## PMComanchePeakPEm Resource

**From:** Monarque, Stephen
**Sent:** Wednesday, February 24, 2010 5:28 PM
**To:** John.Conly@luminant.com; Donald.Woodlan@luminant.com; cp34-rai-luminant@mnes-us.com; Diane Yeager; Eric.Evans@luminant.com; joseph tapia; Kazuya Hayashi; Matthew.Weeks@luminant.com; MNES RAI mailbox; Russ Bywater
**Cc:** ComanchePeakCOL Resource; Magee, Michael
**Subject:** Comanche Peak RCOL Chapter 2.4.3 - RAI Number 143
**Attachments:** RAI 4310 (RAI 143).doc

The NRC staff has identified that additional information is needed to continue its review of the combined license application. The NRC staff's request for additional information (RAI) is contained in the attachment. Luminant is requested to inform the NRC staff if a conference call or public meeting is needed.

The response to this RAI is due within 35 calendar days of February 24, 2010.

Note: If changes are needed to the safety analysis report, the NRC staff requests that the RAI response include the proposed changes.

thanks,

Stephen Monarque
U. S. Nuclear Regulatory Commission
NRO/DNRL/NMIP
301-415-1544

**Hearing Identifier:** ComanchePeak_COL_Public
**Email Number:** 832

**Mail Envelope Properties** (9C2386A0C0BC584684916F7A0482B6CA0B917242A1)

**Subject:** Comanche Peak RCOL Chapter 2.4.3 - RAI Number 143
**Sent Date:** 2/24/2010 5:28:17 PM
**Received Date:** 2/24/2010 5:28:20 PM
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| MESSAGE | 671 | 2/24/2010 5:28:20 PM |
| RAI 4310 (RAI 143).doc | 97786 | |

**Options**
**Priority:** Standard
**Return Notification:** No
**Reply Requested:** No
**Sensitivity:** Normal
**Expiration Date:**
**Recipients Received:**

Request for Additional Information (RAI) No. 4310 COL Revision 1

RAI Number 143

2/24/2010

Comanche Peak Units 3 and 4
Luminant Generation Company, LLC.
Docket No. 52-034 and 52-035
SRP Section: 02.04.03 - Probable Maximum Flood (PMF) on Streams and Rivers
Application Section: FSAR Section 2.4.3

QUESTIONS for Hydrologic Engineering Branch (RHEB)

02.04.03-5

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

On October 1, 2009, the NRC staff issued RAI ID 3665 (RAI Number 105) Question Number 14246 (02.04.03-1), in which the NRC staff asked “Provide a description of the process used to determine that the probable maximum flood (PMF) analysis for streams and rivers is the most conservative of all plausible conceptual models. This description needs to consider the parameter selections and assumptions made in watershed probable maximum precipitation (PMP) estimation, watershed runoff modeling, channel routing and runoff accumulation modeling, and local site drainage and runoff modeling.”

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The NRC staff has reviewed the response the combined license application (COL) FSAR changes documented in FSAR Updated Tracking Report (UTR) No. 4 and referenced in the applicant’s response, and has determined that additional information is needed to complete the NRC staff's review.

The applicant asserts, without explanation, that the conceptual models used to determine the design basis flood comply with Regulatory Guides 1.206 and 1.59. The response also asserts, without explanation, that the river and stream flooding computational methodology is consistent with American National Standards Institute / American Nuclear Society ANSI/ANS-2.8-1992. The staff noted that claims of compliance and consistency with these guidance documents alone do not ensure that the parameter selections or application of the method to specific sites produce a bounding conservative estimate of the design basis flood.

The NRC staff notes that the applicant’s response that widespread use of Snyder’s method or the availability of Snyder’s method in HEC-HMS modeling software ensures that the use of Snyder’s method produces a bounding conservative estimate of runoff is not acceptable. The applicant’s response also included assertions that the chosen parameterization yielded a conservative estimate; however, this is not sufficient to show that the chosen parameterization is bounding conservative with respect to all other parameterizations.

