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CP-201200013
Log # TXX-12002

Ref. # 10 CFR 50.55a(g)(6)(ii)

January 5, 2012

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

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT
DOCKET NO. 50-446
RELIEF REQUEST NO. A-2 FOR THE UNIT 2 SECOND 10 YEAR ISI INTERVAL FROM 10 CFR 50.55a INSPECTION REQUIREMENTS DUE TO GEOMETRIC LIMITATIONS
(SECOND INTERVAL START DATE: AUGUST 03, 2004)

Dear Sir or Madam:

Pursuant to 10 CFR 50.55a(g)(6)(ii), Luminant Generation Company, LLC (Luminant Power) is submitting Relief Request A-2 (see enclosure) for Comanche Peak Unit 2 for the second ten year inservice inspection interval. Luminant Power has determined that certain inspection requirements of ASME Code Case N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds, Section XI, Division 1," are impractical due to geometric limitations. This letter supersedes TXX-11106 dated December 14, 2011.

Seventy-six of seventy-eight penetration nozzles were surface and volumetrically examined in the 2RF12 outage with no indications identified. However, penetrations 74 through 78 could not meet the minimum required examination coverage for ultrasonic examinations per Code Case N-729-1 (of 1–in. for nozzles having incidence angles greater than 30 degrees) because of geometric limitations. The examination coverage met the criteria for acceptability, as prescribed in Appendix I of N-729-1.

In addition, two penetrations (63 and 65) have bell mouth sleeve configurations that prevented inspection in the 2RF12 outage. These two penetrations were previously examined during the 2RF09 outage. These two penetrations will be examined in the 2RF13 outage (Fall 2012). As required by ASME Code Case N-729-1, these two penetrations will still be examined in the prescribed 2.25 RIY period. Upon completion of the examinations of penetrations 63 and 65 in 2RF13, all of the penetration nozzles will meet the 2.25 RIY requirement.

No undue risk to the public health and safety is presented by this request.

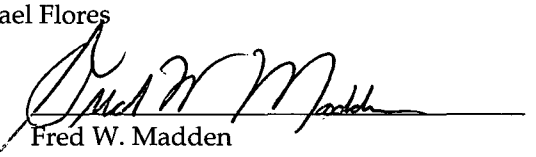
A047
NRR

This communication contains no new licensing basis commitments regarding Comanche Peak Unit 2. Should you have any questions, please contact Mr. Jack Hicks at (254)897-6725.

Sincerely,

Luminant Generation Company LLC

Rafael Flores

By: 
Fred W. Madden
Director, Oversight & Regulatory Affairs

Enclosure - Westinghouse Letter LTR-RIDA-11-244, Rev. 1, dated October 28, 2011, Transmittal of the Request for Relief from Requirements for Limited Examination of Reactor Vessel Head Penetration Welds for Comanche Peak Unit 2

c - E. E. Collins, Region IV
B. K. Singal, NRR
Resident Inspectors, Comanche Peak
Jack Ballard, ANII, Comanche Peak
Luis Ponce, TDLR

ENCLOSURE TO TXX-12002

# TRANSMITTAL OF THE REQUEST FOR RELIEF FROM REQUIREMENTS FOR LIMITED EXAMINATION OF REACTOR VESSEL HEAD PENETRATION WELDS FOR COMANCHE PEAK UNIT 2

Westinghouse

To: Ned Bahtishi

Date: October 28, 2011

From: Daniel B. Denis
Ext: 860-731-6147
Fax: 860-731-4595

Our ref: LTR-RIDA-11-244, Rev. 1

Subject: **Transmittal of the Request for Relief from Requirement for Limited Examination of Reactor Vessel Head Penetration Welds for Comanche Peak Unit 2**

Attachment 1: Request for Relief from Requirement for Limited Examination of Reactor Vessel Head Penetration Welds for Comanche Peak Unit 2

The following transmits the Westinghouse response to the Comanche Peak Unit 2 request for relief on N-729-1 reactor vessel head penetration inspections. The referenced portions of WCAP-16397-P, Rev. 0 are non-proprietary. The entire content of this letter and Attachment 1 may be released to the U.S. Nuclear Regulatory Commission in support of seeking relief for N-729-1 for Comanche Peak Unit 2.

