.150E-04	1.0481E-04	1.05E-04	1.315E+01
27	200	129.2	5.7409E+00	9.8584E+12	1.9521E+13	4.8336E+12	1.0574E+13	1.0071E-06	4.191E-05	7.499E-06	7.406E-06	2.661E-05	4.016E-05	1.296E-04	1.0481E-04	1.05E-04	1.318E+01
28	240	127.9	6.4313E+00	1.0192E+13	2.0955E+13	5.0405E+12	1.1486E+13	1.0071E-06	4.695E-05	8.050E-06	7.657E-06	2.891E-05	4.187E-05	1.395E-04	1.0481E-04	1.05E-04	1.320E+01
29	300	126.3	7.3686E+00	1.0601E+13	2.2506E+13	5.2938E+12	1.2519E+13	1.0071E-06	5.379E-05	8.645E-06	7.964E-06	3.151E-05	4.398E-05	1.519E-04	1.0481E-04	1.05E-04	1.322E+01
30	360	125	8.1999E+00	1.0935E+13	2.3551E+13	5.5007E+12	1.3252E+13	1.0071E-06	5.986E-05	9.047E-06	8.215E-06	3.335E-05	4.570E-05	1.622E-04	1.0481E-04	1.05E-04	1.324E+01
31	400	124.3	8.7011E+00	1.1128E+13	2.4049E+13	5.6203E+12	1.3618E+13	1.0071E-06	6.352E-05	9.238E-06	8.360E-06	3.427E-05	4.669E-05	1.681E-04	1.0481E-04	1.05E-04	1.325E+01
32	480	123	9.5911E+00	1.1463E+13	2.4727E+13	5.8272E+12	1.4143E+13	1.0071E-06	7.002E-05	9.499E-06	8.612E-06	3.559E-05	4.841E-05	1.781E-04	1.0481E-04	1.05E-04	1.326E+01
33	600	121.4	1.0685E+01	1.1871E+13	2.5259E+13	6.0805E+12	1.4592E+13	1.0071E-06	7.8E-05	9.703E-06	8.918E-06	3.672E-05	5.051E-05	1.899E-04	1.0481E-04	1.05E-04	1.329E+01
34	700	120.3	1.1417E+01	1.2154E+13	2.5472E+13	6.2555E+12	1.4791E+13	1.0071E-06	8.334E-05	9.785E-06	9.131E-06	3.722E-05	5.197E-05	1.975E-04	1.0481E-04	1.05E-04	1.330E+01
35	720	120.1	1.1546E+01	1.2205E+13	2.5500E+13	6.2875E+12	1.4819E+13	1.0071E-06	8.429E-05	9.795E-06	9.169E-06	3.729E-05	5.223E-05	1.988E-04	1.0481E-04	1.05E-04	1.331E+01
36																	
37	NOTES																
38	1	Entergy Eng. Report GGNS-98-0039 Rev.3 , Equation 3-1d [30+90 min release duration]						14	Acid dissociation constant from: Entergy Eng. Rep. GGNS-98-0039 Rev.3, Sect.6.1,p.21								
39	2	Ibid, Equation 3-2b						15	Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7								
40	3	Ibid, Equation 3-4d [30+90 min release duration]															
41	4	Ibid, Table A-1															
42	5	Ibid, Equation 3-3a; Entergy Calc. XC-Q11111-98013 Rev.2, Equation 5-1															
43	6	Ibid, Equation 3-3b; Entergy Calc. XC-Q11111-98013 Rev.2, Equation 5-2															
44	7	Ibid, Equation 3-5a: Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7															
45	8	Ibid, Equation 3-5b; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7															
46	9	Ibid, Equation 3-0a; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7															
47	10	Ibid, Equation 3-5d; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7															
48	11	Ibid, Equation 3-5d; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7															
49	12	Ibid, Equation 3-5e; Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.7															
50	13	Entergy Calc. XC-Q11111-98013 Rev.2, Section 5.2.2															

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
1												
2	$Na_2B_{10}O_{16}$ Added [MW=410]											
3												
4												
5												
6												
7												
8				pH EFFECT OF ADDITION OF SODIUM PENTABORATE STANDBY LIQUID CONTROL [SLC] SOLUTION								
9												