In order to make its safety determination, the NRC staff requests the applicant revise the response and provide the technical justifications. The response should focus on the basis used to accept as bounding conservative the chain of models that translates PMP estimates to runoff estimates to Squaw Creek Reservoir spillage to design basis flood elevation. That basis should include detailed deductive statements that establish the chosen parameterizations (e.g., Snyder's unit hydrograph; a constant rather than variable loss coefficient) and the choice of parameter values (e.g., values of peaking and lag coefficients; a loss coefficient of 0.10 inch per hour rather than 0.05 inch//hour) as yielding a bounding conservative estimate for the design basis flood elevation.

This is supplemental RAI 2.4.3-00-S.

02.04.03-6

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that the NRC staff intends to use to evaluate whether an Applicant meets the NRC's regulations.

By letter dated October 1, 2009, the NRC staff issued RAI ID 3665 (RAI Number 105) Question Number 14248 (02.04.03-3), in which the NRC staff asked "Provide a rationale for assumptions made in the modeling of instream flooding and drainage for computation of the PMF on rivers and streams affecting the site. Provide documentation and electronic versions of input files for all computer models used to compute the river and stream flooding."

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The applicant directed the NRC staff to the applicant's response to RAI ID 3665 (RAI Number 105). The NRC staff has reviewed this RAI response and has determined that additional information is needed for the staff to complete its review. The applicant's response to this RAI also referred the staff to Calculation "MITS004 - Probable Maximum Flood Calculation for Comanche Peak Nuclear Power Plant Units 3 and 4 (HEC-HMS & HEC-RAS)", Revision 1 and the input and output (I/O) files (FlowMaster) that were submitted previously, as part of July 2009 Hydrology Safety Site Audit Information Need HYDSV-07, via Luminant letter TXNB-09037, dated September 2, 2009. Refer to NRC staff's 'Hydrology Site Safety Audit Report of the Comanche Peak Nuclear Power Plant, Units 3 and 4 Combined License Application,' dated December 3, 2009. This supplemental RAI question results from the staff's examination of that calculation package and from examination of calculation package TXUT-001-FSAR 2.4.3-CALC-012.

The staff noted that the Squaw Creek Dam discharge rating relationships referenced in the FSAR and in TXUT-001-FSAR 2.4.3-CALC-012 are important determinants of the design basis flood elevation reported by the applicant because they model the ability of Squaw Creek Dam to pass PMF flows from Squaw Creek watershed.

Accordingly, the NRC staff requests that the applicant provide:

1. A description of how the Squaw Creek Dam discharge ratings (Tables 7-8 and 7-9 of TXUT-001-FSAR 2.4.3-CALC-012) were developed.

2. References 13 and 14 of TXUT-001-FSAR 2.4.3-CALC-012 for NRC staff review, as well as detailed as-built specifications of dam and spillway geometry for confirmatory analysis by Staff.

This is supplemental RAI 2.4.3-03-S-a.

02.04.03-7

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that the NRC staff intends to use to evaluate whether an Applicant meets the NRC's regulations.

By letter dated October 1, 2009, the NRC staff issued RAI ID 3665 (RAI 105) Question Number 14248, in which the NRC staff asked “Provide a rationale for assumptions made in the modeling of instream flooding and drainage for computation of the PMF on rivers and streams affecting the site. Provide documentation and electronic versions of input files for all computer models used to compute the river and stream flooding.”

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The applicant directed the staff to the applicant’s response to RAI 3665 (RAI Number 105). The applicant’s response to this RAI also referred to Calculation "MITS004 - Probable Maximum Flood Calculation for Comanche Peak Nuclear Power Plant Units 3 and 4 (HEC-HMS & HEC-RAS)", Revision 1 and the input and output (I/O) files (FlowMaster) that were submitted previously as part of July 2009 Hydrology Safety Site Audit Information Need HYDSV-07 via Luminant letter TXNB-09037, dated September 2, 2009. Refer to the NRC staff's 'Hydrology Site Safety Audit Report of the Comanche Peak Nuclear Power Plant, Units 3 and 4 Combined License Application,' dated December 3, 2009.

This supplemental RAI question results from staff’s examination of that calculation package and from examination of calculation package TXUT-001-FSAR 2.4.3-CALC-012.

The NRC staff noted that the Squaw Creek Dam discharge rating relationships referenced in the COL FSAR and in TXUT-001-FSAR 2.4.3-CALC-012 are important determinants of the design basis flood elevation reported by the applicant because they model the ability of Squaw Creek Dam to pass PMF flows from Squaw Creek watershed.

