

May 11, 2006

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

**Subject: Docket No. 50-362  
Third Ten-Year Inservice Inspection (ISI) Interval Relief Request  
ISI-3-21 Request for Alternative to ASME Code Rules for  
the Embedded Flaw Repair Process for Control Element Drive  
Mechanism (CEDM) # 56  
San Onofre Nuclear Generating Station Unit 3**

Dear Sir or Madam,

Pursuant to 10 CFR 50.55a(a)(3)(i), the Southern California Edison (SCE) Company requests the U. S. Nuclear Regulatory Commission (NRC) approval to allow the continued use of the embedded flaw repair process during Cycle 14 operation as an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Process for the current configuration of Reactor Vessel Head Penetration (RVHP) CEDM # 56.

SCE implemented the embedded flaw repair process on CEDM # 56 during the Cycle 13 refueling outage in October 2004, as described in Relief Request ISI-3-13, supplemented by letter from A. E. Scherer (SCE) to the NRC dated December 2, 2004, and approved by letter from Robert A. Gramm (NRC) to A.E. Scherer (SCE) dated December 23, 2004. Relief Request ISI-3-13 was approved for Unit 3 for operation during Cycle 13 only. The enclosed Relief Request, ISI-3-21, is being submitted for NRC review and approval of an additional cycle of operation (Cycle 14) provided that certain characteristics of the ultrasonic testing examination indication in CEDM # 56 have remained essentially unchanged during the Cycle 13 operation. No additional repairs are proposed within this relief request. A separate relief request, ISI-3-22, is being submitted under separate cover to support repair of the indication in CEDM # 56 if needed.

SCE requests NRC approval of Relief Request ISI-3-21 prior to November, 2006, when the next Unit 3 reactor vessel head penetration examinations are scheduled to begin.

This submittal contains the following commitments.

- 1) If the established inspection criterion described in the enclosed request is exceeded, SCE will perform additional repairs on CEDM # 56.
- 2) Inspection results will be included in the 60-day post refueling outage inspection report in accordance with NRC Order EA-03-009.

Should you have any questions, please contact Mr. Jack Rainsberry at (949) 368-7420.

Sincerely,

A handwritten signature in black ink, appearing to read "A. J. Sheen". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Enclosure

cc: B. S. Mallett, Regional Administrator, NRC Region IV  
N. Kalyanam, NRC Project Manager, San Onofre Units 2, and 3  
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 and 3

**ENCLOSURE**

**Relief Request ISI-3-21**

**Request for Alternative to ASME Code Rules for the Embedded Flaw  
Repair Process**

**SONGS Unit 3 Reactor Vessel Head Penetration (RVHP)**

**Control Element Drive Mechanism (CEDM) # 56**

**Third Ten-Year Inservice Inspection Interval**

**Proposed Alternative**  
**In Accordance with 10 CFR 50.55a(a)(3)(i)**

**Alternative Provides Acceptable Level of Quality and Safety**

**1.0 ASME Code Component Affected**

San Onofre Nuclear Generating Stations (SONGS) Unit 3 reactor vessel head penetration (RVHP) Control Element Drive Mechanism (CEDM) # 56: All RVHPs are American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, Class 1 components.

**2.0 Applicable Code Edition and Addenda**

Reactor Vessel Construction Code, ASME Section III, 1971 Edition, through the Summer 1971 Addenda

Code of Record for Current (Third) Ten-Year Inservice Inspection (ISI) Interval, ASME Section XI, 1995 Edition, through the 1996 Addenda

**3.0 Applicable Code Requirements**

ASME XI, IWA-4410(a) states the repair/replacement activities, such as metal removal and welding, shall be performed in accordance with the Owner's Requirements and the original Construction Code of the component or system. The applicable Construction Code is ASME III, 1971 Edition, through the Summer 1971 Addenda.

**BASE METAL DEFECT REPAIRS**

ASME III, NB-4131 states that defects in base metals, such as the RVHP penetration tubes, may be eliminated or repaired by welding, provided the defects are removed, repaired and examined in accordance with the requirements of NB-2500.

ASME III, NB-2538 addresses elimination of base material surface defects and specifies defects are to be removed by grinding or machining. Defect removal must be verified by a magnetic particle or liquid penetrant examination using acceptance criteria of NB-2545 or NB-2546. If the removal process reduces the section thickness below the NB-3000 design thickness, then repair welding per NB-2539 is to be performed.

### **3.0 Applicable Code Requirements (continued)**

ASME III, NB-2539.1 addresses removal of defects and requires defects be removed or reduced to an acceptable size by suitable mechanical or thermal methods.

