TXU Power

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Ref: #10CFR50.54(f)

CPSES-200501776
Log # TXX-05162

September 1, 2005

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES) DOCKET NOS. 50-445 AND 50-446 RESPONSE TO REQUESTED INFORMATION PART 2 OF NRC GENERIC LETTER 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS"

REF:
1. Letter Logged TXX-05047 from M. Blevins to the NRC dated March 7, 2005, "90-DAY RESPONSE TO NRC GENERIC LETTER 2004-02, POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS"
2. Nuclear Regulatory Commission Public Meeting with Nuclear Energy Institute (NEI) Regarding the Resolution Status of the PWR Sump Blockage Issue (GSI-191), June 30, 2005

Gentlemen:

The US Nuclear Regulatory Commission (NRC) issued Generic Letter 2004-02 on September 13, 2004 to 1) request that addressees perform an evaluation of the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation functions in light of the information provided in the generic letter and, if appropriate, take additional actions to ensure system function, and 2) require addressees to provide the NRC a written response in accordance with 10CFR50.54(f).

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Additionally the NRC requested that addressees submit information specified in part 2 of the generic letter to the NRC. The request was based on identified potential susceptibility of the pressurized water reactor (PWR) recirculation sump screens to debris blockage during design basis accidents requiring recirculation operation of ECCS or CSS and on the potential for additional adverse effects due to debris blockage of flow paths necessary for ECCS and CSS recirculation and containment drainage.

Reference 1 indicated a commitment [CDF-27330] that the analysis of the ECCS and CSS recirculation functions had been initiated and that the final analysis was scheduled to be completed in time to support this submittal. This commitment is updated and revised herein (below). Although the analysis is substantially complete, there are confirmatory actions and analysis refinements, as well as additional testing and data needed to determine the final design and analysis.

Reference 1 also indicated a commitment [CDF-27332] that this submittal would also include any License Amendment requests, a description of the proposed FSAR changes to revise the Licensing Basis, and a description of the plant and programs as they will be after programmatic changes and plant modifications are implemented to comply with GL 2004-02. This commitment is revised herein (below) based on NRC guidance provided in the June 30, 2005 public meeting with NEI [Ref. 2].

TXU Generation Company, LP (TXU Power) is providing a response with the information that was requested to be submitted September 1, 2005.

The Attachment to this letter contains the response for information requested to be submitted. This information is being provided in accordance with 10 CFR 50.54(f).

This letter contains one revised, one revised and complete, two complete, and two new licensing commitments regarding CPSES Units 1 and 2.

	Description of Commitment
27330 (revised)	In response to the request for information in Part 1 of Generic Letter 2004-02, CPSES has *substantially completed* an analysis of the susceptibility of the ECCS and CSS recirculation functions for CPSES Units 1 and 2. The methodology used will conform to the intent of NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology." The analyses when *fully* completed will provide the basis to show compliance with the applicable regulatory requirements including 10 CFR 50.46 and 10 CFR 50 Appendix A, General Design Criteria 35 and 38. *The final analysis is scheduled to be completed by the end of 2006.*

27331 (complete)	Exceptions or refinements to the guidance given in NEI 04-07, should they be taken, will be identified and a basis for them documented in the September 1, 2005 submittal to the NRC.
27332 (revised and complete)	The submittal will also include *the schedule for submitting* any License Amendment requests, a description of the proposed FSAR changes to revise the Licensing Basis, and a description of the plant and programs as they will be after programmatic changes and plant modifications are implemented to comply with GL 2004-02.
27333 (complete)	Containment walk downs for CPSES Unit 2 to support the analysis of sump performance as identified in the Generic Letter are planned during the 2RF08 outage scheduled for this spring. The walk downs will be performed using guidance provided in NEI 02-01, "Condition Assessment Guidelines, Debris Sources inside Containment," Revision 1. In addition, the walk down will include sampling for latent debris (dust and lint) considering guidance in NEI 04-07 Volume 2 (i.e., the NRC SER).
27369 (new)	The Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) recirculation functions under debris loading conditions at Comanche Peak Steam Electric Station (CPSES) Units 1 and 2 will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of Generic Letter 2004-02 [Ref. 1] by December 31, 2007.
27370 (new)	As a result of analyses, testing, and design evaluations not being fully completed, an update to this response (modifications and maintenance actions) will be provided no later than March 31, 2006.

Should you have any questions, please contact Mr. J. D. Seawright at (254) 897-0140.

I state under penalty of perjury that the foregoing is true and correct.

Executed on September 1, 2005.

Sincerely,

TXU Generation Company LP

By: TXU Generation Management Company LLC
Its General Partner

Mike Blevins

By: [signature]
Fred W. Madden
Director, Regulatory Affairs

JDS
Attachment

c - B. S. Mallett, Region IV
M. C. Thadani, NRR
Resident Inspectors, CPSES

Response to Requested Information Part 2 of NRC Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors

Below is CPSES's response to Requested Information Part 2 of NRC Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized-Water Reactors. The generic letter's "Requested Information" is shown in bold followed by CPSES's response.

References for this attachment are identified on Pages 34, 35 and 36 of this attachment.

NRC Requested Information Part 2

Addressees are requested to provide the following information no later than September 1, 2005:

NRC Requested Information 2(a):

[Provide] Confirmation that the ECCS and CSS recirculation functions under debris loading conditions are or will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. This submittal should address the configuration of the plant that will exist once all modifications required for regulatory compliance have been made and this licensing basis has been updated to reflect the results of the analysis described above.

CPSES Response 2(a):

Activities are currently underway to ensure that the Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) recirculation functions under debris loading conditions at Comanche Peak Steam Electric Station (CPSES) Units 1 and 2 will be in full compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of Generic Letter 2004-02 [Ref. 1] by December 31, 2007. Full compliance will be achieved through analysis, testing, modifications to increase the available sump screen area, other changes to the plant to reduce the potential debris loading on the installed containment recirculation sump strainers, and programmatic and process changes to ensure continued compliance. The analysis methods being utilized for demonstrating this compliance are based on the methods described in NEI 04-07 as evaluated by the NRC in the Safety Evaluation Report for NEI 04-07 [Ref. 4]. Further information regarding this approach is provided in subsequent sections of this response.

By December 31, 2007, both Unit 1 and Unit 2 of CPSES will have installed new sump strainers to increase the available (i.e., submerged) screen area from the current approximately 200 ft^2 per sump to an area of approximately 4000 ft^2 per sump. The existing sump screens are 75 inches tall whereas the new strainers will be approximately 42 inches tall. In support of the new strainer design, RWST switchover setpoints are being revised to ensure the new strainers are fully submerged at the completion of RWST injection. Although the exact strainer size that will be installed has not yet been finalized, the proposed replacement size is based on the best available knowledge at this time for the proposed installation areas, potential debris generation and transport, and potential head loss across the screen. The proposed new strainers will be installed

in the existing locations within containment. The strainers will be installed inside the structure of the existing screens outside the secondary shield wall.

To establish the proposed new strainer system, several activities have been or will be completed. These activities have been performed, except where noted, pursuant to the guidance given in NEI 04-07 Volume 1, Pressurized Water Reactor Sump Performance Evaluation Methodology (GR), and NEI 04-07 Volume 2, Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Revision 0, December 6, 2004 (SER). [Ref. 4]

These activities are:

- Containment Condition Assessments – A series of walkdowns have been completed as described in Ref. 2 [CDF-27333]. Containment walk downs were completed for CPSES Unit 1 during the Spring 2004 1RF010 outage. Containment walk downs for CPSES Unit 2 were completed during the spring 2005, 2RF08 outage. The walk downs were performed using guidance provided in NEI 02-01, "Condition Assessment Guidelines, Debris Sources inside Containment," Revision 1 [Ref. 5]. In addition, the Unit 2 walkdown included extensive sampling for latent debris (dust and lint) considering guidance in NEI 04-07 Volume 2 (i.e., the NRC SER). Supplementary walkdowns to assess containment conditions at power were performed in September 2004, May 2005 and June 2005. These containment condition assessments are documented in SMF-2001-002201-00 [Ref. 8.A].

- Replacement of Radiation Protection Locked High Radiation Doors to the Steam Generator Compartments – These doors, consisting of wire mesh, were replaced with doors with bars with six inch wide openings. This was done to prevent upstream blockage and hold up of water and debris during the blow down and wash down phase of LOCA. Delayed release of debris after pool fill is considered adverse to emergency sump performance. This will optimize the transport of debris to the inactive sump under the reactor vessel as well as low flow areas of the containment floor. [Ref. 8.B]

- Redesign of the Drain Path to the Inactive Sump – The locked high radiation door to the incore instrumentation guide tube room, consisting of wire mesh, was replaced with a door with bars with six inch wide openings. The floor hole personnel safety barrier around the guide tubes was redesigned to be raised with vertical bars with six inch openings. This was done to prevent blockage and hold up of water and debris during the blow down and wash down phase of LOCA. The path to the inactive sump is at Elevation 808'-0" whereas there is an effective curb around the emergency sumps that is at elevation 808'-3-7/8". During pool fill, flow and debris will be preferentially directed to the inactive sump. This will optimize the transport of debris to the inactive sump under the reactor vessel as well as low flow areas of the containment floor. [Ref. 8.B]

- Removal of Radiation Protection Barriers and a Tool Room Enclosure – Cages consisting of wire mesh which are no longer required will be removed. This will prevent blockage by debris which could affect flow to the emergency sumps. [Ref. 8.C]

- Implementation of Compensatory Actions – Compensatory actions in response to NRC Bulletin 2003-01 have been implemented as permanent changes in procedures. [Ref. 8.D]

  The modifications to the locked high radiation doors described above were also completed as compensatory actions These improved doors will be retained pursuant to GL 2004-02.

- Containment Coatings Assessments – The current Licensing Basis for CPSES coatings in the containment, as approved by the NRC, is that 100% failure is acceptable for sump performance. A reassessment of CPSES containment building protective coatings is being conducted in support of the response to GL 2004-02. [Ref. 6 (FSAR Sections 6.1B.2 and 6.2.2.3.3) and Ref. 8.E]

- Evaluation of the Plant Labeling Program – The plant labeling program is being evaluated to determine suitable material and program changes in support of the response to GL 2004-02. [Ref. 8.F]

- Upstream Effects Evaluation – The upstream effects evaluation [Ref. 10] is complete. As part of the review performed for resolution of GL 2004-02, a potential plugging point was identified. This potential plugging point is the refueling cavity drains. These drains return a portion of the upper containment spray flow back to the lower volume of containment, to support the water level analysis. CPSES is proposing to install debris interceptors (trash racks) over the drains to prevent blockage of the drain paths in both units. Additional water holdup volumes were identified which are being evaluated for modifications.