The attachment has been revised to reflect the Comanche Peak Unit 2 plan for future head penetration inspections of the nozzles with the bell mouth sleeve configuration. The plant will modify the tooling used for the inspections or modify the bell mouth sleeve hardware so that future inspections can be performed appropriately.

If you have additional questions or require further information, please contact the undersigned.

Authored by: ELECTRONICALLY APPROVED*
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Reactor Internals Design & Analysis II

Verified by: ELECTRONICALLY APPROVED*
John P. Lareau
Chief Engineer, WESDYNE

Approved by: ELECTRONICALLY APPROVED*
Susan C. Jaquith, Manager
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***Electronically approved records are authenticated in the electronic document management system.***

**Attachment 1:**

# Request for Relief from Requirement for Limited Examination of Reactor Vessel Head Penetration Welds for Comanche Peak Unit 2

## 1. ASME Code Component(s) Affected

| | |
|---|---|
| Code Class: | 1 |
| Reference: | ASME Code Case N-729-1 / 10CFR50.55a(g)(6)(ii)(D) |
| Item Number: | B4.20 (UNS N06600 nozzles and UNS N06082 or UNS W86182 partial-penetration welds in head) |
| Drawing: | E-WEST-849-512, Rev. 00 |

## 2. Applicable Code Edition and Addenda

The current Code of record for Comanche Peak Units 1 and 2 is ASME Boiler and Pressure Vessel Code Section XI, 2004 Edition, as augmented by ASME Code Case N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1" (Federal Register 73 FR 52730 September 10, 2008). 10CFR50.55a(g)(6)(ii)(D)(6) requires prior NRC approval to implement Appendix I of N-729-1.

## 3. Applicable Code Requirement

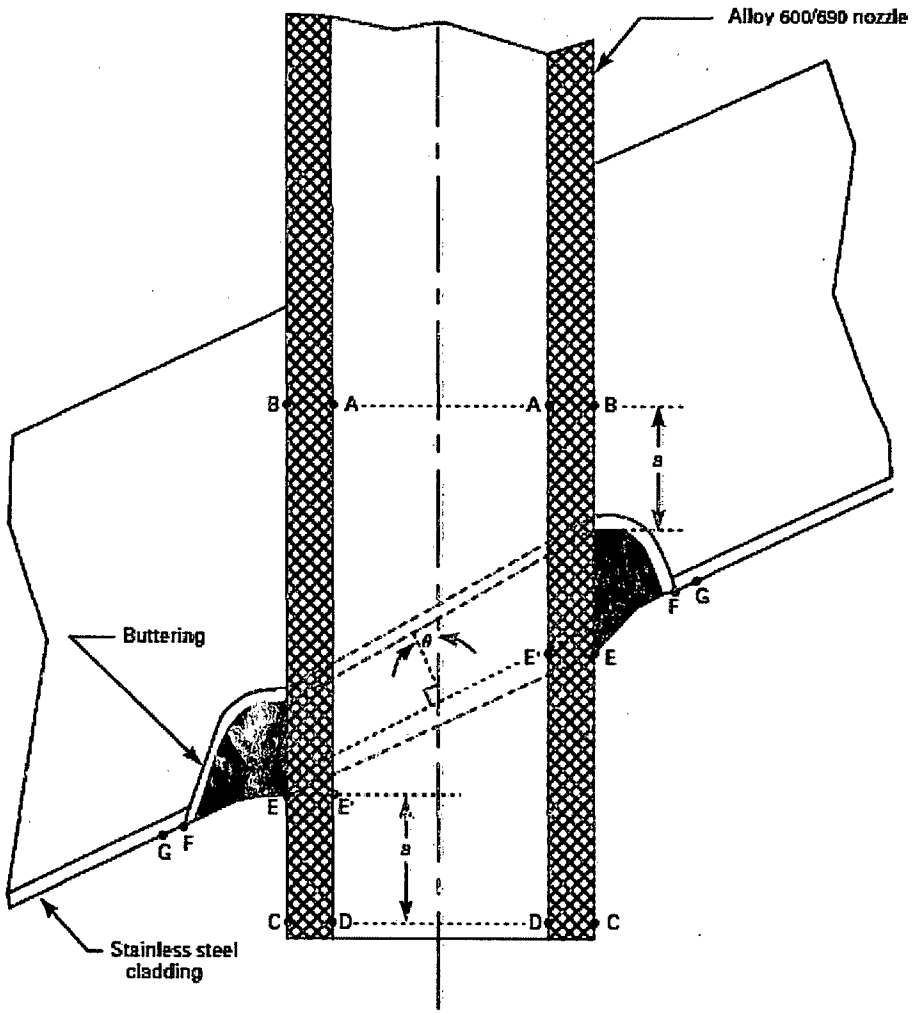
10CFR50.55a(g)(6)(ii)(D)(1) requires that examinations of the reactor vessel head be performed in accordance with ASME Boiler and Pressure Vessel Code Case N-729-1 with the conditions specified in 10CFR50.55a(g)(6)(ii)(D)(6)(2) through (6).