10					Strong Acid							
11	Root x [10]	Net [H+] [11]	pH [12]	K_a	g-equiv.	$Na_2B_{10}O_{16}$	Borate	Boric Acid	pK_a	pH		
12		g-ions/liter		[14]	Net [H+] * V_{POOL}	g-mols	g-equiv.	g-equiv.	$-log_{10}K_a$			
13	-6.1360E-11	5.0119E-06	5.300	5.8135E-10	2.4262E+01	6416.8	12809	51359	9.24	8.63		
14	5.4368E-06	3.8846E-09	8.411	1.0669E-09	1.8805E-02	6416.8	12834	51334	8.97	8.37		
15	2.1054E-05	1.9940E-09	8.700	1.0669E-09	9.6529E-03	6416.8	12834	51334	8.97	8.37		
16	2.1338E-05	1.9563E-09	8.709	1.0669E-09	9.4701E-03	6416.8	12834	51334	8.97	8.37		
17	2.2864E-05	1.9450E-09	8.711	1.0616E-09	9.4153E-03	6416.8	12834	51334	8.97	8.37		
18	2.9279E-05	1.9127E-09	8.718	1 0406E-09	9.2589E-03	6416.8	12834	51334	8.98	8.38		
19	4.1812E-05	1.9216E-09	8.716	1 0037E-09	9.3022E-03	6416.8	12834	51334	9.00	8.40		
20	4.8757E-05	1.9925E-09	8.701	9.8734E-10	9.6456E-03	6416 8	12834	51334	9.01	8.40		
21	5.4365E-05	2.0826E-09	8.681	9.7506E-10	1.0082E-02	6416.8	12834	51334	9.01	8.41		
22	7.1261E-05	2.7075E-09	8.567	9.4639E-10	1.3107E-02	6416.8	12834	51334	9.02	8.42		
23	8.4179E-05	4.0324E-09	8.394	9.2943E-10	1.9520E-02	6416.8	12834	51334	9.03	8.43		
24	9.5048E-05	7.9891E-09	8.098	9.1714E-10	3.8674E-02	6416.8	12834	51334	9.04	8.44		
25	1.0438E-04	1.7016E-07	6.769	9.0778E-10	8.2373E-01	6416.8	12833	51335	9.04	8.44		
26	1.0481E-04	1.0148E-05	4.994	8.9901E-10	4.9124E+01	6416.8	12784	51383	9.05	8.44		
27	1.0481E-04	2.4789E-05	4.606	8.8672E-10	1.2000E+02	6416.8	12714	51454	9.05	8.45		
28	1.0481E-04	3.4644E-05	4.460	8.7912E-10	1.6771E+02	6416 8	12666	51502	9.06	8.45		
29	1.0481E-04	4.7093E-05	4.327	8.6976E-10	2.2797E+02	6416.8	12606	51562	9.06	8.45		
30	1.0481E-04	5.7377E-05	4.241	8.6215E-10	2.7775E+02	6416.8	12556	51612	9.06	8.45		
31	1.0481E-04	6.3287E-05	4.199	8.5806E-10	3.0636E+02	6416.8	12527	51641	9.07	8.45		
32	1.0481E-04	7.3336E-05	4 135	8.5045E-10	3.5501E+02	6416.8	12479	51689	9.07	8.45		
33	1.0481E-04	8.5066E-05	4.070	8.4109E-10	4.1179E+02	6416.8	12422	51746	9.08	8.46		
34	1.0481E-04	9.2659E-05	4.033	8.3466E-10	4.4855E+02	6416 8	12385	51783	9.08	8.46		
35	1.0481E-04	9.3986E-05	4.027	8.3349E-10	4.5497E+02	6416.8	12379	51789	9.08	8.46		
36												
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	A	B	C	D	E	F	G	H
1	CASE 1	GRAND GULF REFERE			pH TRANSIENT			
2							Linear Absorption Coeffici	
3	V_{POOL}	=170954*28.3168	Liters [Min.Tech Spec Basis E				$u_{beta\ air}$	0 0198
4	m_I	=325	Iodine inventory [g-atoms]				$u_{beta\ hypalon}$	52.08
5	m_{Cs}	=2400	Cesium inventory [g-atoms]				$u_{gamma\ air}$	0.0000375
6	t_{gap}	=121/3600	Onset of Gap release [hrs]				$u_{gamma\ hypalon}$	0.099
7							$r_{[gamma\ free\ path\text{-}A]}$	1112.5
8							$r_{[gamma\ free\ path\text{-}B]}$	1384
9				INTEGRATED DOSES				
10			Beta+Gamma	Gamma	Beta	Gamma	Beta	
11	TIME	POOL Temp	POOL	DRYWELL-A	DRYWELL-A	DRYWELL-B	DRYWELL-B	[HI] [1]
12	Hours	Deg F	Mrad	MeV/cm^3	MeV/cm^3	MeV/cm^3	MeV/cm^3	g-mols/liter
13	0	77						0
14	1	160						=$B$4/(120*$B$3)*($A14-(0 5+$B$6))+$B$4/(400*$B$3)
15	2	160	1.3783	1420000000000	2873300000000	0	1122000000000	=$B$4/(120*$B$3)*($A15-(0.5+$B$6))+$B$4/(400*$B$3)