- Event Characterization – The event characterization [Ref.11] evaluates the licensing and design basis to establish the design basis events which require emergency sump recirculation. Additionally, based on plant design inputs, the event characterization establishes the sump flow rates, recirculation pool water level and recirculation pump minimum Net Positive Suction Head margins. This report is complete based on the current plant design and the estimated NPSH margin from Ref. 21.

- Debris Generation Evaluation – Bounding (Unit 1) debris generation analyses [Ref. 12] have been performed in support of a baseline analysis for the current design. Refinements for the new plant design and configuration are in progress. It will be confirmed that Unit 1 debris generation bounds Unit 2.

- Debris Transport Evaluation – Bounding (Unit 1 and Unit 2) debris transport analyses [Ref. 13] have been performed in support of refined analysis for the current design. Refinements for the new plant design and configuration are in progress.

- Head Loss Evaluation – Bounding (Unit 1 and Unit 2) headloss analyses [Ref. 14] have been performed in support of a baseline analysis for the current design. Refinements for the new plant design and configuration are in progress.

- Downstream Effects Evaluations – In accordance with NEI 04-07, the ECCS and CSS were evaluated for blockage and wear concerns. The following evaluations were performed:

  - Blockage (except for reactor vessel) [Ref. 15]

  - Equipment Wear [Ref. 16]

  - Valve Wear [Ref. 17]

  - Reactor Vessel Blockage [Ref. 18]

  - Fuel Blockage [Ref. 19]

- Calculation of Required and Available NPSH – The available NPSH has been estimated during scoping analyses performed for resolution of this issue. The required NPSH for a 50% blocked sump screen headloss condition had previously been conservatively determined, via calculations, for all ECCS and CSS pumps at CPSES. These analyses are being revised to determine the headloss across the debris laden screen and determined the minimum screen size necessary to maintain available NPSH greater than or equal to required NPSH. These calculations will be validated by testing which will demonstrate the margins in the new strainer design.

- Strainer/Screen Requirements (and interrelated planned modifications) – CPSES plans to install new sump strainers to resolve this issue. The exact size is not finalized at this time, but is expected to be approximately 4000 ft^2 per sump, two sumps per unit. The strainers will have nominal 0.095 inches diameter round openings (i.e., less than the existing screens which have a maximum 0.115 inches openings in wire mesh). The CPSES recirculation sump design has each train of ECCS and CSS taking suction from a shared sump (i.e. one shared sump per train).

  Other interrelated modifications currently planned include:

  - Revised RWST switchover setpoints and motor operated valve modification
  - Installation of trash screens for drains including the refueling cavity and the reactor vessel head stand
  - Modifications to minimize water holdup on floors and miscellaneous items
  - Installation of various debris interceptors
  - ECCS and CSS pump NPSHa monitoring instrumentation
  - Replacement of high efficiency Min-K insulation under inactive pipe whip restraints
  - Modification of Min-K insulation under active pipe whip restraints
  - Replacement of NaOH pH control via the Chemical Additive System with tri-sodium phosphate (TSP) baskets
  - Removal of unqualified labels, tags, and tape from containment to the extent practical

In addition, anti-sweat insulation, fire barriers, and penetration seals are being evaluated for possible design modifications.

- Strainer Structural Analysis – Validation of the structural capability of the sump strainer design will be completed as part of the modification developed to install the new strainers, as well as site specific debris load testing that will be performed at the strainer vendor's test facility.

- Potential or Planned Design/Operational/Procedural Changes – CPSES is performing evaluations of existing engineering design specifications, engineering design standards, engineering programs, modification and maintenance processes and procedures, and station operation processes and procedures. These will ensure the inputs and assumptions that support the current analysis effort are incorporated into the applicable documents to maintain the necessary attributes for future compliance with these requirements. Planned changes, described in the response to 2(f) below, include:

    - Revision to design control procedures to explicitly address emergency sump performance impacts (Complete)
    - Revision to Design Basis Documents and Engineering Specifications to ensure necessary control of existing and future materials that could affect sump performance
    - Revision to the Coatings Program as described in Ref. 2
    - Revision to the Station Labeling Program to ensure control of label materials and locations in containment
    - Revision to the Containment foreign material control procedures and programs to monitor and control latent debris

The CPSES licensing basis will be updated to reflect the results of the analysis and modifications performed to demonstrate compliance with the regulatory requirements. These updates will be performed in accordance with the requirements of 10CFR50.71(e). In general, the FSAR will be revised as follows:

- Section 1A(B) to update the discussion of Regulatory Guides 1.79 and 1.82
- Section 6.1B to update for materials, including coatings, and chemical effects
- Section 6.2.2 to update for upstream and downstream design features
- Section 6.2.2.2.1 to reflect the new design and licensing basis for the emergency sumps
- Section 6.2.2.3.1 to reflect the new sump strainer design
- Section 6.2.3.3 to reflect the new design and licensing basis for sump performance
- Section 6.2.3.3.4 to reflect the new design and licensing basis for NPSH
- Section 6.2.2.5 to reflect new instrumentation
- Section 6.3.2.2.10 to reflect the new design and licensing basis for NPSH
- Section 6.3.2.5.2 to address potential changes due to downstream wear
- Section 6.3.2.8 to update for revised RWST switchover changes
- Section 6.5.2 to update containment spray design and chemical additive changes
- Section 7.5 to reflect new accident monitoring instrumentation
- Appendix 17A, Table 17A-1, to reflect new equipment

NRC Requested Information 2(b):

[Provide] A general description of and implementation schedule for all corrective actions, including any plant modifications, that you identified while responding to this generic letter. Efforts to implement the identified actions should be initiated no later than the first refueling outage starting after April 1, 2006. All actions should be completed by December 31, 2007. Provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006. If all corrective actions will not be completed by December 31, 2007, describe how the regulatory requirements discussed in the Applicable Regulatory Requirements section will be met until the corrective actions are completed.

CPSES Response 2(b):

As provided in the response to Requested Information Item 2(a) above, CPSES will be in compliance with the regulatory requirements discussed in the Applicable Regulatory Requirements section of GL 2004-02 by December 31, 2007, including the full implementation of all required corrective actions.

	Corrective Action Description	**Implementation Date/Schedule**
1.	Containment condition assessment	Completed [Ref. 8.A]
2.	Replacement of Radiation Protection Locked High Rad Doors to the Steam Generator Compartments	Completed [Ref. 8.B]
3.	Redesign of the Drain Path to the Inactive Sump	Completed [Ref. 8.B]
4.	Removal of Radiation Protection Barriers and a Tool Room enclosure	Scheduled for completion Summer 2006 [Ref. 8.C]
5.	Implementation of Compensatory Actions	Completed [Ref. 8.D]
6.	Reassessment of Containment Coatings to provide current assessment of unqualified coatings.	Scheduled for completion Spring 2006 [Ref. 8.E]
7.	Evaluation of the Plant Labeling Program	Scheduled for completion by the end of 2005.
8.	Upstream Effects Evaluation	Completed [Ref. 10]
9.	Event Characterization	Completed [Ref. 11]
	Note: NPSH margin was based on an estimate in Ref. 21 in lieu of verified design calculations.	Included in item 19, below
10.	Debris Generation Evaluation	Complete except as follows:
	Confirmation that Unit 1 Debris Generation bounds Unit 2	ECD 12/31/2005
	Testing to support the selection of a 5D ZOI for qualified coatings destruction pressure.	ECD 3/31/2006
	Testing to determine unqualified coating debris source terms	ECD 6/31/2006
	As-built configuration of Radiant Energy Shields	ECD 6/31/2006
	Confirmation that vapor barrier materials were not used in the fiberglass insulation applications	ECD 12/31/2005

	Corrective Action Description	Implementation Date/Schedule
	Identification of flexible tubing material used for RCP lube oil collection system	ECD 12/31/2005
	Revision of analysis for the above and minor open items	ECD 9/31/2006
11.	Debris Transport Evaluation	Complete except as follows:
	Refinements based on new sump strainers and related design modifications	ECD 12/31/2005
12.	Head Loss Evaluation	Complete except as follows:
	Revision based on the changes to items 10 and 11 above	ECD 9/31/2006
13.	Downstream Effects Evaluation, Blockage	Complete except as follows:
	Determination of RHR Pump Seal Cooler Tube ID	ECD 12/31/2005
14.	Downstream Effects Evaluation, Equipment Wear	Complete except as follows:
	Revision [reduction] in concentration of coatings debris for pump backup seal bushing wear.	ECD 9/31/2006
15.	Downstream Effects Evaluation, Valve Wear	Complete except as follows:
	Revision [reduction] in concentration of coatings debris for ECCS throttle valve wear.	ECD 9/31/2006
16.	Downstream Effects Evaluation, Reactor Vessel	Completed [Ref. 18]
17.	Downstream Effects Evaluation, Fuel	Complete except as follows:
	Revision to reflect debris generation and transport refinements	ECD 9/31/2006
18.	Calculation of Required and Available NPSH	ECD 9/31/2006
	Chemical effects testing.	ECD Summer 2006
	Head loss testing on the replacement strainer utilizing the results of the site-specific debris generation and debris transportation evaluations.	ECD Spring 2006
19.	Strainer Replacements (and interrelated modifications)	Unit 2 -Prior to restart from Refueling Outage 2RF09, currently scheduled for Fall 2006. Unit 1 - Prior to restart from Refueling Outage 1RF12, currently scheduled for Spring 2007.
20.	Strainer Structural Analysis	Included in strainer replacements, item 19 above.
21.	Potential or Planned Design/Operational/Procedural Changes	See below -
	Revision to design control procedures	Complete
	Revision to Design Basis Documents and engineering specifications	Prior to restart from Refueling Outage 2RF09, currently scheduled for Fall 2006.
	Revision to the Coatings Program	Prior to restart from Refueling Outage 2RF09, currently scheduled for Fall 2006.

