

MONTICELLO NUCLEAR GENERATING PLANT		3494
TITLE:	CALCULATION COVER SHEET	Revision 15
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CALCULATION COVER SHEET

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Title MNGP AST – Post LOCA pH Analysis CA- 04 - 042 Add. 0

PART A – (Not Applicable to Vendor Calcs)

Assigned Personnel			
Name (Print)	Signature	Title	Initials

Record of Issues							
Rev	Description	Total Sheets	Last Sheet	Preparer	Verifier	Approval	Approval Date

Verification Method(s)

- Review
 Alternate Calculation
 Test
 Other
 Technical Review (per 4 AWI-05.08.07 (FP-E-MOD-07))

3087 (DOCUMENT CHANGE, HOLD AND COMMENT FORM) incorporated: _____					
FOR ADMINISTRATIVE USE ONLY	Resp Subv: CNSTP	Assoc Ref: 4 AWI-05.01.25	SR: N	Freq: 0	vrs
	ARMS: 3494	Doc Type: 3042	Admin initials:	Date:	

Approved (Signatures available in Master File)

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PART B – (Applicable to Vendor Calculations Only)

Vendor Name Sargent & Lundy Vendor Calc No: 2004-02105 R1
Vendor Approval Date: 8/31/05

- Form 3345 or QF-0547 attached.
 Safety related? If safety related, attach DIA or reference here. See Other Comments

Reviewed by: Joel Beres / Mike Aleksey Joel Beres / Mike Aleksey 2/6/05 9/6/05
Print Name Signature Date
Accepted by: Dennis Zercher Dennis Zercher 8-7-2005
Print Name Eng. Supv. Signature Date

Record of Issues			
Revision	Description	Total No. of Sheets	Last Sheet Number
0	Original Issue		

PART C – Design Basis Data (Complete for all Calculations)

10 CFR50.59 Screening or Evaluation No: N/A
Associated Reference(s): AST LAR

Does this calculation:	YES	NO	Calc No(s), Rev(s), Add(s)
Supersede another calculation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<i>GENE-B21000594-1-R2, "Radiological Analyses of Design Basis Accidents - Task 24", Section 3.1 only. See comments.</i>
Augment (credited by) another calculation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Derive inputs from another calculation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<i>CA-03-190 R1 Add. 0; CA-04-036 R1 Add. 0; CA-04-037 R2 Add. 0; CA-04-210 R0 Add. 0</i>
Affect the Fire Protection Program per Form 3765?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If Yes, attach Form 3765
Affect piping or supports?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If Yes, attach Form 3544

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Affect IST Program Valve or Pump Reference Values, and/or Acceptance Criteria?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	If Yes, inform IST Coordinator and provide copy of calculation
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List all documents/procedures that are based on this calculation (include revision):

USAR, Rev 21 (Section 14.7 and associated tables)

List all plant procedures used to ensure inputs/assumptions/outputs are maintained (include revision):

0089 Rev 17, 0086 Rev 28. Also see Future Needs below.

What Systems or components are affected?

System Code(s) (See Form 3805):

SLC, CS

Component ID's (CHAMPS Equip):

N/A

DBD Section (if any):

B.3.5, B.3.1

Topic Code (See Form 3805):

DBAE

Structure Code (See Form 3805):

N/A

Other Comments:

Sargent & Lundy calculation 2004-02103 Rev 1 incorporates AAC Calculation #MNGP-005 Rev 1 (see attachment for cross-references).

Note: This calculation is not incorporated as part of MNGP's design basis until the associated LARs are approved (AST Phase 1 and 2).

Future needs: Update relevant USAR relevant sections and other plant documents in accordance with the MNGP AST Implementation Plan (OTH027344).

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This calculation was completed in accordance with the approved project work plan (DIA Equivalent) for the AST Implementation S&L Letter #SLMON-2003-085, and PO38317.

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MNGP AST Project Calculations List