For examinations in general (and specifically with reference to limited examinations), N-729-1-2500 states:

> Components shall be examined as specified in Table 1. Volumetric and surface examinations shall be qualified in accordance with the low rigor requirements of Article 14 of Section V[1]. If obstructions or limitations prevent examination of the volume or surface required by Fig. 2 for one or more nozzles, the analysis procedure of Appendix I shall be used to demonstrate the adequacy of the examination volume or surface for each such nozzle. If Appendix I is used, the evaluation shall be submitted to the regulatory authority having jurisdiction at the plant site.

Figure 2 in N-729-1 (reproduced here as Figure 1) requires that the volumetric examination of nozzle penetrations with an incidence angle less than or equal to 30 degrees has a required coverage length of 1.5 inches. Volumetric examination of nozzle penetrations with an incidence angle greater than 30 degrees has a required coverage length of 1.0 inch.

[1] The referenced rulemaking changed the volumetric examination qualification requirements. Only the examination coverage extent is addressed in this request.




s = 1.5 in. (38 mm) for Incidence Angle, $\theta$, ≤ 30 deg and for all nozzles ≥ 4.5 in. (115 mm) OD or 1 in. (25 mm) for Incidence Angle, $\theta$, > 30 deg; or to the end of the tube, whichever is less
A-B-C-D = Extent of volumetric examination for the tube (base metal)
A-D = Extent of surface examination for the tube inside surface
G-F = ¼ in. (6 mm) from the theoretical point "F" in accordance with the design drawings, including tolerances, unless the point "F" can be physically determined.
G-F-E-C = Extent of surface examination for the J-groove weld (filler metal and buttering) and tube outside surface below the weld
G-F-E = Extent of surface examination zone for the J-groove weld (filler metal and buttering)

**Figure 1: Examination Volume for Nozzle Base Metal and Examination Area for Weld and Nozzle Base Material (from N-729-1) [1]**

Table 1 provides the incidence angles of the various nozzles at Comanche Peak Unit 2. The bolded values are the nozzles of interest for this relief request. The other 71 nozzles meet the applicable requirements of N-729-1. Table 2 summarizes the examination coverage length requirement for the nozzles at Comanche Peak Unit 2.