	Corrective Action Description	Implementation Date/Schedule
	Revision to the Station Labeling Program	Prior to restart from Refueling Outage 2RF09, currently scheduled for Fall 2006.
	Revision to the Containment foreign material control procedures and programs	Prior to restart from Refueling Outage 2RF09, currently scheduled for Fall 2006.

As a result of the required analyses, testing, and design evaluations not having yet been completed, an update to this response (modifications and maintenance actions) will be provided no later than the end of the first quarter of 2006.

NRC Requested Information 2(c):

[Provide] A description of the methodology that was used to perform the analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. The submittal may reference a guidance document (e.g., Regulatory Guide 1.82, Rev. 3, industry guidance) or other methodology previously submitted to the NRC. (The submittal may also reference the response to Item 1 of the Requested Information described above. The documents to be submitted or referenced should include the results of any supporting containment walkdown surveillance performed to identify potential debris sources and other pertinent containment characteristics.)

CPSES Response 2(c):

CPSES has performed analyses to determine the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. These analyses, which are substantially complete, conform to the NEI 04-07 methodology as approved by the NRC Safety Evaluation Report [Ref. 4] with the exceptions noted in the paragraphs below. In some cases, these analyses have confirmatory items and are on-going, utilizing additional refinements as allowed by the methodology. Specifically, analyses supporting debris generation and transport utilizing the proposed strainer and other hardware modifications (described in Item 2(b) above) have not yet been completed. Specific sensitivity runs have yet to be completed for various debris and transport scenarios. Vendor specific testing of the sump strainer utilizing CPSES specific debris mix has not yet been started.

As stated in the response to Item 2(b) above, an update on the status of these items will be provided no later than the end of the first quarter of 2006.

For those tests and analysis that have not yet been completed or started, except for the strainer vendor testing, CPSES expects those tests and analyses to be completed no later than the end of the second quarter of 2006. CPSES currently expects the strainer vendor testing to be performed during the first quarter of 2006.

For many of the areas requiring analysis and/or evaluation, these analyses and evaluations were performed by the Westinghouse Team under contract with CPSES. The Utilities Service Alliance

(USA), of which CPSES is a participating member, selected the Westinghouse Team to supply this facet of the overall resolution of the issue. The Westinghouse Team is comprised of Westinghouse, Alion Science and Technology (Alion), Enercon Services (Enercon), and Transco Products (Transco). CPSES personnel have reviewed the various reports and evaluations that have been performed to date [Refs. 11 to 20]. These reports identify confirmatory and open items as well as unconfirmed assumptions. CPSES anticipates that open items and confirmatory items will be complete by December 31, 2005.

Westinghouse was responsible for performing the downstream effects component wear evaluation, reactor vessel blockage, and reactor fuel blockage evaluations. Alion was responsible for performing the debris generation, debris transport, and headloss evaluations and analyses. Enercon was responsible for performing the upstream effects and the downstream effects ECCS and CSS components blockage evaluations.

As provided above, the general methodology used for resolution of this issue was that contained in NEI 04-07, Volume 1 (the NEI Guidance Report (GR)) and Volume 2 (the NRC SER). Because there are only minor differences between Unit 1 and Unit 2, a bounding analysis was performed for both units. The specific approaches used for the different aspects of the general methodology are provided for the following topical areas:

1. Containment Condition Assessments

   Containment walkdowns to assess conditions have been completed using guidance provided in NEI 02-01, "Condition Assessment Guidelines, Debris Sources inside Containment," Revision 1. In addition, the walkdowns included sampling for latent debris (dust and lint) considering guidance in NEI 04-07 Volume 2 (i.e., the NRC SER).

   Exception(s) Taken to GR and SER for Containment Condition Assessments

   Although the CPSES Unit 1 and Unit 2 insulation is predominantly reflective metallic insulation (RMI), the statistical sample mass collections (i.e., three samples from each category of surface) was not used. The loadings of latent debris have been observed to be both light and uniform in both CPSES Unit 1 and Unit 2. Many areas and surfaces cannot be reached for sampling without scaffolding or adding special provisions for fall protection devices. CPSES used an alternative approach to minimize personnel risk. Representative samples were taken from accessible surfaces. Visual observations of these sample locations were compared to visual observations of other surfaces and conservative estimates of bounding debris loadings were made. The data from Unit 1 and the data from Unit 2 were used to substantiate a common latent debris source term for both units. See item 5 below.

2. Break Selection

   Emergency sump recirculation is required to meet 10CFR50.46 for a spectrum of loss of coolant accidents. Therefore, break selection was performed to assure bounding breaks were identified and evaluated.

   Emergency sump recirculation is not required to meet 10CFR50.46 for secondary high energy line breaks. The CPSES licensing basis for break selection for secondary line breaks

is BTP MEB 3-1 in accordance with GDC-4 as documented in the FSAR Section 3.6B [Ref. 6 and 24]. The NRC Staff position in the SER Section 3.3.4.1 [Ref. 4] is that the break locations evaluated in the licensing basis "...may not have been defined specific to sump performance" and "...could not have anticipated the range of concerns identified in the course of resolving GSI-191." The NRC's backfit analysis was based on 10CFR50.46 which is not applicable to secondary pipe breaks. For CPSES, sump performance was specifically reviewed in NUREG-0797, Supplements 9 and 11 with respect to insulation and coating debris with respect to sump performance [Ref. 22]. In SER Supplement 9, Appendix L, the NRC Staff addressed insulation debris as evaluated in Ref. 23. That assessment was based on GDC-4 criteria for break selection. Therefore, CPSES does not intend to change its licensing and design basis for break selection in secondary piping for the purposes of sump performance which is in accordance with the GR. However, in recognition of the NRC technical concern, CPSES will perform evaluations of secondary pipe break locations consistent with the methodology being used for LOCA. Therefore, break selection was performed to assure bounding breaks were identified and evaluated. Exceptions to other parts of the GR and SER based on the CPSES licensing basis for secondary pipe breaks will be noted where taken.

Break selection was performed with two considerations governing the approach. The first consideration is that a determination of the worst break location with respect to maximum debris generation and transport was necessary to support performance of the analysis.

Section 3.3.4.1 in the GR recommends that a sufficient number of breaks in each high-pressure system that relies on recirculation be considered to ensure that the breaks that bound variations in debris generation with respect to the size, quantity, and type of debris are identified. At a minimum, the following break locations were considered:

- Break No. 1: Breaks in the RCS with the largest potential for debris
- Break No. 2: Large breaks with two or more different types of debris
- Break No. 3: Breaks in the most direct path to the sump
- Break No. 4: Large breaks with the largest potential particulate debris to insulation ratio by weight
- Break No. 5: Breaks that generate a "thin bed" – high particulate with 1/8 inch fiber bed

The CPSES licensing basis documented in the FSAR is that all LOCA breaks 2 inches and over are contained within the secondary shield walls as shown on CPSES Flow Diagrams [Ref. 6]. From Section 3.3.4.1, Item 7 of the SER [Ref. 4], piping under 2 inches diameter can be excluded when determining the limiting break conditions. Therefore, large break LOCA bounds all small break LOCAs for debris sources and debris generation.

An evaluation of the secondary systems (Main Steam, Feedwater, and Steam Generator Blowdown) showed that Main Steam Line breaks would bound all secondary breaks. These lines traverse the containment annulus between the secondary shield walls and the containment liner.

Exception(s) Taken to GR and SER for Break Selection

For break selection, the only exception taken to the GR and SER was the use of the "every five feet" criteria described in Section 3.3.5.2 of the SER. Due to the configuration of CPSES, the overlapping Zones of Influence (ZOIs) essentially covered the same locations. The approach used was to determine the limiting debris generation locations (based on ZOI) and then determine the break location that would provide this debris. This simplification of the process did not reduce the debris generation potential for the worst case conditions as described in Section 3.3 of the GR and SER.

3. Debris Generation/Zone of Influence (Excluding Coatings)

The debris generation evaluation consisted of two primary steps:
- Determine the Zone of Influence (ZOI) in which debris is generated.
- Identify the characteristics (size distribution) of the destroyed debris

The ZOI was defined as the volume about the break in which the jet pressure is greater than or equal to the destruction damage pressure of the insulation, coatings, and other materials impacted by the break jet.

Both the GR and SER define the ZOI as spherical and centered at the break site or location. The radius of the sphere is determined by the pipe diameter and the destruction pressures of the potential target insulation or debris material. All potentially important debris sources (insulation, coatings, fixed, etc.) within the ZOI were evaluated. [See item 7, below for coatings.]

Section 4 of the GR allowed for the development of target-based ZOIs, taking advantage of materials with greater destruction pressures. The CPSES evaluation used multiple ZOIs at the specific break location dependent upon the target debris. The destruction pressures and associated ZOI radii for common PWR materials were taken from Table 3-2 of the NRC SER [Ref. 4].

Materials that do not have applicable experimental data or documentation were conservatively assumed to have the lowest destruction pressure adopted. That destruction pressure is equivalent to a 28.6D ZOI.

Robust barriers consisting of structures and equipment that are impervious to jet impingement were utilized in the evaluation. Per the guidance given in Section 3.4.2.3 of the SER, when a spherical ZOI extends beyond a robust barrier, the barriers may prevent further expansion of the break jet but they can also cause deflection and reflection. In Section 3.4.2.3, the NRC SER states that when a spherical ZOI extends beyond robust barriers such as walls or encompasses large components such as tanks and steam generators, the extended volume may be conservatively truncated. The SER also stipulates that "shadowed" surfaces of components should be included in the analysis. These approaches were utilized within the CPSES evaluation.

The following break locations and debris generation were considered:

LOCA within the steam generator compartments (reactor coolant system loop rooms)

- RMI insulation
- Min-K insulation
- LDFG (low density fiberglass) insulation
- Lead Shielding Blankets
- Coatings [item 7 below]

Main Steam Line Breaks in the Containment Annulus and Penetration Area

- RMI insulation
- Min-K insulation
- LDFG insulation
- RES (Radiant Energy Shielding)
- Coatings [item 7 below]

Exception(s) Taken to GR and SER for Debris Generation/Zone of Influence

The ZOI values provided in the NRC SER [Ref. 4] are based on HELB conditions associated with primary RCS breaks at approximately 2250 psia and 535°F. These conditions represent subcooled water that flashes into a two-phase jet. Secondary system conditions are much more similar to Boiling Water Reactor system condition of approximately 1000 psia and 570°F which are saturated steam conditions. Therefore, the ZOI values for the potential debris materials exposed to secondary system breaks were calculated using the BWR Owners' Group Utility Resolution Guidance (URG) methodology [Ref. 25].