Calculation No.	Title
MNGP # S&L # AAC #	<p>[Applied Analysis Corporation (AAC) performed DBA calculations for the AST project. Sargent & Lundy provided independent verification and documented results in S&L calculations which incorporated the AAC calculations as attachments. The S&L calculations were accepted by MNGP via the vendor calculation control process (4 AWI-05.01.25). Thus each DBA calculation has three numbers – MNGP, S&L, and AAC.</p> <p>AAC calculations will reference other AST calculations by their AAC number. This list is provided for proper cross-reference of calculations.]</p>
03-190 N/A N/A	Design Inputs For Alternate Source Term (AST) Radiological Analysis
04-036 2004-01852 MNGP-001	MNGP AST - Offsite Post-Accident Atmospheric Dispersion Analysis
04-037 2004-02100 MNGP-002	MNGP AST - CR/TSC Post-Accident Atmospheric Dispersion Analysis
04-038 2004-02101 MNGP-003	MNGP AST - LOCA Radiological Consequence Analysis
04-039 2004-02102 MNGP-004	MNGP AST - MSLBA Radiological Consequence Analysis
04-040 2004-02103 MNGP-005	MNGP AST - CRDA Radiological Consequence Analysis
04-041 2004-02104 MNGP-006	MNGP AST - FHA Radiological Consequence Analysis
04-042 2004-02105 MNGP-007	MNGP AST - Post-LOCA pH Analysis
04-210 2004-07600 N/A	Alternative Source Term – Core Isotopic Inventory
05-130 2005-00480 N/A	Post LOCA Direct Dose to the Control Room From External Sources
05-134 2005-06343 MNGP-012	Post-LOCA Steam Pipe Internal Temperature 30-Day Profile for Radiological Dose Analysis

MONTICELLO NUCLEAR GENERATING PLANT		3345
TITLE:	VENDOR CALCULATION REVIEW CHECKLIST	Revision 3
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CA - 04 - 042, Rev 0
Attachment 1

The purpose of the review is to ensure that the vendor calculation or analysis complies with the conditions of the purchase order and is appropriate for its intended use. The purpose of the review is not to serve as an independent verification. Independent verification of the calculation or analysis by the vendor should be evident in the document.

The reviewer should use the criteria below as a guide to assess the overall quality, completeness and usefulness of the calculation or analysis. The reviewer is not required to check the vendor's calculations in detail.

See 4 AWI-05.01.25 (CALCULATION/ANALYSIS CONTROL) for guidance. Place initials by items reviewed.

REVIEW

1. Form 3544 (PIPING AND SUPPORT NUMBERING) completed for calculations affecting piping or supports.
2. Design inputs correspond to those which were transmitted to the vendor.
3. Assumptions are described and reasonable. Basis for assumptions identified.
4. Applicable codes, standards and regulations are identified and met.
5. Applicable construction and operating experience is considered.
6. Applicable structure(s), system(s), and component(s) are listed.
7. Formulas and equations documented and unusual symbols are defined.
8. Acceptance criteria are identified, adequate and satisfied.
9. Results are reasonable compared to inputs.
10. Source documents are referenced.
11. The calculation is appropriate for its intended use.
12. The calculation complies with the terms of the Purchase Order.
13. Inputs, assumptions, outputs, etc. which could affect plant operation are enforced by adequate procedural controls. List any affected procedures.

Handwritten initials and marks:
 1. NA
 2. [initials]
 3. [initials]
 4. [initials]
 5. [initials]
 6. [initials]
 7. [initials]
 8. [initials]
 9. [initials]
 10. [initials]
 11. [initials]
 12. [initials]
 13. [initials]

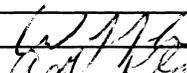
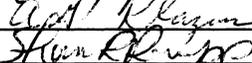
0089 Rev. 17 Boron Concentration - Standby Liquid Control System
0086 Rev. 20 SBLC Refueling Tests

Completed By: *[Signature]* Date: 7/6/05 9/6/05

3087 (DOCUMENT CHANGE, HOLD AND COMMENT FORM) incorporated:				
FOR ADMINISTRATIVE	Resp Supv: CNSTP	Assoc Ref: 4 AWI-05.01.25	SR: N	Freq: 0 yrs
	ARMS: 3345	Doc Type: 3042	Admin initials:	Date:

Approved (Signatures available in Master File)