**Table 1: Comanche Peak Unit 2 Head Penetration**
**Nozzles with Intersection Angles Identified (Vent Line Not Included) [2]**

| Nozzle Number | Angle (Degrees) | Nozzle Number | Angle (Degrees) | Nozzle Number | Angle (Degrees) |
|---|---|---|---|---|---|
| 1 | 0.0 | 27 | 26.2 | 53 | 36.3 |
| 2 | 11.4 | 28 | 26.2 | 54 | 38.6 |
| 3 | 11.4 | 29 | 26.2 | 55 | 38.6 |
| 4 | 11.4 | 30 | 30.2 | 56 | 38.6 |
| 5 | 11.4 | 31 | 30.2 | 57 | 38.6 |
| 6 | 16.2 | 32 | 30.2 | 58 | 38.6 |
| 7 | 16.2 | 33 | 30.2 | 59 | 38.6 |
| 8 | 16.2 | 34 | 30.2 | 60 | 38.6 |
| 9 | 16.2 | 35 | 30.2 | 61 | 38.6 |
| 10 | 18.2 | 36 | 30.2 | 62 | 44.3 |
| 11 | 18.2 | 37 | 30.2 | **63** | **44.3** |
| 12 | 18.2 | 38 | 33.9 | 64 | 44.3 |
| 13 | 18.2 | 39 | 33.9 | **65** | **44.3** |
| 14 | 23.3 | 40 | 33.9 | 66 | 45.4 |
| 15 | 23.3 | 41 | 33.9 | 67 | 45.4 |
| 16 | 23.3 | 42 | 35.1 | 68 | 45.4 |
| 17 | 23.3 | 43 | 35.1 | 69 | 45.4 |
| 18 | 24.8 | 44 | 35.1 | 70 | 45.4 |
| 19 | 24.8 | 45 | 35.1 | 71 | 45.4 |
| 20 | 24.8 | 46 | 35.1 | 72 | 45.4 |
| 21 | 24.8 | 47 | 35.1 | 73 | 45.4 |
| 22 | 26.2 | 48 | 35.1 | **74** | **48.7** |
| 23 | 26.2 | 49 | 35.1 | **75** | **48.7** |
| 24 | 26.2 | 50 | 36.3 | **76** | **48.7** |
| 25 | 26.2 | 51 | 36.3 | **77** | **48.7** |
| 26 | 26.2 | 52 | 36.3 | **78** | **48.7** |

**Table 2: Comanche Peak Unit 2 Nozzle Penetrations and Inspection Coverage Requirements from N-729-1**

| Penetration Number | Incidence Angle θ (Degrees) | Required Coverage "a" (Inches) |
|---|---|---|
| 1 to 29 | ≤ 30 | 1.5 |
| 30 to 78 | > 30 | 1.0 |

## 4. Reason for Request

During 2RF08 outage in 2005 [4], 76 of the 78 CRDM nozzles were inspected. The coverage limitations for extent below the weld were addressed in relaxation request TXX-06204 (Accession Number ML063630152) [3] for nozzles 74 through 78. During that inspection, two other nozzles could not be inspected (63 and 65) due to a unique sleeve design that precluded ID inspection at the elevation of the weld due to a centering ring on the sleeve. These two nozzles were inspected during 2RF09 outage after temporary removal of the sleeve. Modified sleeves were installed in nozzles 63 and 65 following examination of the nozzles.

During the most recent outage, 2RF12, the modified replacement sleeves precluded ID access. Although the centering ring was moved to a higher elevation, the bell mouth design prevented scanner access.

Relief is sought for the ultrasonic exams (dictated by N-729-1 [1]) for nozzles 63, 65, 74, 75, 76, 77, and 78. The relief request for nozzles 63 and 65 is for examination delay by one outage. For nozzles 74, 75, 76, 77, and 78, the relief request is for examination coverage.