4. Debris Characteristics (Excluding Coatings)

The CPSES specification for the Diamond Power Mirror® RMI insulation did not specify the use of "Sure-Hold" bands. Therefore, the damage pressure for the RMI is assumed to be 2.4 psig with a 28.6D ZOI corresponding to "Mirror® with standard bands" in Table 3-2 of the NRC SER [Ref. 4]. The size distribution for RMI was assumed to be 75% small pieces and 25% large pieces consistent with the NEI GR. Small pieces are defined as pieces 4 inches square and less in size.

Anti-sweat fiberglass used on cooling and cold water lines were assumed to be low density fiberglass (LDFG) similar to Nukon™, Thermal-Wrap™, and Knauf™ LDFG. The calculation used the following 4-category 3-ZOI based size distribution for the LDFG:

Size	18.6 psi ZOI (7.0 L/D)	10.0 – 18.6 psi ZOI (11.9 – 7.0 L/D)	6.0 – 10.0 psi ZOI (17.0 – 11.9 L/D)
Fines (Individual Fibers)	20%	13%	8%
Small Pieces (< 6" on a Side)	80%	54%	7%
Large Pieces (> 6" on a side)	0%	16%	41%
Intact (covered) Blankets	0%	17%	44%

The Min-K insulation is installed ¼ inch thick and encased in Type 304 Stainless Steel not to exceed a sheet thickness of 0.125 inches. Damage pressure for this configuration is not available. Therefore, the damage pressure for the Min-K is assumed to be 2.4 psig with a 28.6D ZOI corresponding to "Min-K" in Table 3-2 of the NRC SER [Ref. 4]. The size distribution for Min-K will be assumed to be 100% small pieces in accordance with the NEI GR.

Permanent lead shielding is installed on portions of the pressurizer spray line. The lead wool blankets are Lancs Industries; "HT" Series lead wool blankets consisting of 10 lb/ sq ft lead wool that consist of Alpha Maritex Style 8459-2-SS silicon impregnated fiberglass outside cover encapsulating Lancs Industries, Inc. lead wool. Therefore, the damage pressure for the permanent lead blankets at CPSES is assumed to be 6 psig with a 17.0D ZOI corresponding to "Jacketed Nukon with standard bands" in Table 3-2 of the NRC SER [Ref. 4]. The size distribution for the lead blanket covers was assumed to be 60% fines and 40% large pieces and the size distribution for the lead wool will be assumed to be 100% small pieces consistent with the NEI GR.

No HEMYC fire blankets are exposed to primary RCS system breaks (i.e. LOCA). This material is used in the annulus and is prohibited in the RCS loop rooms. This material is used as a radiant energy shield for raceways and electrical equipment. The material could be in the debris from certain secondary line breaks. The HEMYC fire blankets are comprised of Kaowool enclosed in SilTemp blankets. No debris generation data is available for these specific fire blankets or combination of materials. Therefore, the damage pressure for the HEMYC fire blankets will be assumed to be 4 psig which is the lowest damage pressure of materials provided in the URG and is considered conservative. The ZOI for material with a 4 psig damage pressure exposed to secondary system HELBs is 12D.

The size distribution for the HEMYC blankets was assumed to be 100% fines.

The analysis used a conservative assumption of 200 lbm as a reasonable upper bound for latent debris. The particulate / fiber mix of the latent debris was assumed to be 15% fiber. The latent fiber debris was assumed to have a mean density of 94 lbm/ft^3 (1.5 g/cm^3) and the latent particulate debris a nominal density of 169 lbm/ft^3 (2.7 g/cm^3). The latent particulate size was assumed to have a specific surface area of 106,000 ft^{-1} [Ref. 4]. The latent debris fiber bulk density was assumed to be the same as that of LDFG which is 2.4 lb/ft^3 [Ref. 4]. The characteristic size of the latent fiberglass is also assumed to be the same as LDFG or approximately 7 microns [Ref. 4].

Exception(s) Taken to GR and SER for Debris Characteristics

Exceptions are taken with regard to the size distribution of Min-K insulation within the ZOI and for the particle sizes for unqualified epoxy coatings.

The NEI GR in Table 3-2 reports a characteristic particle size of <0.1 micron for Min-K, trade name of microporous insulation made by Thermal Ceramics, Inc (Min-K). The Thermal Ceramics Product Information data sheet for Min-K states; "The particulate and

fibrous material are sized to create pores which are < 0.1 micron in diameter, less than the mean free path of air. By limiting quantity and motion of air particles in the pores, both conduction due to air and convection heat transfer is limited, thus reducing the thermal conductivity. This is the basis of microporous insulation." Therefore, the open holes or pores between fibers/particulate are 0.1 micron; the particles or fibers themselves are not necessarily <0.1 micron. Specific testing to confirm or determine the appropriate size distribution for Min-K to be utilized is planned. The results will be provided in an update.

5. Latent Debris

CPSES has elected to use a bounding value of 200 lbm for the latent debris source term in containment. To qualify the use of that value, containment walkdown surveillances were performed in Unit 1 during the Spring 2004 (1RF10) refueling outage and in Unit 2 during the Spring 2005 (2RF08) refueling outage. Subsequent to those walkdowns, a calculation was performed to quantify the latent debris that could exist in CPSES Unit 2. This calculation conservatively determined the debris loading to be just less than 91 lbm. [Ref. 8.A]

Apart from the debris collection that was performed, it was also identified that there were unqualified labels in containment. As previously stated in the response to Item 2(b), these labels, which could be exposed to a viable transport medium or path, will be removed to the extent practical. It is CPSES intent to minimize unqualified labels, but if all can not be removed, then the total surface area of the labels will be considered for potential contribution to the head loss across the sump strainer(s).

In addition to the unqualified labels, it is CPSES intent to remove paper labels from within break location ZOIs for LOCA. The qualification for the labels did not include consideration of the jet impingement effects from a high energy break.

Exception(s) Taken to GR and SER for Latent Debris

The methodology provided in the SER (Section 3.5) [Ref. 4] for collection of the debris samples was not explicitly followed for CPSES. See item 1, above.

6. Debris Transport

The methodology used in this analysis was based on the NEI 04-07 GR for refined analyses as modified by the NRC's SER, as well as the refined methodologies suggested by the SER in Appendices III, IV, and VI. The specific effect of each mode of transport was analyzed for each type of debris generated, and a logic tree was developed to determine the total transport to the sump screen. The purpose of this approach was to break a complicated transport problem down into specific smaller problems that could be more easily analyzed.

A three-dimensional computer aided drafting (CAD) model of the Comanche Peak containment building was used to determine transport flow paths during each phase of the LOCA event. The current plant design and configuration were used. It was assumed that Comanche Peak Unit 1 and Unit 2 are essentially mirror images of each other, and therefore the debris transport would be the same for both units.

The Computational Fluid Dynamics (CFD) calculation for recirculation flow in the Comanche Peak containment pool was performed using Flow-3D® Version 8.2 [Ref. 29]. Flow-3D® is a commercially available general purpose computer code for modeling the dynamic behavior of liquids and gasses influenced by a wide variety of physical processes. The program is based on the fundamental laws of mass, momentum, and energy conservation. It has been constructed for the treatment of time-dependent multi-dimensional problems, and is applicable to most flow processes.

The information presented above represents the debris transport that would have to be considered for mitigative capability as defined in Section 6.1 of the SER.

The debris transport analysis, including CFD calculations, has not yet been completed in support of the modified plant design. This analysis is waiting for the determination of the new pool water flood levels, locations and sizes of TSP baskets, and modeling of the new strainers and debris interceptors. This information should be available by October 31, 2005, and the refined debris transport analysis completed by December 31, 2005. The information related to this analysis will be included in an update.

Exception(s) Taken to GR and SER for Debris Transport

A 10% erosion of fiberglass was used instead of the 90% recommended in the SER based on the following.

Tests performed as a part of the drywell debris transport study (DDTS) have indicated that the erosion of fibrous debris is significantly different for debris directly impacted by containment sprays versus debris directly impacted by break flow [Ref. 30]. The erosion of large pieces of fibrous debris by containment sprays was found to be less than 1%, whereas the erosion due to the break flow was much higher. Due to differences in the design of PWR plants compared to the boiling water reactor (BWR) plants, the results of the erosion testing in the DDTS are only partially applicable. In a BWR plant, a LOCA accident would generate debris that would be held up below the break location on grating above the suppression pool. In a PWR plant like Comanche Peak, however, the break would generate debris that would either be blown to upper containment or blown directly to the floor where the pool would form. Most of the debris would not be hung up directly below the break flow where it would undergo the high erosion rates suggested by the DDTS. Any debris blown to upper containment that is not washed back down, however, would be subject to erosion by the sprays. Based on the results of the DDTS testing, a 1% erosion factor was applied for small and large piece fibrous debris held up in upper containment. The erosion mechanism for debris in the pool is somewhat different than what was tested in the DDTS. The SER (Appendix III) [Ref. 4] describes erosion tests that indicated that the erosion rate of fibrous debris could be on the order of 0.3% of the current debris per hour for a pool with a 16-inch

depth (compared to 2% per hour for a pool with a 9-inch depth). Using the following equation, this gives a total erosion of 7% after 24 hours, and 89% after 30 days.

$$F_{eroded} = 1 - (1\text{-rate})^{\text{Number of Hours}}$$

where:
F_{eroded} = total fraction of debris eroded
rate = erosion rate of current debris per hour
Number of Hours = Number of hours debris is subject to erosion

The NRC SER [Ref. 4] points out substantial uncertainties associated with the erosion testing including the following:

- The integral debris transport tests lasted 3 to 5 hours. Therefore, the question remains whether the erosion rate tapers off with time. In addition, it is not certain that all of the end-of-test debris accumulation was the result of erosion products.
- The test results include the usual variances in test data, such as flow and depth control and debris collection.
- Although the test series was designed to approximate the flow and turbulence characteristics of the volunteer-plant sump pool, the tank characteristics may have been significantly different than those at the plant. The difference in the erosion rates between the 9 inch and 16 inch pool depths in the integrated tests clearly illustrates the effect of pool turbulence on fibrous debris erosion.
- The geometry of the volunteer-plant sump pool is larger and more complex than that of the test tank used in the integrated tests.
- The long-term tests did not study large-piece debris.