The staff’s synthesis of data from multiple tables in the FSAR and TXUT-001-FSAR 2.4.3-CALC-012 are provided in Table A to this supplemental RAI. Table A indicates that the crest of the service spillway is at about 775 ft, and the crest of the emergency spillway is at about 783 ft. The storage, stage, discharge relationship displayed in Table A is used in the applicant’s implementation of HEC-HMS for calculating the PMF at Comanche Peak, Units 3 & 4. However, the dam break analysis has maximum backwater elevation on the downstream side of the Squaw Creek Reservoir dam at 775 ft, essentially the elevation of the service spillway crest and just eight feet below the crest of the emergency spillway. This above normal or “flooded tailwater” condition was not discussed by the applicant in the FSAR. If the normal discharge relationships for the emergency and service spillways are not adjusted to account for this flooded condition, then the applicant’s computations would indicate passage of more flow than is

actually possible in the PMF condition, and the resulting design basis flood elevation would be erroneously low and not conservative.

Accordingly, the Staff requests that the Applicant provide a description of how the above normal tailwater condition was modeled in computations of Squaw Creek Dam and spillway discharge during the PMF scenario described in the FSAR.

This is supplemental RAI 2.4.3-03-S-b.

The applicant's analysis of flooding in Squaw Creek Reservoir used discharge rating data presented in Tables 7-8 and 7-9 of TXUT-001-FSAR 2.4.3-CALC-012 and the extrapolation described on page 18 for evaluation of the probable maximum flood. The two tables combined provide the stage-discharge relationship used in the Applicant's implementation of HEC-HMS to calculate PMF levels. Table A, below, compiles the storage, stage and discharge relationships presented by the Applicant's contractor. The left side of the Table A is from Table 7-8. Except for the last three rows, the right side of Table A is from Table 7-9. The bottom three entries in the rightmost column are the results of the extrapolation presented by the Applicant's contactor. The values summarized by Table A are critical to evaluation of PMF at the proposed Comanche Peak Nuclear Power Plant, Units 3 and 4.

Table A. Stage, storage and discharge relationship for Squaw Creek Reservoir from TXUT-001-FSAR 2.4.3-CALC-012.

| From Table 7-8 | | From Table 7-9 | | | |
|---|---|---|---|---|---|
| Stage (ft) | Storage (acre-ft) | Storage (acre-ft) | Service spillway (cfs) | Emergency spillway (cfs) | Total discharge (cfs) |
| 770 | 135,752 | | | | 0 |
| 775 | 151,418 | 151,418 | 0 | - | 0 |
| 776 | 154,243 | 154,243 | 300 | - | 300 |
| 777 | 157,562 | 157,562 | 900 | - | 900 |
| 778 | 160,903 | 160,903 | 1,700 | - | 1,700 |
| 779 | 164,270 | 164,270 | 2,700 | - | 2,700 |
| 780 | 167,665 | 167,665 | 3,800 | - | 3,800 |
| 781 | 171,093 | 171,093 | 5,100 | - | 5,100 |
| 782 | 174,560 | 174,560 | 6,400 | - | 6,400 |
| 783 | 178,072 | 178,072 | 8,000 | - | 8,000 |
| 784 | 181,628 | 181,628 | 9,600 | 3,500 | 13,100 |
| 785 | 185,229 | 185,229 | 11,400 | 13,000 | 24,400 |
| 786 | 188,877 | 188,877 | 13,300 | 26,000 | 39,300 |
| 787 | 192,574 | 192,574 | 15,300 | 41,500 | 56,800 |
| 788 | 196,321 | 196,321 | 17,400 | 59,500 | 76,900 |
| 789 | 200,119 | 200,119 | 19,600 | 81,000 | 100,600 |
| 790 | 203,967 | 203,967 | 21,900 | 104,500 | 126,400 |
| 791 | 207,867 | | | | *151,964* |
| 793 | 215,821 | | | | *203,143* |
| 795 | 223,980 | | | | *255,964* |

02.04.03-8

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that staff intends to use to evaluate whether an applicant meets the NRC's regulations.

The staff issued RAI ID 3665 (RAI number 105) Question Number 14248 (02.04.03-3), in which the NRC staff asked “Provide a rationale for assumptions made in the modeling of instream flooding and drainage for computation of the PMF on rivers and streams affecting the site. Provide documentation and electronic versions of input files for all computer models used to compute the river and stream flooding.”