ISSUE SUMMARY
Form SOP-0402-07, Revision 7

DESIGN CONTROL SUMMARY			
CLIENT:	Nuclear Management Company	UNIT NO.: 1	Page No.: 1 of 5
PROJECT NAME:	Monticello Nuclear Generating Plant		
PROJECT NO.:	11163-013	<input checked="" type="checkbox"/> NUCLEAR SAFETY- RELATED	
CALC. NO.:	2004-02105	<input type="checkbox"/> NOT NUCLEAR SAFETY-RELATED	
TITLE:	MNGP AST – Post-LOCA pH Analysis		
EQUIPMENT NO.:	_____		
IDENTIFICATION OF PAGES ADDED/REVISED/SUPERSEDED/VOIDED & REVIEW METHOD			
Initial Issue (42 pages): Calculation (5 pages), Attachment A – AAC Calculation MNGP-007 (36 pages), Attachment B – List of Electronic Files (1 page)			
			INPUTS/ ASSUMPTIONS
			<input checked="" type="checkbox"/> VERIFIED
			<input type="checkbox"/> UNVERIFIED
REVIEW METHOD:	<u>Detailed Review</u>	REV.	<u>0</u>
STATUS:	<u>Approved</u>	DATE FOR REV.:	<u>04/15/04</u>
PREPARER	<u>W. J. Johnson/(See original for signatures)</u>	DATE:	<u>04/15/04</u>
REVIEWER	<u>R. Kahn/(See original for signatures)</u>	DATE:	<u>04/15/04</u>
APPROVER	<u>M. A. Pressburger/(See original for signatures)</u>	DATE:	<u>04/15/04</u>
IDENTIFICATION OF PAGES ADDED/REVISED/SUPERSEDED/VOIDED & REVIEW METHOD			
Revised to incorporate additional NMC comments. Revision 1 supersedes Revision 0. Revision 1 (44 pages): Calculation (5 pages), Attachment A – AAC Calculation MNGP-007 (38 pages), Attachment B – List of Electronic Files (1 page)			
			INPUTS/ ASSUMPTIONS
			<input checked="" type="checkbox"/> VERIFIED
			<input type="checkbox"/> UNVERIFIED
REVIEW METHOD:	<u>Detailed Review</u>	REV.	<u>1</u>
STATUS:	<u>Approved</u>	DATE FOR REV.:	<u>8/31/05</u>
PREPARER	<u>W. J. Johnson/</u> 	DATE:	<u>8/31/05</u>
REVIEWER	<u>A. G. Klazura/</u> 	DATE:	<u>8/31/05</u>
APPROVER	<u>S. R. Raupp/</u> 	DATE:	<u>8/31/05</u>
IDENTIFICATION OF PAGES ADDED/REVISED/SUPERSEDED/VOIDED & REVIEW METHOD			
			INPUTS/ ASSUMPTIONS
			<input type="checkbox"/> VERIFIED
			<input type="checkbox"/> UNVERIFIED
REVIEW METHOD:	_____	REV.	_____
STATUS:	_____	DATE FOR REV.:	_____
PREPARER	_____	DATE:	_____
REVIEWER	_____	DATE:	_____
APPROVER	_____	DATE:	_____

NOTE: PRINT AND SIGN IN THE SIGNATURE AREAS



Calcs. For MNGP-AST – Post-LOCA pH Analysis	
X	Safety Related
	Non-Safety Related

Calc No.	2004-02105	
Rev.	1	Date
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Client	Nuclear Management Company	
Project	Monticello Nuclear Generating Plant	
Proj. No	11163-013	Equip. No.

Prepared by	Date
Reviewed by	Date
Approved by	Date

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7 REFERENCES.....	5
ATTACHMENT A. Calculation No. MNGP-007, MNGP AST – Post-LOCA pH Analysis (38 pages)	A-1
ATTACHMENT B. Computer File Listing For Calculation No. MNGP-007 (1 page).....	B-1



Calcs. For MNGP-AST – Post-LOCA pH Analysis	
X	Safety Related
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Reviewed by	Date
Approved by	Date

1 PURPOSE AND SCOPE

A new calculation has been prepared to demonstrate that, in the event of a Loss-of-Coolant Accident (LOCA) at Nuclear Management Company’s (NMC) Monticello Nuclear Generating Plant (MNGP), the pH of the Torus Suppression Pool remains above 7.0, thus ensuring that the particulate iodine deposited in the suppression pool does not re-evolve and become airborne as elemental iodine. The calculation is documented in Applied Analysis Corp. (AAC) calculation MNGP-007 (Reference 1), which is included in its entirety in Attachments A and B. This analysis was performed in accordance with the guidance provided in Regulatory Guide 1.183 (Reference 2).

The purpose of this calculation is to document the S&L independent verification of AAC calculation MNGP-007. The verification consists of a review to assure that the methodology used in the calculation is appropriate to the purpose of the calculation, that the inputs are in accordance with the approved inputs provided by NMC, and that the results of the analysis are consistent with the inputs and methodology.

2 DESIGN INPUT

The design inputs and their bases are identified in Section 4.0 of MNGP-007 (Attachment A). MNGP specific inputs used in the pH calculation are referenced to NMC Design Input Request (DIR) calculation CA-03-190 (Reference 3). Additional inputs are obtained from published documents. The design inputs are therefore approved by NMC.

3 ASSUMPTIONS

The assumptions used in the determination of the suppression pool pH are documented in Section 3.0 of MNGP-007 (Attachment A). These assumptions are consistent with the methodology and data used in the calculation. Furthermore, these assumptions are consistent with NMC input per calculation CA-03-190 (Reference 3).