Since the test data showed in general that the erosion consisted primarily of small, loosely attached pieces of fiber breaking off from larger pieces, it is considered reasonable to assume that erosion would taper off after 24 hours. To be conservative, however, the 24 hour erosion was rounded up to 10%. This erosion fraction was applied for both small and unjacketed large fiberglass pieces in the containment pool.

As discussed in the coatings evaluation below, CPSES is planning to perform testing to determine the transport capability of coatings, and their potential for erosion in a transport pool flowstream. This will significantly reduce the transport predicted within this analysis. An additional item that will be used is the results of the EPRI testing that was performed for unqualified materials. Based on the expected very low transport and approach velocity's, consideration will be given to determining the fraction of unqualified coatings that could fail as chips that would settle out in the transport pool prior to reaching the sump strainer. This value would be conservatively derived based on data supporting the percentage of the coatings which would fail. Credit will be taken for those coatings that remained intact during the testing. The other consideration that would be taken is the point of introduction into the sump pool. If testing or evaluations predict that the coating chip would settle, the entrance

point to the pool would be factored in to account for a potential non-direct settling potential. Once the final information is available for both of these items, an update will be provided as previously committed.

7. Coatings Evaluation

As described in Ref. 2 and under Break Selection, above, the NRC previously reviewed CPSES for sump performance issues related to coatings. As a result, the containment coatings were declassified from safety related to non-safety related. Therefore, in the current licensing basis, CPSES does not have any qualified coatings. A reevaluation of all declassified coatings inside containment is being performed. Program changes are being prepared to restore a safety related coatings program and to restore qualification for containment coatings. There will be three classifications: Qualified, Acceptable, and Unqualified using EPRI TR-1003102 and ASTM D-5144. The exempt coatings log was revised to include coatings which require additional testing or analysis to classify as Qualified or Acceptable. Qualified and Acceptable coatings will be referred to as "qualified". Unqualified coatings will be included on the Coatings Exempt Log (CEL).

As described in Sections 3.4.3.3.3 and 3.4.3.3.4 of the GR, qualified and unqualified coatings within the coating ZOI were assumed to fail and all unqualified coatings outside the coating ZOI were assumed to fail. Based on recommendations in the SER, all coatings inside a 10D ZOI were assumed to fail as 10-micron spherical particles. All unqualified coatings outside the ZOI were assumed to fail as 10-micron spherical particles except for epoxy coatings which are known to fail in LOCA by delamination. It was conservatively assumed that the particles were the size of the minimum film thickness of each coat.

In accordance with the GR, unqualified coatings that are under intact insulation were not considered to fail.

EPRI is currently testing original manufacturer and other unqualified coating systems to determine debris characteristics outside the coating ZOI. This EPRI data may be used when the information becomes available. If CPSES chooses to use the EPRI data, this information will be included in the next update as previously committed.

The 10D ZOI for qualified coatings that was used for CPSES is believed to be an overly conservative assumption. A ZOI of 5D is anticipated based on testing that is currently proposed to be performed. The Utilities Service Alliance has contracted with Westinghouse to have qualified coatings tested under two phase flow conditions to determine the appropriate ZOI for assuming that 100% of the coatings will fail. CPSES is one of the licensees participating in this effort and has issued a contract to Westinghouse to perform this testing. It is anticipated that the results of this testing will support the 5D ZOI utilized for the generation of qualified coatings debris.

For coatings outside the 10D ZOI, the inventory for exposed unqualified and/or indeterminate coatings is obtained from the CPSES Protective Coatings Exempt Log (CEL). The CEL currently lists 266,526.7 ft^2 of surface area coated by unqualified and/or indeterminate coatings. A large quantity of the coatings under evaluation are expected to be

successfully removed from the CEL; however, the initial calculations considered the currently listed 266,526.7 ft^2 of coatings on the CEL.

The following presents a summary of the unqualified coatings in containment at CPSES that was used for the initial analyses:

Generic Coating Material	Debris Quantity (lbm)
Inorganic Zinc	25,634.4
Epoxy	32,300.4
Alkyd Enamel	992.0

These values for Unit 1 were used for the initial bounding evaluations and analyses.

Inorganic zinc is known to fail in 10 to 20 micron particles by powdering. However, not all of the coatings will fail, and data with respect to the percent of failure would significantly reduce the debris load. Epoxy is known to fail in chips by delamination. Again, not all the coatings will fail, and data with respect to the percent of failure and the range of chip sizes would significantly reduce the debris load transported to the sump. In addition, it is expected that LOCA testing of coatings with minor deviations from previous tests, such as film thickness, will show that they are qualified.

Exception(s) Taken to GR and SER for Coatings

As previously described in this section discussing epoxy coatings, an exception to the GR and SER was taken with regard to the unqualified coatings failure size. As allowed by the SER, testing is planned to not only validate this exception, but also to provide plant specific data for debris generation and transport.

8. Head Loss

The head loss evaluation performed for CPSES utilized the HLOSS program and was performed in accordance with the recommendations of the GR and SER, except as noted. The head loss evaluation considered a RCS cross-over line large break LOCA for each loop compartment and the Main Steam Line Break in two areas. All of the breaks analyzed were thin bed events. The inputs for the head loss evaluation came from the previously described debris generation and transport analyses.

The debris generation calculation [Ref. 12] determined the following debris source terms for LBLOCA and MSLB. These debris source terms were determined to bound Main Feedwater line break, Steam Generator Blowdown line break, and SBLOCA conditions.

LBLOCA Insulation Debris Source Term

Loop Compartment Break Location	Quantity of Insulation Debris Generated					
	RMI	Anti-Sweat LDFG	Lead Blanket Covers	Lead Wool	Min-K Fibrous	Min-K Particulate
Loop 1	48,874 ft^2	33.2 ft^3	8.4 ft^3	12.2 ft^3	0.16 ft^3	10.2 lbm
Loop 2	48,184 ft^2	21.0 ft^3	0 ft^3	0 ft^3	0.36 ft^3	23.0 lbm
Loop 3	48,178 ft^2	31.5 ft^3	0 ft^3	0 ft^3	0.50 ft^3	32.0 lbm
Loop 4	51,810 ft^2	23.3 ft^3	10.9 ft^3	15.2 ft^3	0.24 ft^3	15.4 lbm

LBLOCA Coatings Debris Source Term

Loop Compartment Break Location	Acceptable Coatings (lbm)				CEL Coatings (lbm)		
	High Build Epoxy	General Epoxy	Zinc	Silicone	Zinc	Epoxy	Enamel
Loop 1	10.4	4542.2	337.0	73.1	25,634.4	32,300.4	992.0
Loop 2	8.4		350.4				
Loop 3	13.4		356.6				
Loop 4	9.6		344.2				

MSLB Insulation Debris Source Term

Break Location	Quantity of Insulation Debris Generated					
	RMI	LDFG	Radiant Energy Shields		Min-K Fibrous	Min-K Particulate
			Kaowool	Siltemp		
Containment Cooling Unit Area	5,731 ft^2	108.0 ft^3	28 ft^3	26 ft^3	0.32 ft^3	20.5 lbm
MS Penetration Area	13,840 ft^2	17.9 ft^3			1.46 ft^3	93.4 lbm

MSLB Coatings Debris Source Term

Break Location	Acceptable Coatings (lbm)			CEL Coatings (lbm)		
	High Build Epoxy	General Epoxy	Zinc	Zinc	Epoxy	Enamel
Containment Cooling Unit Area	53.8	4542.2	170.4	25,634.4	32,300.4	992.0
MS Penetration Area	9.2		314.7			

Latent Debris Source Term

Break	Latent Fiber	Latent Particulate
ALL	30 lbm	170 lbm

The debris transport calculation [Ref. 13] determined the following debris transport fractions for the fibrous and particulate insulation, coatings, and latent debris for the LBLOCA and the MSLB.

LBLOCA Debris Transport Fractions

Debris Type	Debris Transport Fraction (DTF)
Stainless Steel RMI	49%
Anti-sweat Fiberglass	63%
Lead Blanket Covers	71%
Lead Wool	89%
Min-K™	96%
Acceptable Epoxy (inside ZOI)	96%
Acceptable IOZ (inside ZOI)	96%
Not Qualified Epoxy (outside ZOI)	40%
Not Qualified IOZ (outside ZOI)	100%
Not Qualified Alkyd Enamel (outside ZOI)	100%
Dirt/Dust	85%
Latent Fiber	79%

MSLB Debris Transport Fractions

Debris Type	Debris Transport Fraction (DTF)
Stainless Steel RMI	89%
Anti-sweat Fiberglass	91%
Kaowool™	85%
SilTemp™	85%
Min-K™	85%
Acceptable Epoxy (inside ZOI)	85%
Acceptable IOZ (inside ZOI)	85%
Not Qualified Epoxy (outside ZOI)	100%
Not Qualified IOZ (outside ZOI)	100%
Not Qualified Alkyd Enamel (outside ZOI)	100%
Dirt/Dust	100%
Latent Fiber	100%

For all the breaks, the limiting debris constituents were determined to be Min-K and coatings. The particulate-to-fiber mass ratios were well outside the range of testing used to develop NUREG/CR-6224. The analysis could not determine a valid recommended minimum screen size based on the NUREG/CR-6224 correlations for flat plate strainers with high approach velocities. For usable information regarding the behavior of such a high particulate to fiber ratio on a large complex sump strainer with lower approach velocities, vendor testing will be required. To determine the impact of CPSES specific debris on strainer head loss, testing will be performed as part of the resolution of this issue.

The minimum estimated head loss margin for LOCA is 5.6 ft. A sump strainer size of 4,000 square feet per sump is expected to be shown to be acceptable following debris reduction, analysis refinements, and sump strainer testing that will be performed.