16	=0.5+1.5+B6	160	1.3792	1450600000000	2878400000000	0	1214800000000	=$B$4/(120*$B$3)*($A16-(0.5+$B$6))+$B$4/(400*$B$3)
17	3	159.1	1.4049	2163000000000	3023500000000	66925000000	1290800000000	=H$16
18	5	155.5	1.4581	3099100000000	3320800000000	646710000000	1446800000000	=H$16
19	12	149.2	1.6425	4703200000000	4331200000000	1640400000000	1978900000000	=H$16
20	18	146.4	1.7985	5446200000000	5160900000000	2100600000000	2418300000000	=H$16
21	24	144.3	1.9526	5973300000000	5958400000000	2427100000000	2843000000000	=H$16
22	48	139.4	2.5509	7243400000000	8850300000000	3213800000000	4403800000000	=H$16
23	72	136.5	3.1213	7986300000000	11319000000000	3674000000000	5764900000000	=H$16
24	96	134.4	3.6648	8513500000000	13425000000000	4000500000000	6952100000000	=H$16
25	120	132.8	4.183	8922400000000	15224000000000	4253800000000	7987400000000	=H$16
26	150	131.3	4.7966	9331200000000	17105000000000	4507100000000	9097500000000	=H$16
27	200	129.2	5.7409	9858400000000	19521000000000	4833600000000	10574000000000	=H$16
28	240	127.9	6.4313	10192000000000	20955000000000	5040500000000	11486000000000	=H$16
29	300	126.3	7.3686	10601000000000	22506000000000	5293800000000	12519000000000	=H$16
30	360	125	8.1999	10935000000000	23551000000000	5500700000000	13252000000000	=H$16
31	400	124.3	8.7011	11128000000000	24049000000000	5620300000000	13618000000000	=H$16
32	480	123	9.5911	11463000000000	24727000000000	5827200000000	14143000000000	=H$16
33	600	121.4	10.685	11871000000000	25259000000000	6080500000000	14592000000000	=H$16
34	700	120.3	11.417	12154000000000	25472000000000	6255500000000	14791000000000	=H$16
35	720	120.1	11.546	12205000000000	25500000000000	6287500000000	14819000000000	=H$16
36								
37	NOTES							
38	1	Entergy Eng. Report GGI						14
39	2	Ibid, Equation 3-2b						15
40	3	Ibid, Equation 3-4d [30+9						
41	4	Ibid, Table A-1						
42	5	Ibid, Equation 3-3a; Ente						
43	6	Ibid, Equation 3-3b; Ente						
44	7	Ibid, Equation 3-5a; Ente						
45	8	Ibid, Equation 3-5b; Ente						
46	9	Ibid, Equation 3-0a; Ente						
47	10	Ibid, Equation 3-5d; Ente						
48	11	Ibid, Equation 3-5d; Ente						
49	12	Ibid, Equation 3-5e; Ente						
50	13	Entergy Calc. XC-Q111						

GRAND GULF REFERENCE CALCULATION

	I	J	K	L
1				
2		$L_{A\,tray}$ [lb]	873.65	Cable Length [trays]- Zone A
3	1/cm	$L_{A\,fa}$ [lb]	873.65	Cable Length [free air]- Zone A
4	1/cm	$L_{B\,tray}$ [lb]	14049.27	Cable Length [trays] - Zone B
5	1/cm	$L_{B\,fa}$ [lb]	1561.03	Cable Length [free air] - Zone B
6	1/cm	R_0 [cm^2]/lb	800	Cable Area
7	cm	th [cm]	=0.28*2.54	Hypalon Jacket Thickness [13]
8	cm			
9		CONCENTRATIONS		
10		From Beta	From Gamma	From Beta
11	$[HNO_3]$ [2]	[HCL] -A [5]	[HCL] -A [6]	[HCL] -B [5]
12	g-mols/liter	g-mols/liter	g-mols/liter	g-mols/liter
13				
14				
15	=0.0000073*$C15	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E15	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D15	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G15
16	=0.0000073*$C16	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E16	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D16	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G16.