ASME III, NB-2539.4 provides the rules for examination of the base material repair welds and specifies they shall be examined by the magnetic particle or liquid penetrant methods with acceptance criteria per NB-2545 and NB-2546. Additionally, if the depth of the repair cavity exceeds the lesser of 3/8 inch or 10 percent of the section thickness, the repair weld shall be examined by the radiographic method using the acceptance criteria of NB-5320.

#### **WELD METAL DEFECT REPAIRS**

ASME III, NB-4451 states defects in weld metal shall be eliminated and, when necessary, repaired per NB-4452 and NB-4453.

ASME III, NB-4452 addresses elimination of weld metal surface defects and specifies defects are to be removed by grinding or machining. Defect removal must be verified by a magnetic particle or liquid penetrant examination using acceptance criteria of NB-5340 or NB-5350. If the removal process reduces the section thickness below the NB-3000 design thickness, then repair welding per NB-4453 is to be performed.

ASME III, NB-4453.1 addresses removal of defects in welds and requires the defect removal be verified with magnetic particle or liquid penetrant examinations using acceptance criteria of NB-5340 or NB-5350, or in the case of partial penetration welds where the entire thickness of the weld is removed, and only a visual examination is required.

#### **REQUESTED RELIEF**

Repairs to address an indication identified in CEDM # 56 were implemented during the Cycle 13 refueling outage in October 2004. The repairs were performed in accordance with approved SCE relief request ISI-3-13 for Unit 3 Cycle 13 operation only. ISI-3-21 is a request to extend relief from the preceding ASME Code requirements to allow operation for an additional cycle of operation (Cycle 14). There are no changes from the relief previously requested and approved in ISI-3-13. The following relief from ASME Code requirements is required to support Unit 3 Cycle 14 operation.

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Relief is requested from the requirements of ASME Section XI, IWA-4410 (a), to perform repairs on the RPVH penetrations per the rules of the Construction Code.

Relief is requested from the requirements in ASME III, NB-4131, NB-2538 and NB-2539.1 to eliminate base material defects prior to repair welding.

- Relief is requested to use substitute examination methods in lieu of those specified in NB-2539.4. For the embedded flaw weld on the outside diameter (OD) surface of the CEDM # 56 penetration tube, surface examinations using the liquid penetrant method will be performed on the overlay repair weld surface.
- Ultrasonic examinations of the penetration volume and OD repair weld will be performed from the inside diameter (ID) surface opposite the overlay repair weld. The ultrasonic method is a different volumetric examination method than is specified in NB-2539.4.
- Surface examinations using the liquid penetrant method will be performed on the J-weld overlay repair weld surface

Relief is requested from the requirements in ASME III, NB-4451, NB-4452 and NB-4453.1 to eliminate weld metal defects prior to repair welding.

### 4.0 Reason for the Request

Southern California Edison (SCE) Company performed RVHP penetration inspections during the Unit 3 Cycle 13 refueling outage to meet the requirements of the First Revised NRC Order EA-03-009 (Reference 1). During that inspection, an indication was found in CEDM # 56 that was repaired using the embedded flaw repair process. However, the characteristics of the indication in CEDM # 56 were not covered by the evaluation and analysis that support the previously approved Safety Evaluation Report (SER) on embedded flaw repair (Westinghouse Topical Report WCAP-15987-P, Revision 2, Reference 2).

**4.0 Reason for the Request (continued)**

Specifically, the measured depth of the indication in CEDM # 56 is 78 percent through wall, which exceeds the allowable flaw size of 75 percent through wall described in section C.4.2 of WCAP 15987-P Revision 2 (Reference 2). As a result, a revised allowable flaw size of 89 percent through wall was calculated using a method consistent with ASME Code, Section XI, IWB 3640 for the specific service conditions applicable to CEDM # 56. That calculation methodology is unchanged from the methodology previously approved in the SER for ISI-3-8 (Reference 5). The results of this evaluation were submitted in support of relief request ISI-3-13 (Reference 6) and are included as attachment 1 to this relief request.

The NRC approved relief request ISI-3-13 (Reference 7) provided that, prior to the end of the next Unit 3 operating cycle, SCE will identify a long-term repair method and implement that repair on CEDM # 56 during the next Unit 3 (Cycle 14) refueling outage.

Supplemental examinations of the CEDM # 56 J-weld, and penetration ID and OD surfaces performed in the Cycle 13 refueling outage prior to the repair did not confirm or disprove that the indication was a primary water stress corrosion cracking (PWSCC) flaw; however the penetration Outside Diameter (OD) examination was discounted due to tooling uncertainties. As a result, the repair was implemented to address a possibility that the indication was actually a flaw.