Exception(s) Taken to GR and SER for Head Loss

There were no specific exceptions taken to the completion of the head loss analysis as described in the GR and SER. As previously described, there were exceptions taken to the inputs for this analysis. These input assumptions will be validated by testing. This testing is expected to be completed by the end of the second quarter of 2006. Updates to this information will be provided as previously committed in this response.

It is noted that neither chemical effects nor unqualified coatings will be considered in the head loss for secondary pipe breaks. These effects will be included for LOCA only.

9. Chemical Effects

In order to finalize the NPSH margin for the new sump strainer design, head loss testing and data for chemical effects will be required. This testing is being planned by vendors of sump strainers; however, a firm schedule has not been provided. In the interim, the overall approach that CPSES is utilizing for resolution of the issue will provide substantial margin to account for any unexpected impacts.

When the data from the Integrated Chemical Effects Test program has been compiled and head loss testing of precipitants completed, CPSES does not expect a significant impact to final sump strainer head loss margin as a result of chemical effects in the sump pool. Consideration to chemical effects is being made based on the results of the testing to date [Ref. 26 and 28]. Chemical effects of significance occur in the long term when there are naturally occurring phenomena which offset the effects of additional debris. The cooling of the recirculating coolant and the increasing water levels due to condensation of steam will provide significant increasing NPSH margin. Required flow rates from the sump will be decreasing due to reductions in decay heat, and containment spray would be secured at some point. Additional changes that will increase margin for chemical effects include:

- Industry and NRC Sponsored Integrated Chemical Effects Testing (ICET) [Ref. 26 and 28]
    - ICET Test Number 1 would apply to the current CPSES design. A visual, qualitative evaluation performed of the test loop, material samples, and debris accumulation determined that those plants that use NaOH as a pH buffering agent (including CPSES) could experience significant chemical constituent formation that could lead to significant impact to sump strainer headloss. CPSES utilizes NaOH during the injection phase of the accident, and has RMI and fiberglass as insulation. ICET Test Number 2 utilized tri-sodium phosphate (TSP) with fiberglass. Based on the general observations of ICET Test Number 2, the potential for significant sump head loss impacting chemical constituents appears to be significantly less of a concern for plants using TSP. CPSES is performing site specific comparisons to the chemical effects testing to demonstrate that the results of Test Number 2 will be bounding for CPSES chemical effects.

- Replace NaOH pH control of post accident sump recirculation fluid with tri-sodium phosphate (TSP) baskets.
    - As previously described, CPSES currently plans to submit a license amendment to change from NaOH to TSP thus minimizing the potential impacts of chemical effects.

- Available Sump Pool Level
    - o Modifications to RWST switchover are planned to increase the minimum sump pool level as described in the response to 2(a).
- Debris reduction
    - o Reduction of debris sources are planned as described in the response to 2(a).

<u>Exception(s) Taken to GR and SER for Chemical Effects</u>

CPSES has not identified any exceptions to the GR and SER recommendations for dealing with chemical effects. However, it is noted that chemical effects will be addressed only for LOCA as described in item 8, Head Loss, above.

10. <u>Upstream Effects</u>

CPSES has performed an upstream effects evaluation to determine flow paths, hold up volumes, and restricted flow areas. [Ref. 10]

<u>Exception(s) Taken to GR and SER for Upstream Effects</u>

CPSES has not identified any exceptions to the GR and SER recommendations for dealing with upstream effects.

11. <u>Downstream Effects</u>

Downstream effects evaluations are substantially complete for CPSES.

The basic methodology used for performing these evaluations is in accordance with the recommendations and guidance contained within the GR, SER, and WCAP-16406-P, Evaluation of Downstream Sump Debris Effects in Support of GSI-191, dated June 2005 [Ref. 9].

- Equipment Blockage

    The downstream blockage evaluation included piping, valves, instrumentation lines, orifices, heat exchangers, spray nozzles and the chemical eductors which are part of the required recirculation flow path for ECCS and Containment Spray. This evaluation was based on the following assumptions:

    - o The width of deformable particles that may flow past the screens is limited to the size of the flow passage plus 10%.
    - o The thickness of deformable particles that may flow past the screens is limited to one half the size of the flow passage hole.

- o The maximum length of deformable particles that may flow past the screens is equal to two times the diameter of the flow passage hole in the sump screen.
- o The thickness and/or width and maximum length of non-deformable particles that may flow past the screens is limited to the size of the flow passage hole.
- o The maximum debris size used for evaluation was 0.115 inches for non-deformable particulate and 0.23 inches (twice the existing screen size) for deformable particulate.

The dimensions of the RHR pump seal cooler tube ID is an open item requiring confirmation. Except for this open item, the evaluation is complete and no blockage issues with the equipment in the required flow paths were identified.

- Wear

The effects of debris ingested through the containment sump screen during the recirculation mode of the ECCS and CSS include erosive wear and abrasion of flow paths. The Comanche Peak heat exchangers, orifices, and spray nozzles were evaluated for the effects of erosive wear for a constant debris concentration of 23,332 ppm over the mission time of 30 days. The erosive wear on these components is determined to be sufficient to affect the system performance. For pumps, the effect of debris ingestion through the sump screen on three aspects of operability, including hydraulic performance, mechanical shaft seal assembly performance, and mechanical performance (vibration) of the pump, were evaluated. The hydraulic and mechanical performances of the pump were determined to be affected by the recirculating sump debris. A reduction in the unqualified coatings which could contribute to downstream wear is pursued as described in item 7, above.

Valves in the ECCS and Containment Spray recirculation flow path were evaluated for wear. All the valves were found to meet acceptance for wear except for the ECCS throttle valves. The current concentration of unqualified coatings is very high. In order to bring the wear on each of the valves below 3%, the total concentration of the unqualified coatings must be less than 410 ppm. This is expected to be satisfactory when the debris generation and transport refinements are complete.

- Reactor Vessel Blockage

It was found that dimensions of the essential flow paths through the reactor internals are adequate to preclude plugging by sump debris. There is sufficient clearance for debris that may pass the containment sump screen, as the limiting dimensions of the essential flow paths in the upper and lower internals are all greater than the maximum particle dimension of 0.230 inches. The maximum particle dimension is twice the sump screen hole diameter. The sump screen hole diameter being evaluated is 0.115 inches, which is the current sump screen size. The smallest clearance found is 2.10 inches, which means that any sump screen size smaller than 1.05 inches will prevent plugging by sump debris in CPSES Units 1 and 2.

- Fuel Blockage Evaluation

  In the evaluation of the cold-leg break, the high rate of bypass flow around the core precludes the formation of a fiber bed on the bottom of the core since most of the fibrous debris passing through the containment sump screen bypasses the core and is returned to the containment sump for further filtering. At the time of hot-leg injection (approximately 3 hours after accident initiation), a fiber layer is calculated to build up to 0.0145 inches, which is well below the 0.125 inch acceptance criterion.

  For the evaluation of the hot-leg break, the results of the calculated thickness of the fibrous bed forming on the bottom of the core for baseline and sensitivity cases all passed the acceptance criterion of less than 0.125 inches, except for the baseline case with sump screen capture efficiency of 95% - fuel bottom nozzle capture efficiency of 95%. This is expected to pass the acceptance criterion of less than 0.125 inches when the debris generation and transport refinements are complete. In addition, the approach velocity of the new sump strainers will be less than 0.01 fps whereas the 95% capture efficiency was based on 1.0 fps. Sensitivity cases show that an approach velocity less than 0.2 fps and a screen capture efficiency of 97% would ensure that a thin bed could not form on the fuel.

  For hot-leg recirculation following either a cold-leg or hot-leg break, the fiber concentration is depleted enough that a negligible amount of fiber deposits on the top nozzle.

<u>Exception(s) Taken to GR and SER for Downstream Effects</u>

No deviations from the GR and SER have been identified. The following notable differences from the published guidance were included in the Comanche Peak evaluation:

NEI 04-07 [Ref. 4]

Volume 2 of NEI 04-07 (the NRC SER on the Guidance Report) contains a requirement for licensees to assume that all unqualified coatings fail and become 10 μm particulate. Although this requirement is conservative when evaluating head loss across a sump screen for which a "thin bed" effect is possible, it is not conservative when evaluating wear on components and valves.

The Westinghouse wear evaluation of ECCS valves and components assumes an unqualified coating particulate size distribution that varies from 110% of the sump screen opening to 10 μm. This assumption is reasonable and conservative when evaluating the impact of unqualified coatings particulate on component and valve wear. There is significant publicly available documentation that shows that coatings outside the conditions defined in the Zone of Influence (ZOI) will tend to fail at sizes larger than their constituent pigment size.

WCAP-16406-P [Ref. 9]

The CPSES evaluation included two areas where there were notable differences from the guidance in WCAP-16406-P. The areas are as follows:

- The concern for instrumentation tubing is the potential for debris collection in the instrument sensing lines. The instruments of concern are those which are connected to the recirculating flow path through the ECCS or CSS and which must function post-accident to support application of the Emergency Operating Procedures (EOPs).

  For debris to enter the sensing lines, the flow in the process line must have insufficient velocity to maintain the debris in suspension.

  The flow rates in the ECCS lines during the plant's recirculation mode are compared to the debris terminal settling velocity to evaluate the potential for debris settling. As long as the transverse velocity of the ECCS flow is seven times that of the debris terminal settling velocity, the debris will be maintained in solution and will not settle into the instrumentation tubing. WCAP-16406-P, Table 8.6-1 provides terminal settling velocities for various debris materials. The most limiting (highest) settling velocity in this table is 0.37 ft/sec for stainless steel. However, Section 8.2 of WCAP-16406-P, which describes valve evaluations, states that the flow rate must be greater than 0.42 ft/sec to avoid debris settling. Given that this velocity is higher than any of those provided in WCAP-16406-P, Table 8.6-1, it is conservative to apply this as the acceptance criterion to instrument lines. Therefore, this more conservative acceptance criterion has been applied to the instrumentation line evaluation.