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The applicant directed the staff to the applicant’s response to RAI ID 3665 (RAI Number 105). The staff has generated a supplemental RAI to address its need for additional information. The applicant’s response to this RAI also referred to Calculation "MITS004 - Probable Maximum Flood Calculation for Comanche Peak Nuclear Power Plant, Units 3 and 4 (HEC-HMS & HEC-RAS)", Revision 1 and the input and output (I/O) files (FlowMaster) that were submitted previously, as part of July 2009 Hydrology Safety Site Audit Information Need HYDSV-07 via Luminant letter TXNB-09037, dated September 2, 2009. This supplemental RAI question results from the staff’s examination of that calculation package and from examination of calculation package TXUT-001-FSAR 2.4.3-CALC-012. Refer to the NRC staff's 'Hydrology Site Safety Audit Report of the Comanche Peak Nuclear Power Plant, Units 3 and 4 Combined License Application,' dated December 3, 2009.

The staff noted that the Squaw Creek Reservoir storage-elevation and discharge-elevation relationships referenced in the FSAR and in TXUT-001-FSAR 2.4.3-CALC-012 are important determinants of the design basis flood elevation reported by the applicant because they determine how much flood rise is produced when Squaw Creek Reservoir is surcharged by the PMF.

Page 18 of 28 of TXUT-001-FSAR 2.4.3-CALC-012 reports that the discharge-storage relationship available to the applicant was linearly extrapolated to higher storage and discharge flow levels. The NRC staff needs to reproduce this extrapolation in confirmatory analysis and make a safety determination about the design basis flood elevation that depends upon this extrapolation.

In order to ensure that the methods used to perform the analyses used to make its safety determinations technically valid and conservative, the staff requests that the applicant provide in the COL FSAR, deductive statements proving that the linear extrapolation is bounding conservative. The analysis should demonstrate that the linear extrapolation to extreme storage values conservatively underestimates Squaw Creek Dam discharge and overestimates Squaw Creek Reservoir elevation during PMF conditions, and that the resulting design basis flood elevation is bounding conservative.

This is supplemental RAI 2.4.3-03-S-c.

02.04.03-9

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that the NRC staff intends to use to evaluate whether an applicant meets the NRC's regulations.

The NRC staff issued RAI ID 3665 (RAI Number 105) Question Number 14248, in which the NRC staff asked “Provide a rationale for assumptions made in the modeling of instream flooding and drainage for computation of the PMF on rivers and streams affecting the site. Provide documentation and electronic versions of input files for all computer models used to compute the river and stream flooding.”

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The applicant directed the staff to the applicant’s response to RAI ID 3665 (RAI Number 105). The staff has generated a supplemental RAI to address its need for additional information. The applicant’s response to RAI 3665 Question 14248 also referred to Calculation "MITS004 - Probable Maximum Flood Calculation for Comanche Peak Nuclear Power Plant, Units 3 and 4 (HEC-HMS & HEC-RAS)", Revision 1 and the input and output (I/O) files (FlowMaster) that were submitted previously, as part of July 2009 Hydrology Safety Site Audit Information Need HYDSV-07 via Luminant letter TXNB-09037, dated September 2, 2009. This supplemental RAI question results from the staff’s examination of the calculation package and from examination of calculation package TXUT-001-FSAR 2.4.3-CALC-012. Refer to the NRC staff's 'Hydrology Site Safety Audit Report of the Comanche Peak Nuclear Power Plant, Units 3 and 4 Combined License Application,' dated December 3, 2009.

The NRC staff noted that the Squaw Creek Reservoir storage-elevation and discharge-elevation relationships referenced in the FSAR and in TXUT-001-FSAR 2.4.3-CALC-012 are important determinants of the design basis flood elevation reported by the Applicant because they determine how much flood rise is produced when Squaw Creek Reservoir is surcharged by the PMF. The design documents for Squaw Creek Dam and Reservoir that detail the development of these relationships must be referenced in the COL FSAR, as well as the calculations in which these data are used. These documents are fundamental in the analysis of flood and safety determination and need to be included in the FSAR. The staff will also reference these documents to make its safety determinations.

Accordingly, the NRC staff requests that the applicant submit calculation packages 2.4.3-CALC-011 and 2.4.4-CALC-015 and references 11, 12, 13, and 14 of TXUT-001-FSAR 2.4.3-CALC-012 on the docket.