Additional NDE data analysis performed since Cycle 13 operation suggests that the apparent change in the indication profile between Cycle 12 and Cycle 13 inspections was more likely due to inspection tool calibration differences than an actual change in the indication. In addition, indications in other RVHPs with similar ultrasonic characteristics have been confirmed not to be PWSCC. Based on these observations, SCE has concluded that a far more likely cause of the CEDM # 56 indication is reflection from acceptable grain structure within the penetration base material.

SCE has reviewed the available repair methods and concluded that additional repair is not warranted. Additional repairs introduce adverse effects on the reactor coolant pressure boundary design and radiological exposure to workers that SCE considers to be of greater consequence than the risk associated with operating with the possibility that there is an embedded flaw in CEDM # 56. As a result, SCE has developed an acceptance limit based on the Cycle 13 measurements that would be employed to detect changes in the indication. If this acceptance limit is exceeded that would confirm the indication in CEDM # 56 is a flaw. A

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description of the basis for the Cycle 14 acceptance criteria is provided in Attachment 2.

If the acceptance limit is not exceeded, then there is no change in the level of quality and safety since the last inspection. If the acceptance limit were exceeded, then repairs would be initiated. SCE is separately providing relief request ISI-3-22 to support contingency repairs if necessary.

### **5.0 Proposed Alternative and Basis for Use**

#### **PROPOSED ALTERNATIVE**

The proposed alternative is to leave CEDM # 56 penetration as currently repaired for Cycle 14 operation. Design, implementation, and inspection of the repair are consistent with the information contained in Reference 6 and approved in Reference 7.

#### **BASIS FOR USE**

SCE Relief Request ISI-3-13 (Reference 6), reviewed and approved by the NRC Safety Evaluation Report (SER) (Reference 7) supports that the embedded flaw process provided an acceptable level of quality and safety for operation during Cycle 13. SCE has reviewed the available repair methods and concluded that additional repair is not warranted to address the remaining possibility that this indication is a flaw. Additional repairs introduce adverse effects that SCE considers to be greater than the risk associated with continued operation during Cycle 14. SCE proposes to ensure the level of quality and safety, as discussed in References 6 and 7, is maintained by imposing inspection criteria to be used during the Cycle 14 refueling outage that will preclude operation without additional repairs in the event that there has been any measurable growth of the indication from the previously evaluated condition.

SCE performed an ASME Code reconciliation to verify that the bases contained in WCAP-15987-P Revision 2 are applicable to SONGS Units 2 and 3. The referenced July 3, 2003, Safety Evaluation (Reference 3) found WCAP-15987-P Revision 2 to be acceptable for referencing in licensing applications as an alternative to the 1989 Edition of Section III of the ASME Code, with limitations noted in the SER. The SONGS Code reconciliation was performed in accordance with the SONGS ASME XI Program between the applicable repair requirements of ASME III, 1989 Edition and ASME III, 1971 Edition, Summer 1971 Addenda (construction code of record for the SONGS reactor vessels) and the differences identified were suitably reconciled.



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In the case of OD overlay repair welds, the proposed substitute examination methods have been previously demonstrated to be adequate for flaw detection and sizing as shown in Reference 4.

The embedded flaw repair process is considered a permanent repair that will last through the useful life of the RVHP. As long as a PWSCC flaw remains isolated from the primary water environment the only known mechanism for any further potential propagation is fatigue. If this indication is postulated to be a flaw, the calculated fatigue usage in this region would be very low, because the reactor vessel head region is isolated from the transients that affect the hot leg or cold leg piping.

The thickness of the weld used to embed the indication was designed to provide a permanent embedment of any postulated flaw. The embedded flaw process imparts less residual stresses than weld repair following the complete removal of the flaw.

Since Alloy 52 (690) weldment is considered highly resistant to PWSCC, a new PWSCC crack should not initiate and grow through the Alloy 52 overlay to reconnect the primary water environment with the embedded flaw. The resistance of the alloy 690 materials has been demonstrated by laboratory testing, and in approximately 10 years of operational service in steam generator tubes, where no PWSCC has been found.

As previously discussed, an additional analysis was performed using the same methodology as the Topical Report to evaluate and analyze CEDM # 56 for an embedded flaw repair. The results of this analysis demonstrate that an embedded flaw repair on CEDM # 56 will meet ASME Section XI Code requirements for allowable flaw size until the end of the SONGS Unit 3 third ten-year inspection interval (August 17, 2013). A copy of the analysis "Evaluation of the Acceptability of Embedded Flaw Repair of the Indication in Reactor Vessel Head Penetration No. 56 at SONGS Unit 3" is provided in Attachment 1. This analysis was previously submitted as part of ISI-3-13 (Reference 6) and reviewed by the NRC (Reference 7).