Nozzle penetration numbers 63 and 65 have bell mouth sleeve configurations that present difficulty for nozzle inspection. The nozzles were previously examined in October 2006 during the 2RF09 outage [5], one outage after the other 76 penetration nozzles were examined. (The vent line penetration was examined, but is not included in this discussion.) Code Case N-729-1 [1] does not provide for delay in specific nozzle inspections, so a relief request is necessary. Comanche Peak Unit 2 will use different tooling for the nozzles in the bell mouth sleeve configuration or modify the bell mouth sleeve hardware to examine nozzles 63 and 65 in future inspections. As required by N-729-1 [1], nozzles 63 and 65 will still be examined within the prescribed 2.25 RIY period. Even with the requested delay, all nozzles will meet the 2.25 RIY requirement.

For nozzle numbers 74, 75, 76, 77, and 78, the minimum coverage provided by N-729-1 [1] (of 1.0 inch for nozzles at angles greater than 30 degrees) cannot be met by the ultrasonic examination due to geometric limitations. The examination coverage meets the criteria for acceptability as prescribed by Appendix I of N-729-1 [1], [2]. The data provided in Table 3 are from the previous examination of the nozzles in spring 2005 [3].

**Table 3: Penetrations with Alternate Examination Volumes (Less than 1 Inch)**

| Penetration Nozzle Number | Intersection Angle | N-729-1 [1] Required Inspection Length | Actual Scan Length | 20 ksi Line (Inches below J-groove Weld) |
|---|---|---|---|---|
| 74 | 48.7° | 1.0" | 0.81" | 0.29" |
| 75 | 48.7° | 1.0" | 0.30" | 0.29" |
| 76 | 48.7° | 1.0" | 0.73" | 0.29" |
| 77 | 48.7° | 1.0" | 0.33" | 0.29" |
| 78 | 48.7° | 1.0" | 0.36" | 0.29" |

Using the RIY equation in N-729-1-2410 (b) [1] reproduced here (and a head temperature of 561°F), the Comanche Peak Unit 2 time period of 2.25 RIY will be reached in 6.2 EFPY of operation.

$$RIY = \sum_{j=n1}^{n2} \left\{ \Delta EFPY_j \exp\left[ -\frac{Q_g}{R}\left( \frac{1}{T_{head\,j}} - \frac{1}{T_{ref}} \right) \right] \right\}$$

## 5. Proposed Alternative and Basis for Use

### 5.A

For nozzles 63 and 65, the ultrasonic examinations required by N-729-1 [1] will be performed and will satisfy the RIY period criterion. The exam will be conducted one outage subsequent to the prior inspection of the other 76 nozzles. The nozzles will still be inspected within 2.25 RIY of the previous inspection. These nozzles had inspection delayed by one cycle previously, and this time delay will be continued forward for one cycle. At the next cycle, different tooling or permanent modification of the bell mouth sleeve hardware will allow inspection of all nozzles at the next required inspection.

### 5.B

As an alternative to the volumetric and surface examination coverage requirements shown as dimension "a" in Figure 2 of N-729-1 [1] (reproduced here as Figure 1), Comanche Peak proposes the use of attainable ultrasonic examination distances shown in Table 3 of this relief request for those head penetrations listed in Table 1. The required examination coverage dimension for all other penetrations will be met or exceeded.

Appendix I of ASME Boiler and Pressure Vessel Code Case N-729-1 [1] provides an analysis procedure for evaluating an alternative examination area or volume to what is specified in Figure 2 of N-729-1 if impediments or obstructions prevent the examination of the complete inspection area. I-1000 of N-729-1 [1] requires that for eliminating portions of the Figure 2 examination zone below the J-groove weld for alternate inspection zones, the analyses shall be performed using at least the stress analysis method (provided in I-2000) or the deterministic fracture mechanics analysis method (provided in I-3000) to demonstrate satisfaction of the applicable criteria. To support this relief request, the techniques of these sections were validated using [2].

An assumed flaw of 0.2 inch below the weld will grow to the bottom of the weld toe after 6.6 EFPY, greater than the 6.2 EFPY that is equivalent to 2.25 RIY at Comanche Peak Unit 2. The assumed flaw is also conservative because the minimum actual inspection coverage is 0.30 inch.