4 METHODOLOGY AND ACCEPTANCE CRITERIA

Methodology

Calculation MNGP-007 follows the methodology developed by the NRC in NUREG/CR-5950 (Reference 4). The calculation considers the effects on pH of cesium hydroxide production due to cesium releases from the core, hydroiodic acid production due to iodine releases from the core, hydrochloric acid production due to radiolysis of chloride-bearing cable and nitric acid produced by irradiation of water and air. The effect of carbonic acid due to the absorption of carbon dioxide in the suppression pool water is conservatively bounded by selecting the lowest initial pH for the suppression



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pool water. The effect of injecting sodium pentaborate from the standby liquid control system (SLCS) is also evaluated. Although the time dependent release of material from the core is used consistent with the assumptions in the LOCA analysis from Regulatory Guide 1.183, the radiation exposure is the same as used for equipment qualification. This is conservative since the equipment qualification doses are based on instantaneous releases. These effects and the method of evaluation used in MNGP-007 are consistent with Reference 4 and with similar analyses approved by the NRC for other plants. The methodology is therefore considered appropriate and conservative.

Acceptance Criteria

Appendix A of Regulatory Guide 1.183 indicates that iodine re-evolution should be considered for suppression pool pH values less than 7. Therefore the acceptance criterion for this calculation is that the long term suppression pool pH value remain above 7 for the duration of the accident.

5 CALCULATIONS

Not applicable to this calculation.

6 RESULTS AND CONCLUSIONS

The time results of the suppression pool pH studies are summarized in Section 7.0 of MNGP-007 (Attachment A). Two cases are considered. The first case does not utilize the SLCS for pH control, and the pH is well below the acceptance value of 7.0. This implies the SLCS will be required to assure the suppression pool pH remains above 7.0. The second case demonstrates that utilizing the SLCS results in a final suppression pool pH of 8.59, which is well above the acceptance value of 7.0.

Note that the case that utilizes the SLCS starts the pH calculation at 2 hours after the start of the accident, which is the time at which it is assumed SLCS injection is complete. Prior to this time, sump pH is not considered critical because the behavior of iodine in the containment is governed by thermal-hydraulic conditions and is not affected by re-evolution. It should also be noted that a sensitivity study was performed that demonstrated that the pH results of the SLCS case are not very sensitive to the amount of cable in the drywell.

Based on the above discussion, it is concluded that the methodology used in the MNGP-007 is appropriate to the purpose of the calculation, that the inputs are in accordance with the approved inputs provided by NMC, and that the results of the analysis are consistent with the inputs and methodology.



Calcs. For MNGP-AST – Post-LOCA pH Analysis			
X	Safety Related		Non-Safety Related

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Prepared by		Date	
Reviewed by		Date	
Approved by		Date	

7 REFERENCES

1. MNGP-007, Revision 1, "MNGP AST – Post-LOCA pH Analysis," prepared by Applied Analysis Corp. for Nuclear Management Company, Monticello Nuclear Generating Plant
2. Regulatory Guide 1.183, "Alternative Radiological Source Term for Evaluating Design Basis Accidents at Nuclear Power Plants," Revision 0, USNRC, July 2000
3. NMC Calculation CA-03-190, "Design Inputs for Alternate Source Term (AST) Radiological Analysis," Revision 1
4. NUREG/CR-5950, "Iodine Evolution and pH Control," USNRC, December 1992

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	Equip. No.		

ATTACHMENT B. Computer File Listing For Calculation No. MNGP-007

Associated with AAC calculation No. MNGP-007 are a number of files, including Excel spreadsheet files that contain input data and calculate results. All of the files identified in MNGP-007 are contained on a compact disk (CD) associated with this calculation. The list of files and the purpose of each file is summarized in the list below.

File Name	Purpose
MNGP-007\	
DVCS_MNGP_007.pdf	Design Verification Comment Sheet
MNGP_007_Coversheet.pdf	Signed Coversheet
DVCS_MNGP_007R1.pdf	Design Verification Comment Sheet, Revision 1
MNGP_007_R1_Coversheet.pdf	Signed Coversheet, Revision 1
30 Day Beta Dose CF.xls	Spreadsheet for determination of Drywell Beta dose
30 Day Gamma Dose.xls	Spreadsheet for determination of Drywell Gamma dose
Cs-Halogen Mass Inventory Determination.xls	Spreadsheet for determination of Br/Cs/I mass inventory
Drywell Cable Surface Area Determination.xls	Spreadsheet with the data for cable surface area determination
Eagle-Picher Sodium Pentaborate Data Sheet.pdf	Pentaborate data sheet
SP pH With CsOH - No SLCS.xls	Spreadsheet for pH analysis without Sodium Pentaborate
SP pH With SLCS - No CsOH.xls	Spreadsheet for pH analysis with Sodium Pentaborate

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