The Cycle 14 refueling outage inspection (November 2006) of this nozzle will be performed to meet the NRC Order (Reference 1) and will be consistent with the requirements specified in Section 4.0 of Reference 5 for vessel head penetration nozzle O.D. repairs below the J-groove weld. The depth of the indication in CEDM # 56 will be compared to the depth measured during the Cycle 13 inspection. Any change in depth greater than the measurement resolution capability would mean that the CEDM 56 indication is actually a flaw. This change threshold criterion is a measured increase of 0.020 inch in depth of the indication. A change of

that magnitude would not be expected from normal variances in measurement errors. If the Cycle 14 measurement indicates a flaw is present, repairs will be made in accordance with approved Code and a separately approved relief request. A description of the depth measurement and its capability to resolve changes in depth are provided in Attachment 2. Inspection results will be included in the 60-day post refueling outage report required by Reference 1.

In summary, SCE has concluded that the indication in CEDM # 56 is unlikely to be an actual flaw. Additional repair beyond the existing weld overlay on the J-weld and penetration OD are not recommended unless a flaw is confirmed. Measurements performed during the Cycle 14 refueling will employ criteria designed to detect change that would be attributed to the presence of an active flaw. In the unlikely condition that a flaw is present and remains undetected by the Cycle 14 inspection, the embedded flaw repair process implemented during the Cycle 13 refueling outage is considered to be an alternative to ASME Code requirements that provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i).

## **6.0 Duration of Proposed Alternative**

Relief is requested for SONGS Unit 3 operation during Cycle 14 operation of the third in-service inspection interval at SONGS Units 2 and 3, which began on August 18, 2003, and is scheduled to end on August 17, 2013. Prior to Cycle 15 operation, a separate relief request will be submitted as appropriate based on information gathered during the Cycle 14 refueling outage.

## **7.0 Precedents**

Letter from Robert A. Gramm (NRC) to A. E. Scherer (SCE) dated December 23, 2004; Subject: San Onofre Nuclear Generating Station (SONGS) Unit 3- Re: Request for Relief from Requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (CODE) Concerning Reactor Pressure Vessel Head Penetration (RVHP) Repairs (TAC No. MC4969).

## **8.0 References**

1. U. S. Nuclear Regulatory Commission (NRC) First Revised NRC Order EA-03-009 Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 20, 2004

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2. Letter from H. A. Sepp (Westinghouse) to the Document Control Desk (NRC) dated May 16, 2003; Subject: Request for Review and Approval Westinghouse Topical Report WCAP 15987-P Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations" (Proprietary) and WCAP-15987-NP (Non-proprietary)
3. Letter from H. N. Berkow, (NRC) to H. A. Sepp, (Westinghouse) dated July 3, 2003; Subject: "Acceptance for Referencing – Topical Report WCAP 15987-P, Revision 2, "Technical Basis of the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations, (TAC No. MB8997)"
4. Letter LTR-NRC-03-61 from J. S. Galembush (Westinghouse) to Terrence Chan (NRC) and Bryan Benney (NRC) dated October 1, 2003; Subject: "Inspection of Embedded Flaw Repair of a J-groove Weld"
5. Letter From Stephen Dembeck (NRC) to A.E. Scherer (SCE) dated May 5, 2004; Subject: San Onofre Nuclear Generating Station, Units 2 And 3, Inservice Inspection Program Relief Request ISI-3-8, Embedded Flaw Repair Process (Tac Nos. Mc1470 And Mc1471)
6. Letter From A.E. Scherer (SCE) to the U. S. Nuclear Regulatory Commission dated October 26, 2004; Subject: Docket No. 50-362, Third Ten-Year Inservice Inspection (ISI) Interval Relief Request ISI-3-13 Request to Use Alternative To ASME Code Rules For The Embedded Flaw Repair Process for Reactor Vessel Head Penetration 56, San Onofre Nuclear Generating Station, Unit 3
7. Letter from Robert A. Gramm (NRC) to A. E. Scherer (SCE) dated December 23, 2004; Subject: San Onofre Nuclear Generating Station (SONGS) Unit 3- Re: Request for Relief from Requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (CODE) Concerning Reactor Pressure Vessel Head Penetration (RVHP) Repairs (TAC No. MC4969).