### 5.1 Stress Analysis in Accordance with ASME Code Case N-729-1 Appendix I-2000

I-2000 of ASME Code Case N-729-1 [1] requires that a plant-specific analysis demonstrate that the hoop and axial stresses remain below 20 ksi (tensile) over the entire N-729-1 examination region (excluding the alternate examination region) as defined by N-729-1, Figure 2. Analyses were performed for the CRDM geometry of a nozzle in an angular position from the reactor vessel centerline at 48.7 degrees. The nozzles bounded by the analysis are provided in Table 4.

**Table 4: Comanche Peak Unit 2 Bounding Nozzle Analyses**

| Analyzed Penetration Nozzle Incidence Angle θ (Degrees) | Penetration Nozzle Numbers Bounded by the Analyzed Nozzle |
|---|---|
| 0 | 1 to 21 |
| 26.2 | 22 to 61 |
| 44.3 | 62 to 65 |
| 45.4 | 66 to 73 |
| 48.7 | 74 to 78 |

The distance below the J-groove weld that needs to be examined, as determined by the point at which the CRDM penetration hoop stress distribution for the operating stress levels is less than 20 ksi (tension), was analyzed in [2] (in Appendix A).

The stress analysis methodology is provided in Sections 3 and 5 of [2]; the summary is provided in Section 7 of [2]. Hoop stresses are provided in Figure 2 of this request.

The hoop stress distribution plots in these figures indicate that the minimum achievable inspection coverage below the bottom of the J-groove weld ensures that stresses remain below 20 ksi (tensile) over the entire region outside the alternative examination zone defined by Figure 2 of N-729-1 [1]. The hoop stresses were used to prepare crack growth prediction to demonstrate that obtaining at least 0.29 inch below the J-groove weld is sufficient to allow for a minimum of 6.2 EFPY (at least four 18-month cycles between examinations).

The inspection coverage obtained and the corresponding alternative coverage requested by Comanche Peak Unit 2 are greater than 0.29 inch, as shown in Table 3. The deterministic fracture mechanics analysis presented in Section 5.2.