This is supplemental RAI 2.4.3-03-S-d.

02.04.03-10

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that the staff intends to use to evaluate whether an Applicant meets the NRC's regulations.

The NRC staff issued RAI ID 3665 (RAI Number 105) Question Number 14248, in which the NRC staff asked “Provide a rationale for assumptions made in the modeling of instream flooding and drainage for computation of the PMF on rivers and streams affecting the site. Provide documentation and electronic versions of input files for all computer models used to compute the river and stream flooding.”

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The applicant directed the staff to the applicant’s response to RAI ID 3665 (RAI Number 105). The NRC staff has generated a supplemental RAI to address its need for additional information. The applicant’s response to this RAI also referred to Calculation "MITS004 - Probable Maximum Flood Calculation for Comanche Peak Nuclear Power Plant Units 3 and 4 (HEC-HMS & HEC-RAS)", Revision 1 and the input and output (I/O) files (FlowMaster) that were submitted previously, as part of July 2009 Hydrology Safety Site Audit Information Need HYDSV-07 via Luminant letter TXNB-09037, dated September 2, 2009. This supplemental RAI question results from the NRC staff’s examination of that calculation package and from examination of calculation package TXUT-001-FSAR 2.4.3-CALC-012. Refer to the NRC staff's 'Hydrology Site Safety Audit Report of the Comanche Peak Nuclear Power Plant, Units 3 and 4 Combined License Application,' dated December 3, 2009.

Pages 12 and 13 of TXUT-001-FSAR 2.4.3-CALC-012 report selection of a base flow rate. The applicant used a 1977-present average of July baseflows—the lowest of all months for the 1977-present period of record.

In order to make its safety determinations based on appropriate consideration of conservative estimates, the staff requests that the applicant justify why the average of July baseflows is bounding conservative as compared to the use of a greater baseflow statistic.

This is supplemental RAI 2.4.3-03-S-e.

02.04.03-11

NUREG-0800, Standard Review Plan (SRP), Section 2.4.3, 'Probable Maximum Flood (PMF) on Streams and Rivers,' establishes criteria that staff intends to use to evaluate whether an applicant meets the NRC's regulations.

The NRC staff issued RAI ID 3665 (RAI Number 105) Question Number 14248, in which the NRC staff asked “Provide a rationale for assumptions made in the modeling of instream flooding and drainage for computation of the PMF on rivers and streams affecting the site. Provide documentation and electronic versions of input files for all computer models used to compute the river and stream flooding.”

The applicant responded in document CP-200901564-Log No TXNB-09067-(ML093230704) executed on November 13, 2009. The applicant directed the staff to the

applicant’s response to RAI ID 3665 (RAI Number 105). The NRC staff has generated a supplemental RAI to address its need for additional information. The applicant’s response to this RAI also referred to Calculation "MITS004 - Probable Maximum Flood Calculation for Comanche Peak Nuclear Power Plant Units 3 and 4 (HEC-HMS & HEC-RAS)", Revision 1 and the input and output (I/O) files (FlowMaster) that were submitted previously, as part of July 2009 Hydrology Safety Site Audit Information Need HYDSV-07 via Luminant letter TXNB-09037, dated September 2, 2009. This supplemental RAI question results from the staff’s examination of that calculation package and from examination of calculation package TXUT-001-FSAR 2.4.3-CALC-012. Refer to the NRC staff's 'Hydrology Site Safety Audit Report of the Comanche Peak Nuclear Power Plant, Units 3 and 4 Combined License Application,' dated December 3, 2009.

The NRC staff noted that the applicant does not specify the reservoir elevation corresponding to the Squaw Creek Reservoir surface used to compute critical fetch length for wind and wave height computation.

In order to make safety determinations based on adequate consideration of appropriate mechanisms that result in a conservative estimate, the staff requests that the applicant include a figure in the COL FSAR detailing the location of the critical fetch length. The NRC staff also requests that the applicant describe any dependence of the critical fetch length on reservoir elevation, which would require that the fetch length be computed for the reservoir at the PMF (rather than normal) elevation of Squaw Creek Reservoir to yield a conservative estimate of wind and wave height.

This is supplemental RAI 2.4.3-03-S-f.