17	=0.0000073*$C17	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E17	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D17	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G17
18	=0.0000073*$C18	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E18	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D18	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G18
19	=0.0000073*$C19	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E19	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D19	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G19
20	=0.0000073*$C20	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E20	=3 512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D20	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G20
21	=0.0000073*$C21	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E21	=3 512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D21	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G21
22	=0.0000073*$C22	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E22	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D22	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G22
23	=0.0000073*$C23	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E23	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D23	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G23
24	=0.0000073*$C24	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E24	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D24	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G24
25	=0.0000073*$C25	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E25	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D25	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G25
26	=0.0000073*$C26	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E26	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D26	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G26
27	=0.0000073*$C27	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E27	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D27	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G27
28	=0.0000073*$C28	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E28	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D28	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G28
29	=0.0000073*$C29	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E29	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D29	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G29
30	=0 0000073*$C30	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E30	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D30	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G30
31	=0.0000073*$C31	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E31	=3 512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D31	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G31
32	=0.0000073*$C32	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E32	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D32	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G32
33	=0.0000073*$C33	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E33	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D33	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G33
34	=0.0000073*$C34	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E34	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D34	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G34
35	=0.0000073*$C35	=3.512E-20/$B$3*$K$6*($K$2/2+$K$3)/$H$3*$E35	=3.512E-20/$B$3*$K$6*($K$2+$K$3)*(1-EXP(-$H$5*$H$7))/$H$5*(1-EXP(-$H$6*$K$7))*$D35	=3.512E-20/$B$3*$K$6*($K$4/2+$K$5)/$H$3*$G35
36				
37				
38	Acid dissociation consta			
39	Entergy Calc. XC-Q111			
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	M	N	O
1			
2			
3			
4			
5			
6			
7			
8			
9			
10	From Gamma		
11	[HCL] -B [6]	Total [H+] [7]	[CsOH] [3]
12	g-mols/liter	g-ions/liter	g-mols/liter
13		=POWER(10,-$T$13)+$H13+$I13+$J13+$K13+$L13+$M13	0
14		=POWER(10,-$T$13)+$H14+$I14+$J14+$K14+$L14+$M14	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A14-(0 5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3
15	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F15	=POWER(10,-$T$13)+$H15+$I15+$J15+$K15+$L15+$M15	=(0.4*$B$5-0.475*$B$4)/(3*$B$3)*($A15-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3
16	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F16	=POWER(10,-$T$13)+$H16+$I16+$J16+$K16+$L16+$M16	=(0 4*$B$5-0.475*$B$4)/(3*$B$3)*($A16-(0.5+$B$6))+(0.05*$B$5-0.0475*$B$4)/$B$3
17	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F17	=POWER(10,-$T$13)+$H17+$I17+$J17+$K17+$L17+$M17	=$O$16
18	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F18	=POWER(10,-$T$13)+$H18+$I18+$J18+$K18+$L18+$M18	=$O$16
19	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F19	=POWER(10,-$T$13)+$H19+$I19+$J19+$K19+$L19+$M19	=$O$16
20	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F20	=POWER(10,-$T$13)+$H20+$I20+$J20+$K20+$L20+$M20	=$O$16
21	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F21	=POWER(10,-$T$13)+$H21+$I21+$J21+$K21+$L21+$M21	=$O$16
22	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F22	=POWER(10,-$T$13)+$H22+$I22+$J22+$K22+$L22+$M22	=$O$16
23	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F23	=POWER(10,-$T$13)+$H23+$I23+$J23+$K23+$L23+$M23	=$O$16
24	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F24	=POWER(10,-$T$13)+$H24+$I24+$J24+$K24+$L24+$M24	=$O$16
25	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F25	=POWER(10,-$T$13)+$H25+$I25+$J25+$K25+$L25+$M25	=$O$16
26	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F26	=POWER(10,-$T$13)+$H26+$I26+$J26+$K26+$L26+$M26	=$O$16
27	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F27	=POWER(10,-$T$13)+$H27+$I27+$J27+$K27+$L27+$M27	=$O$16