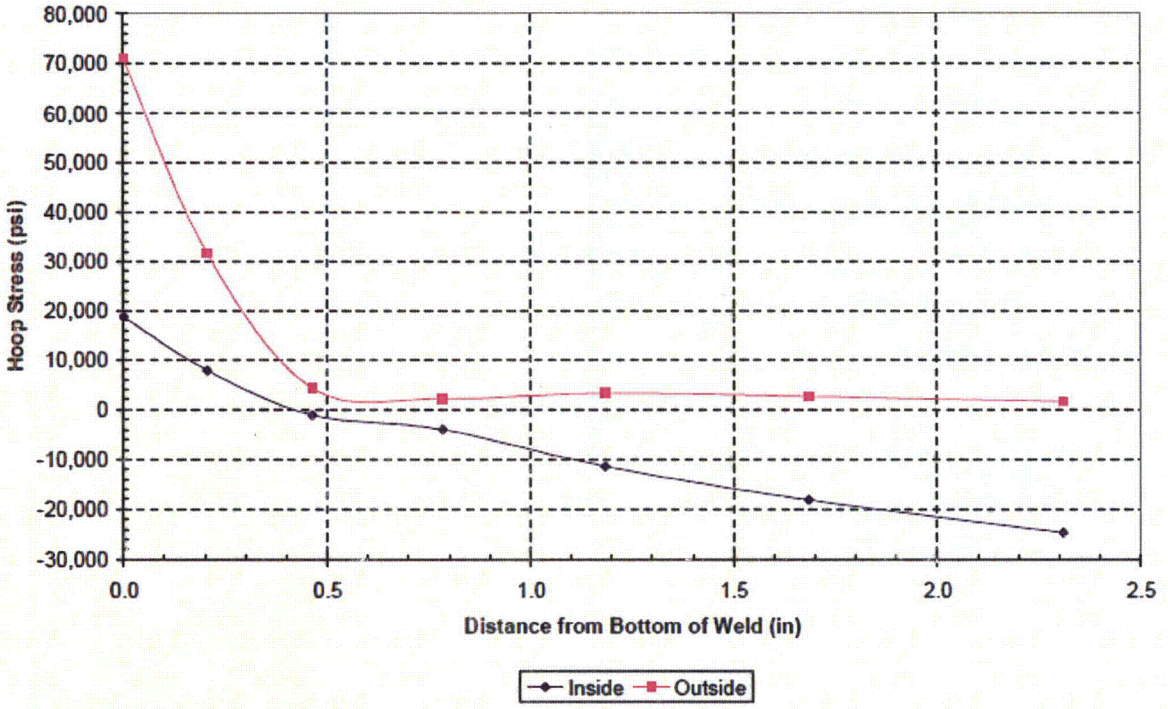



**Figure 2: Hoop Stress Distribution Downhill Side (48.7° Penetration Nozzle) [2]**

### 5.2 Deterministic Fracture Mechanics Analysis for Code Case N-729-1 I-3200, Method 1 [1]

In addition to the stress analysis detailed above, a fracture mechanics analysis was performed that meets the requirements of N-729-1 Appendix I, Method 1 of I-3200 [1] to demonstrate that a potential axial crack in the unexamined zone will not grow to the toe of the J-groove weld prior to the next scheduled examination.

The complete fracture analysis, provided in Sections 3 and 6 of [2], was performed using input from the stress analysis from Section 5 of [2] from the bounding nozzle penetration geometries, and is discussed in Section 5.1 of this request. The results of the analysis are shown as a flaw tolerance chart. This chart can be used to determine the minimum required inspection coverage to ensure that any flaws that could initiate below the J-groove weld in the uninspected region will not reach the bottom of the weld before the next inspection. This chart, reproduced as Figure 3, is further discussed and described in [2].

In accordance with Method 1 of I-3200 [1], the crack growth calculations performed to produce the flaw tolerance chart assume that the initial extremity of the through-wall flaw is at or within the bottom edge of the alternative examination zone. Furthermore, it is assumed that the lower extremity is located on either the inner or outer surface where the hoop stress becomes compressive. The average of the inside and outside hoop stresses was applied along the entire length of the assumed through-wall crack, and the stress intensity factor was calculated using the standard expression for an axial through-wall crack in a cylinder. The crack growth rate determination used in [2] meets the requirements of Appendix O of ASME Boiler and Pressure Vessel Code Section XI.
The resulting flaw tolerance chart demonstrates that a postulated through-wall flaw at the bottom edge of the proposed alternative examination zone will not grow to the toe of the J-groove weld within an inspection interval of four refueling cycles. In all cases, the crack growth predictions show greater than 6.2 EFPY of operation required to grow the postulated flaw to the toe of the weld. Additionally, the assumed initial upper extremity locations of axial through-wall flaws are conservative based on a review

of the achievable inspection coverage zone in this request (minimum coverage of 0.30 inch) because the assumed upper crack extremities are located within the achievable inspection zone.

Examination of portions of the nozzle significantly below the J-groove weld is not pertinent to the phenomena of concern, which includes leakage through the J-groove weld and circumferential cracking in the nozzle above the J-groove weld. In all cases, the measured coverage is adequate to allow Comanche Peak Unit 2 to continue to operate prior to the hypothetical flaws reaching the J-groove weld. In accordance with 10CFR50.55a(g)(6)(ii)(D) requirements (1) through (6), the next examination required for these units would be completed prior to flaw propagation into the J-groove welds. The flaw propagation studies are aligned with the examination interval at Comanche Peak Unit 2.