- Important assumptions in the fuel evaluation are the amount of debris that is captured by the sump screen, and the amount of debris that is captured at the underside of the fuel bottom nozzle (core inlet). This amount is called the capture efficiency. The only data that exists to quantify these capture efficiencies is the Los Alamos Report LA-UR-04-5416, "Screen Penetration Test Report," dated November 2004. [Ref. 27] This report was used as the basis for the base case assumptions. However, data in the report can be used to justify other capture efficiencies. In order to understand the effects of different capture efficiencies, three sensitivity cases were run in addition to the "base case. These sensitivity cases varied the capture efficiencies as shown in the table below:

Case	Screen Capture Efficiency (%)	Core Inlet Capture Efficiency (%)
Base Case	95	95
Sensitivity Case 1	97	95
Sensitivity Case 2	95	50
Sensitivity Case 3	97	50

The Base Case and Case 2 screen capture efficiency of 95% was based on a 1.0 fps approach velocity. The Case 1 and Case 3 screen efficiency of 97% was based on a 0.2 fps approach velocity. The approach velocity for the new strainers will be less than 0.01 fps.

<u>NRC Requested Information 2(d):</u>

The submittal should include, at a minimum, the following information:

(i) The minimum available NPSH margin for the ECCS and CSS pumps with an unblocked sump screen.

(ii) The submerged area of the sump screen at this time and the percent of submergence of the sump screen (i.e., partial or full) at the time of the switchover to sump recirculation.

(iii) The maximum head loss postulated from debris accumulation on the submerged sump screen, and a description of the primary constituents of the debris bed that result in this head loss. In addition to debris generated by jet forces from the pipe rupture, debris created by the resulting containment environment (thermal and chemical) and CSS washdown should be considered in the analyses. Examples of this type of debris are disbonded coatings in the form of chips and particulates and chemical precipitants caused by chemical reactions in the pool.

(iv) The basis for concluding that the water inventory required to ensure adequate ECCS or CSS recirculation would not be held up or diverted by debris blockage at choke-points in containment recirculation sump return flowpaths.

(v) The basis for concluding that inadequate core or containment cooling would not result due to debris blockage at flow restrictions in the ECCS and CSS flowpaths downstream of the sump screen, (e.g., a HPSI throttle valve, pump bearings and seals, fuel assembly inlet debris screen, or containment spray nozzles). The discussion should consider the adequacy of the sump screen's mesh spacing and state the basis for concluding that adverse gaps or breaches are not present on the screen surface.

(vi) Verification that close-tolerance subcomponents in pumps, valves and other ECCS and CSS components are not susceptible to plugging or excessive wear due to extended post-accident operation with debris-laden fluids.

(vii) Verification that the strength of the trash racks is adequate to protect the debris screens from missiles and other large debris. The submittal should also provide verification that the trash racks and sump screens are capable of withstanding the loads imposed by expanding jets, missiles, the accumulation of debris, and pressure differentials caused by post-LOCA blockage under predicted flow conditions.

(viii) If an active approach (e.g., backflushing, powered screens) is selected in lieu of or in addition to a passive approach to mitigate the effects of the debris blockage, describe the approach and associated analyses.

CPSES Response 2(d):

The submittal should include, at a minimum, the following information:

(i) The minimum available NPSH margin for the ECCS and CSS pumps with an unblocked sump screen.

2(d)(i) Response

The minimum available NPSH margin for the ECCS and CSS pumps based on the new RWST switchover setpoints and the containment flood level recalculation has not been completed. Formal calculations will be completed as part of the design change process. However, a preliminary estimate has been made.

The estimated clean screen NPSH available ($NPSH_A$) and NPSH required ($NPSH_R$) for Large Break LOCA based on current water levels are provided below:

	RHR Pumps	CSS Pumps
NPSH Available (ft)	27.1	22.7
NPSH Required (ft)	20.0	17.1
NPSH Margin (ft)	7.1	5.6

The RHR pump margin above is for the initiation of switchover. It would increase to 8.91 feet by the completion of switchover. Revisions to RWST setpoints and flooding calculations will significantly increase the clean screen margins (e.g. by as much as a foot at the completion of switchover).

(ii) The submerged area of the sump screen at this time and the percent of submergence of the sump screen (i.e., partial or full) at the time of the switchover to sump recirculation.

2(d)(ii) Response

The final design will ensure that the sump strainer will be fully submerged at the time of completion of RWST injection and switchover. The maximum sump flow rate (12,420 gpm for one train) and maximum transport flow rate (24,040 gpm for two trains) will not occur prior to 100% coverage. The minimum level, at the time of the initiation of switchover to ECCS recirculation, will only partially submerge the strainers. However, the flow rates will be limited to ECCS injection which is dependent on the break size.

As previously stated, the expected minimum sump strainer screen area will be 4000 ft^2 and will be approximately 42 inches tall. The preliminary minimum flood levels and corresponding flow rates for the initiation of ECCS switchover to recirculation are:

- LBLOCA – maximum 4500 gpm per train at minimum depth of 1.87 feet
- SBLOCA – maximum 1600 gpm per train at minimum depth of 1.93 feet

For each of the LOCA design basis events, more than 50% of the sump strainer area will be submerged at the initiation of switchover. The containment spray pumps will be injecting approximately six to seven thousand gpm per train which will increase water levels, continuously adding free strainer area until the strainer is fully submerged with margin.

For secondary pipe breaks, the sump strainer will be fully submerged prior to the initiation of switchover to recirculation.

(iii) The maximum head loss postulated from debris accumulation on the submerged sump screen, and a description of the primary constituents of the debris bed that result in this head loss. In addition to debris generated by jet forces from the pipe rupture, debris created by the resulting containment environment (thermal and chemical) and CSS washdown should be considered in the analyses. Examples of this type of debris are disbonded coatings in the form of chips and particulates and chemical precipitants caused by chemical reactions in the pool.

2(d)(iii) Response

As previously provided in response to Item 2(c), discussion number 8, Head Loss, the maximum predicted head loss cannot be determined at this time using NUREG-6224 methodology. Also, as previously discussed, the principal constituents that contribute to this head loss are coatings and Min-K insulation.

Additional testing of unqualified coating systems will be performed to qualify or define acceptability for sump performance. In addition, plant specific data will be obtained and reviewed for means of debris reduction.

Min-K which is no longer required (where pipe whip restraints are inactive) will be replaced with alternate insulation. Min-K which is still required, for active pipe whip restraints and for which there is no equivalent replacement, is being evaluated for means of debris reduction.

Refer also to the response provided for Item 2(c), discussion number 8, Chemical Effects, for discussion of the areas of margin that will ensure adequate margin will exist in the design and function of the replacement strainer to ensure adequate NPSH is available for the ECCS and CSS pumps.

(iv) The basis for concluding that the water inventory required to ensure adequate ECCS or CSS recirculation would not be held up or diverted by debris blockage at choke-points in containment recirculation sump return flowpaths.

2(d)(iv) Response

As previously described in response to Items 2(a) and 2(c), an extensive upstream effects evaluation of the containment recirculation sump return flowpaths was performed to support the sump performance analysis.

Modifications to ensure that the water inventory required for adequate ECCS or CSS recirculation would not be held up or diverted by debris blockage at choke-points in containment recirculation sump return flowpaths are described in the response to 2(a) above.

(v) The basis for concluding that inadequate core or containment cooling would not result due to debris blockage at flow restrictions in the ECCS and CSS flowpaths downstream of the sump screen, (e.g., a HPSI throttle valve, pump bearings and seals, fuel assembly inlet debris screen, or containment spray nozzles). The discussion should consider the adequacy of the sump screen's mesh spacing and state the basis for concluding that adverse gaps or breaches are not present on the screen surface.

2(d)(v) Response

As previously described in response to Items 2(a) and 2(c), a downstream effects evaluation has been performed for CPSES. The evaluations determined that there are no areas where blockage would develop which could result in an inadequate core cooling or containment cooling conditions. These evaluations were based on a maximum sump screen opening of 0.115 inches. The new sump strainer unit, by design, will ensure that there are no openings or gaps in its design or construction that would be in excess of this maximum screen opening. CPSES will ensure that the installation of the replacement strainers will not result in openings in excess of the strainer screen opening as part of the design and installation. Additionally, as part of the programmatic and process changes that will occur as a result of the resolution of this issue, the necessary surveillance inspections will be established to ensure continuing compliance with this requirement.

(vi) Verification that close-tolerance subcomponents in pumps, valves and other ECCS and CSS components are not susceptible to plugging or excessive wear due to extended post-accident operation with debris-laden fluids.

2(d)(vi) Response

As previously provided in response to Items 2(a) and 2(c), the downstream effects evaluation that has been performed has determined that with the exception of the identified components that may be subjected to excessive wear, the ECCS and CSS components will not become blocked for the stated mission time of 30 days with debris-laden fluids, and will not exhibit excessive wear from this debris-laden fluid.

(vii) Verification that the strength of the trash racks is adequate to protect the debris screens from missiles and other large debris. The submittal should also provide verification that the trash racks and sump screens are capable of withstanding the loads imposed by expanding jets, missiles, the accumulation of debris, and pressure differentials caused by post-LOCA blockage under predicted flow conditions.

2(d)(vii) Response

CPSES is designed such that the emergency sumps are protected from dynamic effects, including any missiles, either from LOCAs or from secondary line breaks.

The calculated transport velocity in the sump pool is sufficiently low such that any debris of neutral buoyancy would not be expected to impact the strainer with enough force to cause any type of damage. The current design includes a trash rack for protection of the wire mesh. The new sump strainers will be contained within the existing sump structure which will retain the trash rack design feature to ensure large debris cannot cause blockage or damage.

To further define the protection afforded to the sump strainer, the CPSES licensing basis requires that any equipment that is installed in containment, whether it is safety related or non-safety related, must demonstrate that its installation would not result in a safety related structure, system, or component (SSC) being impacted by a failure of that component. One of the methods used to maintain this compliance is that the installed items demonstrate compliance with Seismic Category I or II structural requirements.

Confirmation that the new strainers are qualified for the pressure differentials caused by post-LOCA blockage under predicted flow conditions will be performed in conjunction with the new strainer design.

(viii) If an active approach (e.g., backflushing, powered screens) is selected in lieu of or in addition to a passive approach to mitigate the effects of the debris blockage, describe the approach and associated analyses.

2(d)(viii) Response

CPSES is not pursuing any form of active strainer design.

NRC Requested Information 2(e):

[Provide] A general description of and planned schedule for any changes to the plant licensing bases resulting from any analysis or plant modifications made to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. Any licensing actions or exemption requests needed to support changes to the plant licensing basis should be included.