28	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F28	=POWER(10,-$T$13)+$H28+$I28+$J28+$K28+$L28+$M28	=$O$16
29	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F29	=POWER(10,-$T$13)+$H29+$I29+$J29+$K29+$L29+$M29	=$O$16
30	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F30	=POWER(10,-$T$13)+$H30+$I30+$J30+$K30+$L30+$M30	=$O$16
31	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F31	=POWER(10,-$T$13)+$H31+$I31+$J31+$K31+$L31+$M31	=$O$16
32	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F32	=POWER(10,-$T$13)+$H32+$I32+$J32+$K32+$L32+$M32	=$O$16
33	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F33	=POWER(10,-$T$13)+$H33+$I33+$J33+$K33+$L33+$M33	=$O$16
34	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F34	=POWER(10,-$T$13)+$H34+$I34+$J34+$K34+$L34+$M34	=$O$16
35	=3.512E-20/$B$3*$K$6*($K$4+$K$5)*(1-EXP(-$H$5*$H$8))/$H$5*(1-EXP(-$H$6*$K$7))*$F35	=POWER(10,-$T$13)+$H35+$I35+$J35+$K35+$L35+$M35	=$O$16
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	P	Q	R	S	T	U
1						
2	SLC [lbs]	5800	$Na_2B_4O_710H_2O$ Added [MW=410]			
3						
4						
5						
6						
7						
8						pH EFFECT OF ADDITION OF SODIU
9						
10						
11	Total [OH+] [8]	-LOG(Kw) [9]	Root x [10]	Net [H+] [11]	pH [12]	K_a
12	g-ions/liter			g-ions/liter		[14]
13	=POWER(10,-14)/POWER(10,-$T$13)+$O13	=15.5129-0.0224*$B13+0.00003352*POWER(B13,2)	=(N13+P13-SQRT(POWER(($N13+$P13),2)-(4*(N13*P13-POWER(10,-$Q13)))))/2	=$N13-$R13	5.3	=(0.0585*B13+1.309)/10000000000
14	=POWER(10,-14)/POWER(10,-$T$13)+$O14	=15.5129-0.0224*$B14+0.00003352*POWER(B14,2)	=(N14+P14-SQRT(POWER(($N14+$P14),2)-(4*(N14*P14-POWER(10,-$Q14)))))/2	=$N14-$R14	=-LOG10($S14)	=(0.0585*B14+1.309)/10000000000
15	=POWER(10,-14)/POWER(10,-$T$13)+$O15	=15.5129-0.0224*$B15+0.00003352*POWER(B15,2)	=(N15+P15-SQRT(POWER(($N15+$P15),2)-(4*(N15*P15-POWER(10,-$Q15)))))/2	=$N15-$R15	=-LOG10($S15)	=(0.0585*B15+1.309)/10000000000
16	=POWER(10,-14)/POWER(10,-$T$13)+$O16	=15.5129-0.0224*$B16+0.00003352*POWER(B16,2)	=(N16+P16-SQRT(POWER(($N16+$P16),2)-(4*(N16*P16-POWER(10,-$Q16)))))/2	=$N16-$R16	=-LOG10($S16)	=(0.0585*B16+1.309)/10000000000
17	=POWER(10,-14)/POWER(10,-$T$13)+$O17	=15.5129-0.0224*$B17+0.00003352*POWER(B17,2)	=(N17+P17-SQRT(POWER(($N17+$P17),2)-(4*(N17*P17-POWER(10,-$Q17)))))/2	=$N17-$R17	=-LOG10($S17)	=(0.0585*B17+1.309)/10000000000
18	=POWER(10,-14)/POWER(10,-$T$13)+$O18	=15.5129-0.0224*$B18+0.00003352*POWER(B18,2)	=(N18+P18-SQRT(POWER(($N18+$P18),2)-(4*(N18*P18-POWER(10,-$Q18)))))/2	=$N18-$R18	=-LOG10($S18)	=(0.0585*B18+1.309)/10000000000
19	=POWER(10,-14)/POWER(10,-$T$13)+$O19	=15.5129-0.0224*$B19+0.00003352*POWER(B19,2)	=(N19+P19-SQRT(POWER(($N19+$P19),2)-(4*(N19*P19-POWER(10,-$Q19)))))/2	=$N19-$R19	=-LOG10($S19)	=(0.0585*B19+1.309)/10000000000
20	=POWER(10,-14)/POWER(10,-$T$13)+$O20	=15.5129-0.0224*$B20+0.00003352*POWER(B20,2)	=(N20+P20-SQRT(POWER(($N20+$P20),2)-(4*(N20*P20-POWER(10,-$Q20)))))/2	=$N20-$R20	=-LOG10($S20)	=(0.0585*B20+1.309)/10000000000