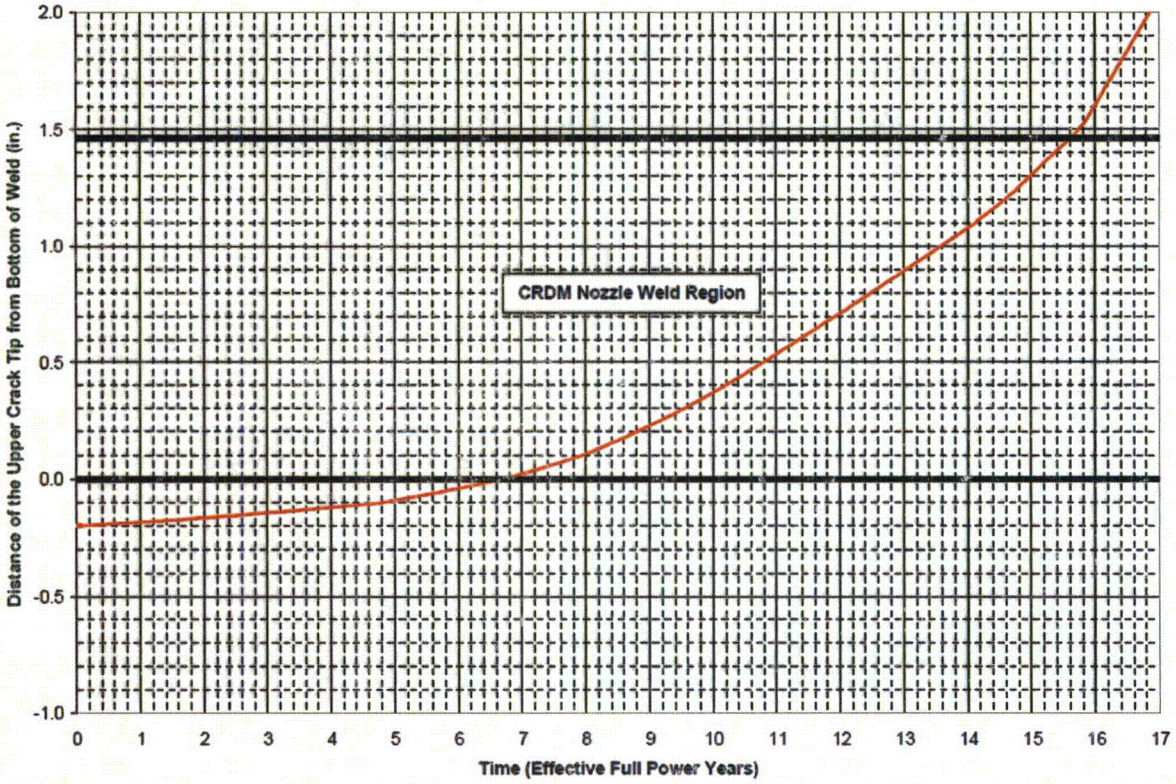



**Figure 3: Crack Growth Prediction for Comanche Peak Units 1 and 2, for Through-wall Longitudinal Flaws (48.7° Penetration Nozzle Downhill Side) [2]**

## 6. Duration of Proposed Alternative

The duration of the proposed alternative is for the remainder of the Comanche Peak Unit 2 10-year ISI interval.

## 7. Precedent

Precedence for relief from the requirements of examination coverage exists because Beaver Valley Unit 2, San Onofre Unit 2, and Indian Point Unit 2 have all been granted relief for the same issue.

## 8. References

1. ASME Boiler and Pressure Vessel Code Case, N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1," March 28, 2006.
2. Westinghouse Report, WCAP-16397-P, Rev. 0, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Comanche Peak Units 1 and 2," June 2005.
3. TXU Generation Co. Relaxation Request, TXX-06204 (Accession Number ML063630152), "Comanche Peak Steam Electric Station (CPSES) Docket Nos. 50-445 and 50-446 Update to 60-Day Response to Revision 1 of NRC Order EA-03-009, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors"," December 18, 2006.
4. 2005 Final Inspection Report, WSI-PJF-1303011-FSR-001
5. 2006 Final Inspection Report, WDI-PJF-1303310-FSR-001