CPSES Response 2(e):

CPSES proposes to submit the following license amendments associated with resolution of this issue:

- A Technical Specification (TS) license amendment to change Surveillance Requirement SR 3.5.2.8.The surveillance requirement currently states:
    - Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet trash racks and screens show no evidence of structural distress or abnormal corrosion.

The existing inlet trash racks and screens are to be replaced with sump strainers and debris interceptors; therefore, revised TS wording is required.

- A Technical Specification (TS) license amendment to change TS Table 3.3.2-1, Function 7, Refueling Water Storage Tank – Low Low Allowable Value to correspond to a setpoint change from 45% to 38%.

  Changes to the setpoint will result in significantly higher water levels in the sump recirculation pool on initiation and completion of switchover from RWST injection to emergency sump recirculation. This change is interrelated to the new sump design. See the response to 2(a) above.

- A Technical Specification (TS) license amendment to delete TS 3.6.7, Spray Additive System, and to add TS 3.5.6, Recirculation Fluid pH Control System.

  The results of the Integrated Chemical Effects Tests show that substantial sump performance benefits can be achieved by use of tri-sodium phosphate (TSP) in lieu of sodium hydroxide (NaOH). Therefore, the system for sump recirculation pH control will utilize TSP baskets in lieu of the spray additive system. See the response to 2(c) above.

These proposed license amendments are currently expected to be submitted no later than December 31, 2005. A detailed submission schedule will be developed and provided to the NRC Project Manager for CPSES. If there are any potential delays in meeting this submission date, this will be promptly discussed with the NRC Project Manager for CPSES.

<u>NRC Requested Information 2(f):</u>

[Provide] A description of the existing or planned programmatic controls that will ensure that potential sources of debris introduced into containment (e.g., insulations, signs, coatings, and foreign materials) will be assessed for potential adverse effects on the ECCS and CSS recirculation functions. Addressees may reference their responses to GL 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," to the extent that their responses address these specific foreign material control issues.

<u>CPSES Response 2(f):</u>

The programmatic, process, and procedural changes currently proposed to be reviewed and revised as necessary in support of the resolution of this issue include:

- Revision to design control procedures to explicitly address the impact of design changes on emergency sump performance has been completed.

- Changes to Engineering Specifications and Procedures to ensure that the necessary controls exist to prevent introduction of materials to containment unless the required evaluations have been completed.

- Changes to Containment Inspection and Surveillance Procedures and processes to ensure:

  - Operations procedures for Containment Access and Containment Closeout contain the necessary controls to ensure that Containment will remain in a configuration that fully supports the inputs and assumptions associated with the analyses and design developed in support of this resolution.

  - Engineering procedures for Containment inspections contain the necessary attributes to ensure the inputs and assumptions associated with the analyses and design developed in support of this resolution. This includes topical areas such as coatings, insulation, and latent debris.

  - Coatings inspection and evaluation procedures will be changed to enhance the current process by:

    - Providing direction within the current inspection procedure that each specific location of degraded or questionable condition in either qualified or non-qualified coatings be promptly entered into the Corrective Action Program.
    - Engineering will perform evaluations of each of coatings discrepancies to establish the extent of condition of the identified failure and the probable cause for the failure.
    - Engineering will determine what additional evaluations may be necessary to fully bound the extent of condition. This extent of condition evaluation may be as simple as performing expanded visual coating inspections, or it may include performance of pull tests or cross-hatch tests. For all coatings visual inspections, whether the initial inspections or the extent of condition visual inspections, personnel that are qualified to the applicable ANSI requirements for performance of coatings visual inspections will be utilized to perform the inspections.
    - Ensuring degraded or questionable coatings are evaluated and, if necessary, remediated prior to ascension to Mode 4 during refueling or maintenance outages. This remediation may include recoating the affected area(s) with a qualified coating system, or removal of the degraded or questionable condition coatings to a sound and tightly adhered area.

- Capturing the information that was used as design input for analyses, modifications, or other aspects of this effort to ensure that the necessary configuration can and will be maintained. Examples of the types of information that will be captured and the proposed methods of maintaining this information are:

  - Insulation will be maintained under design control to ensure that future maintenance activities do not change the input assumptions without an appropriate Engineering evaluation having been performed.

- The debris generation, debris transport, and headloss analyses inputs and assumptions will be captured into an approved Engineering document or database to enable retrieval to support evaluation of conditions that may be contrary to these inputs and assumptions, and to ensure that future changes to the plant can be evaluated against these design and licensing basis criteria.

- The upstream and downstream effect inputs and assumptions will be captured into an approved Engineering document or database to enable retrieval to support evaluation of conditions that may be contrary to these inputs and assumptions, and to ensure that future changes to the plant can be evaluated against these design and licensing basis criteria.

The programmatic, process, and procedural changes described above will be implemented on the schedule as previously described in response to item 2(b).

<u>References for this Attachment</u>

1. NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004.

2. Letter from M. R. Blevins, TXU Generation Company, LP, to U. S. Nuclear Regulatory Commission (NRC) Document Control Desk, "90 Day Response to Nuclear Regulatory Commission Generic Letter 2004-02: Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," TXX-05047, dated March 7, 2005.

3. Letter from S. C. Black, NRC, to A. R. Pietrangelo, Nuclear Energy Institute, "Pressurized Water Reactor Containment Sump Evaluation Methodology," dated December 6, 2004, (ML043280631).

4. Nuclear Energy Institute report NEI 04-07, "Pressurized Water Reactor Sump Performance Methodology," dated December 2004.

5. Nuclear Energy Institute report NEI 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments," dated September 2002.

6. Comanche Peak Steam Electric Station Final Safety Analysis Report (FSAR), Amendment 100, August 1, 2005.

7. Comanche Peak Steam Electric Station Technical Specifications, Amendments 119, August 4, 2005.

8. CPSES SmartForm (Corrective Action Program) Documents:

   A. SMF-2001-002201-00: Track activities associated with NRC Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on PWR Sump Performance"

B. SMF-2002-001952-00: Doors to the Steam Generator Compartments could adversely effect the containment and ECCS design functions if closed in MODES 1-4

C. SMF-2002-003029-00: Removal of 808 Transfer Tube Area Cages

D. SMF-2003-002008-01: Response to "NRC Bulletin 2003-01: Potential impact of debris blockage on emergency sump recirculation at pressurized-water reactors"

E. SMF-2004-002882-00: Errors in screen size in the FSAR, the 1984 paint study and other calculations.

F. SMF-2004-003972-00: Labeling Program deficiencies - Specification inappropriately voided. Vendor documentation is incomplete. Procedure contains adverse allowances for label materials.

G. SMF-2005-003364-00: Process SmartForm for GSI-191 Sump Related Modifications.

9. WCAP-16406-P, Evaluation of downstream Sump Debris Effects in Support of GSI-191, dated June 2005.

10. WES002-PR-02, Evaluation of Containment Recirculation Sump Upstream Effects for the Comanche Peak Steam Electric Station, Rev. 0 dated 8/17/05.

11. ALION-REP-CPSES-2803-002, Comanche Peak: Characterization of Events That May Lead to ECCS Sump Recirculation, Rev. 0 dated August 24, 2005.

12. ALION-CAL-TXU-2803-03, Comanche Peak Recirculation Sump Debris Generation Calculation, Rev. 0 dated August 24,2005.

13. ALION-CAL-TXU-2803-04, Comanche Peak Reactor Building GSI-191 Debris Transport Calculation, Rev. 0 dated August 25, 2005.

14. ALION-CAL-TXU-2803-05, Comanche Peak GL 2004-02 Recirculation Sump Head Loss Analysis, Rev. 0 dated August 30, 2005.

15. WES002-PR-01, Evaluation of Containment Recirculation Sump Downstream Effects for the Comanche Peak Steam Electric Station, Rev. 0 dated 8/17/05.

16. CN-SEE-05-100, Comanche Peak Sump Debris Downstream Effects Evaluation for ECCS Equipment, Rev. 0 [Westinghouse Proprietary Class 2]

17. CN-SEE-05-87, Comanche Peak Sump Debris Downstream Erosion Effects Evaluation for ECCS Valves, Rev. 0 [Westinghouse Proprietary Class 2]

18. CN-CSA-05-19, Comanche Peak Steam Electric Station Units 1 and 2 GSI-191 Downstream Effects – Vessel Blockage Evaluation, Rev. 0. [Westinghouse Proprietary Class 2]

19. CN-CSA-05-70, Comanche Peak Units 1 and 2 GSI-191 Downstream Effects – Reactor Fuel Blockage Evaluation, Rev.0 [Westinghouse Proprietary Class 2]

20. CN-CSA-05-65, Comanche Peak Units 1 and 2 GSI-191 Downstream Effects Debris Ingestion Evaluation, Rev. 0. [Westinghouse Proprietary Class 2]

21. ER-ME-123, GSI-191 Scoping Study, Rev. 0 dated December 20, 2004.

22. NUREG-0797, Safety Evaluation Report Related to the Operation of Comanche Peak Steam Electric Station, Units 1 and 2.

23. Gibbs & Hill Report, "Evaluation of Paint and Insulation Debris Effects on Containment Emergency Sump Performance," June 1984.

24. Acceptance Criteria of NRC Standard Review Plan, Section 3.6.1, Plant Design For Protection Against Postulated Piping Failures in Fluid Systems Outside Containment and Section 3.6.2, Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping. Also Branch Technical Position MEB 3-1, Postulated Breaks and Leakage Locations in Fluid System Piping Outside Containment.

25. General Electric BWR Owners' Group Report NEDO-32686, Rev. 0, "Utility Resolution Guidance for ECCS Suction Strainer Blockage".

26. LA-UR-05-0124, Integrated Chemical Effects Test Project: Test #1 Data Report, June 2005.

27. LA-UR-04-5416, "Screen Penetration Test Report," dated November 2004.

28. Memorandum dated August 8, 2005, from Michele G. Evans (NRC Engineering Research Applications Branch) to John N. Hannon, Chief Plant Systems Branch (NRC), "Transmittal of Information Summarizing Integrated Chemical Effects Results and Implications To-date."

29. Flow-3D® User's Manual Volumes 1 & 2, Version 8.2, Flow Science, Santa Fe NM, 2003.

30. D.V. Rao, et al., "Drywell Debris Transport Study: Experimental Work", NUREG/CR-6369, Volume 2, September 1999.