21	=POWER(10,-14)/POWER(10,-$T$13)+$O21	=15.5129-0.0224*$B21+0.00003352*POWER(B21,2)	=(N21+P21-SQRT(POWER(($N21+$P21),2)-(4*(N21*P21-POWER(10,-$Q21)))))/2	=$N21-$R21	=-LOG10($S21)	=(0.0585*B21+1.309)/10000000000
22	=POWER(10,-14)/POWER(10,-$T$13)+$O22	=15.5129-0.0224*$B22+0.00003352*POWER(B22,2)	=(N22+P22-SQRT(POWER(($N22+$P22),2)-(4*(N22*P22-POWER(10,-$Q22)))))/2	=$N22-$R22	=-LOG10($S22)	=(0.0585*B22+1.309)/10000000000
23	=POWER(10,-14)/POWER(10,-$T$13)+$O23	=15.5129-0.0224*$B23+0.00003352*POWER(B23,2)	=(N23+P23-SQRT(POWER(($N23+$P23),2)-(4*(N23*P23-POWER(10,-$Q23)))))/2	=$N23-$R23	=-LOG10($S23)	=(0.0585*B23+1 309)/10000000000
24	=POWER(10,-14)/POWER(10,-$T$13)+$O24	=15.5129-0.0224*$B24+0.00003352*POWER(B24,2)	=(N24+P24-SQRT(POWER(($N24+$P24),2)-(4*(N24*P24-POWER(10,-$Q24)))))/2	=$N24-$R24	=-LOG10($S24)	=(0.0585*B24+1.309)/10000000000
25	=POWER(10,-14)/POWER(10,-$T$13)+$O25	=15.5129-0.0224*$B25+0.00003352*POWER(B25,2)	=(N25+P25-SQRT(POWER(($N25+$P25),2)-(4*(N25*P25-POWER(10,-$Q25)))))/2	=$N25-$R25	=-LOG10($S25)	=(0.0585*B25+1.309)/10000000000
26	=POWER(10,-14)/POWER(10,-$T$13)+$O26	=15.5129-0.0224*$B26+0.00003352*POWER(B26,2)	=(N26+P26-SQRT(POWER(($N26+$P26),2)-(4*(N26*P26-POWER(10,-$Q26)))))/2	=$N26-$R26	=-LOG10($S26)	=(0.0585*B26+1.309)/10000000000
27	=POWER(10,-14)/POWER(10,-$T$13)+$O27	=15.5129-0.0224*$B27+0.00003352*POWER(B27,2)	=(N27+P27-SQRT(POWER(($N27+$P27),2)-(4*(N27*P27-POWER(10,-$Q27)))))/2	=$N27-$R27	=-LOG10($S27)	=(0.0585*B27+1.309)/10000000000
28	=POWER(10,-14)/POWER(10,-$T$13)+$O28	=15.5129-0.0224*$B28+0.00003352*POWER(B28,2)	=(N28+P28-SQRT(POWER(($N28+$P28),2)-(4*(N28*P28-POWER(10,-$Q28)))))/2	=$N28-$R28	=-LOG10($S28)	=(0.0585*B28+1.309)/10000000000
29	=POWER(10,-14)/POWER(10,-$T$13)+$O29	=15.5129-0.0224*$B29+0.00003352*POWER(B29,2)	=(N29+P29-SQRT(POWER(($N29+$P29),2)-(4*(N29*P29-POWER(10,-$Q29)))))/2	=$N29-$R29	=-LOG10($S29)	=(0.0585*B29+1.309)/10000000000
30	=POWER(10,-14)/POWER(10,-$T$13)+$O30	=15.5129-0.0224*$B30+0.00003352*POWER(B30,2)	=(N30+P30-SQRT(POWER(($N30+$P30),2)-(4*(N30*P30-POWER(10,-$Q30)))))/2	=$N30-$R30	=-LOG10($S30)	=(0.0585*B30+1.309)/10000000000
31	=POWER(10,-14)/POWER(10,-$T$13)+$O31	=15.5129-0.0224*$B31+0 00003352*POWER(B31,2)	=(N31+P31-SQRT(POWER(($N31+$P31),2)-(4*(N31*P31-POWER(10,-$Q31)))))/2	=$N31-$R31	=-LOG10($S31)	=(0.0585*B31+1.309)/10000000000
32	=POWER(10,-14)/POWER(10,-$T$13)+$O32	=15.5129-0.0224*$B32+0.00003352*POWER(B32,2)	=(N32+P32-SQRT(POWER(($N32+$P32),2)-(4*(N32*P32-POWER(10,-$Q32)))))/2	=$N32-$R32	=-LOG10($S32)	=(0.0585*B32+1.309)/10000000000
33	=POWER(10,-14)/POWER(10,-$T$13)+$O33	=15.5129-0.0224*$B33+0.00003352*POWER(B33,2)	=(N33+P33-SQRT(POWER(($N33+$P33),2)-(4*(N33*P33-POWER(10,-$Q33)))))/2	=$N33-$R33	=-LOG10($S33)	=(0.0585*B33+1.309)/10000000000
34	=POWER(10,-14)/POWER(10,-$T$13)+$O34	=15.5129-0.0224*$B34+0.00003352*POWER(B34,2)	=(N34+P34-SQRT(POWER(($N34+$P34),2)-(4*(N34*P34-POWER(10,-$Q34)))))/2	=$N34-$R34	=-LOG10($S34)	=(0.0585*B34+1 309)/10000000000
35	=POWER(10,-14)/POWER(10,-$T$13)+$O35	=15.5129-0.0224*$B35+0.00003352*POWER(B35,2)	=(N35+P35-SQRT(POWER(($N35+$P35),2)-(4*(N35*P35-POWER(10,-$Q35)))))/2	=$N35-$R35	=-LOG10($S35)	=(0.0585*B35+1.309)/10000000000
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	V	W	X	Y	Z	AA
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10	Strong Acid					
11	g-equiv.	$Na_2B_4O_7 10H_2O$	Borate	Boric Acid	pK_a	pH
12	Net [H+] * V_{POOL}	g-mols	g-equiv.	g-equiv.	$-\log_{10}K_a$	15
13	=S13*$B$3	=$Q$2*453.6/410	=W13*2-V13	=W13*8+V13	=-LOG10(U13)	=Z13+LOG10((X13/$B$3)/(Y13/$B$3))
14	=S14*$B$3	=$Q$2*453 6/410	=W14*2-V14	=W14*8+V14	=-LOG10(U14)	=Z14+LOG10((X14/$B$3)/(Y14/$B$3))
15	=S15*$B$3	=$Q$2*453.6/410	=W15*2-V15	=W15*8+V15	=-LOG10(U15)	=Z15+LOG10((X15/$B$3)/(Y15/$B$3))
16	=S16*$B$3	=$Q$2*453.6/410	=W16*2-V16	=W16*8+V16	=-LOG10(U16)	=Z16+LOG10((X16/$B$3)/(Y16/$B$3))
17	=S17*$B$3	=$Q$2*453.6/410	=W17*2-V17	=W17*8+V17	=-LOG10(U17)	=Z17+LOG10((X17/$B$3)/(Y17/$B$3))
18	=S18*$B$3	=$Q$2*453.6/410	=W18*2-V18	=W18*8+V18	=-LOG10(U18)	=Z18+LOG10((X18/$B$3)/(Y18/$B$3))
19	=S19*$B$3	=$Q$2*453 6/410	=W19*2-V19	=W19*8+V19	=-LOG10(U19)	=Z19+LOG10((X19/$B$3)/(Y19/$B$3))
20	=S20*$B$3	=$Q$2*453.6/410	=W20*2-V20	=W20*8+V20	=-LOG10(U20)	=Z20+LOG10((X20/$B$3)/(Y20/$B$3))
21	=S21*$B$3	=$Q$2*453.6/410	=W21*2-V21	=W21*8+V21	=-LOG10(U21)	=Z21+LOG10((X21/$B$3)/(Y21/$B$3))
22	=S22*$B$3	=$Q$2*453.6/410	=W22*2-V22	=W22*8+V22	=-LOG10(U22)	=Z22+LOG10((X22/$B$3)/(Y22/$B$3))
23	=S23*$B$3	=$Q$2*453 6/410	=W23*2-V23	=W23*8+V23	=-LOG10(U23)	=Z23+LOG10((X23/$B$3)/(Y23/$B$3))
24	=S24*$B$3	=$Q$2*453 6/410	=W24*2-V24	=W24*8+V24	=-LOG10(U24)	=Z24+LOG10((X24/$B$3)/(Y24/$B$3))
25	=S25*$B$3	=$Q$2*453.6/410	=W25*2-V25	=W25*8+V25	=-LOG10(U25)	=Z25+LOG10((X25/$B$3)/(Y25/$B$3))
26	=S26*$B$3	=$Q$2*453.6/410	=W26*2-V26	=W26*8+V26	=-LOG10(U26)	=Z26+LOG10((X26/$B$3)/(Y26/$B$3))
27	=S27*$B$3	=$Q$2*453.6/410	=W27*2-V27	=W27*8+V27	=-LOG10(U27)	=Z27+LOG10((X27/$B$3)/(Y27/$B$3))
28	=S28*$B$3	=$Q$2*453.6/410	=W28*2-V28	=W28*8+V28	=-LOG10(U28)	=Z28+LOG10((X28/$B$3)/(Y28/$B$3))
29	=S29*$B$3	=$Q$2*453.6/410	=W29*2-V29	=W29*8+V29	=-LOG10(U29)	=Z29+LOG10((X29/$B$3)/(Y29/$B$3))
30	=S30*$B$3	=$Q$2*453.6/410	=W30*2-V30	=W30*8+V30	=-LOG10(U30)	=Z30+LOG10((X30/$B$3)/(Y30/$B$3))
31	=S31*$B$3	=$Q$2*453.6/410	=W31*2-V31	=W31*8+V31	=-LOG10(U31)	=Z31+LOG10((X31/$B$3)/(Y31/$B$3))
32	=S32*$B$3	=$Q$2*453.6/410	=W32*2-V32	=W32*8+V32	=-LOG10(U32)	=Z32+LOG10((X32/$B$3)/(Y32/$B$3))
33	=S33*$B$3	=$Q$2*453.6/410	=W33*2-V33	=W33*8+V33	=-LOG10(U33)	=Z33+LOG10((X33/$B$3)/(Y33/$B$3))
34	=S34*$B$3	=$Q$2*453.6/410	=W34*2-V34	=W34*8+V34	=-LOG10(U34)	=Z34+LOG10((X34/$B$3)/(Y34/$B$3))
35	=S35*$B$3	=$Q$2*453.6/410	=W35*2-V35	=W35*8+V35	=-LOG10(U35)	=Z35+LOG10((X35/$B$3)/(Y35/$B$3))
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