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SUBJECT: Forwards revised request for relief for non-welded repair using ASME Code Case N-523 of main Unit 2 SG instrumentation piping connection.

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September 29, 1995

PG&E Letter DCL-95-216

U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555

Docket No. 50-323, OL-DPR-82
Diablo Canyon Unit 2
Request for Relief for a Temporary Repair of the Unit 2 Main Steam Generator Instrumentation Piping Connection Utilizing ASME Code Case N-523

Gentlemen:

Attached for NRC review and approval is a revised request for relief for a non-welded repair using ASME Code Case N-523 of the main Unit 2 steam generator instrumentation piping connection. A leak was discovered in this line on September 7, 1995. This leak cannot be isolated and Code weld repaired during plant operation, and would necessitate a plant shutdown and cooldown to Mode 5 (Cold Shutdown). Based on the guidance provided by Generic Letter 90-05, a Code weld repair during power operation is impractical. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is requested that the NRC grant relief for a temporary repair using an engineered mechanical clamp designed to meet the guidance of ASME Code Case N-523. The clamp will be used until the next entry into Mode 5 of sufficient duration; but not later than the next refueling outage, scheduled to begin March 16, 1996, at which time a Code weld repair will be performed.

This request was initially discussed with the NRC staff during a telephone conservation on September 8, 1995. The NRC verbally approved the request based on the technical information in DCL-95-201, dated September 21, 1995, and additional information provided during the telephone conversation. This letter is written to revise the relief request and document the additional information discussed during the phone conversation.

Attachment 2 to DCL-95-201 contained vendor proprietary information necessary for NRC technical review and, in accordance with Section 2.790(b) of 10 CFR Part 2, PG&E requests that the information be withheld from public disclosure to protect commercially competitive methods and techniques. All proprietary vendor information has been deleted from attachments to this letter and may be placed in the public document room. Therefore, this submittal replaces the previous submittal in its entirety and becomes the document of record.

A044

This revised Code Case relief request was approved by the PG&E Plant Staff Review Committee. If there are any questions concerning this matter, please contact Mr. William G. Crockett at (805) 545-4346.

Sincerely,

Warren H. Fujimoto

cc: L. J. Callan
Kenneth E. Perkins
James C. Stone
Michael D. Tschiltz
Diablo Distribution

Enclosure

1355S/DDM/2246

Enclosure
PG&E Letter DCL-95-216

REQUEST FOR RELIEF FOR A TEMPORARY REPAIR OF UNIT 2 MAIN STEAM GENERATOR INSTRUMENTATION PIPING CONNECTION UTILIZING ASME CODE CASE N-523

On September 7, 1995, with Diablo Canyon Power Plant (DCPP) Unit 2 in Mode 1 (Power Operation), a visual examination discovered a pinhole leak in the steam generator (SG) number 2-3 instrumentation sensing line connection. The discovery was made by a plant operator performing a confirmatory inspection for possible leakage sources inside the main containment structure, due to an increasing trend of containment sump inventory and discharge required by Technical Specification (TS) 4.4.6.2.1.b, "Reactor Coolant System - Operational Leakage."

The pinhole leak is located at the socket weld for a SG narrow range level sensing line in Code Class 2 high-energy piping. This leak cannot be isolated and Code weld repaired during power operation. A Code weld repair requires a plant shutdown to Mode 5 (Cold Shutdown), which would subject the unit to an unnecessary plant shutdown. Based on the above and the guidance provided by Generic Letter 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," a Code weld repair during power operation is impractical. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is requested that the NRC grant relief for a temporary repair in accordance with Code Case N-523, "Mechanical Clamping Devices for Class 2 and 3 Piping, Section XI, Division 1," to avoid a unit shutdown and to limit the leakage from the through-wall flaw. The engineered mechanical clamp will be used until the next scheduled Mode 5 entry of sufficient duration; but not later than the next refueling outage, scheduled to begin March 16, 1996, at which time, a Code weld repair will be performed.

Description of System Function

SG 2-3 narrow range level sensing line tap has developed a pinhole leak at the base of the socket weld of the 3/4 inch, ASTM A-106 Grade B, schedule 80 piping attached to the SA-508, Class I, SG nozzle number 9. This line provides the lower pressure sensing necessary for instrumentation channels LT-536 and LT-537. Channel LT-537 is one of three redundant level instrumentation channels for SG 2-3 that provides a safety related (instrument Class IA) reactor trip signal (low-low SG level) and turbine trip (high-high level, when above P-14). The safety-related functions include reactor trip system and engineered safeguards features actuation system protection as required by TSs 3.3.1 and

3.3.2, respectively. LT-537 also provides a control input to the digital feedwater control system, and indication for the emergency response facility data system, plant computer and control room. Channel LT-536 is a non-safety related device (instrument Class IC), which provides SG 2-3 indication (instrument Class II) at the dedicated shutdown panel as required by Equipment Control Guideline 4.2, "Steam Generator Level and Pressure Instruments (Appendix R)," for use in the unlikely event of a postulated fire in the cable spreading room.

The normal operating pressure and temperature range of this line is approximately 805 psig and 519 degrees F to 1005 psig and 545 degrees F. The maximum design condition for this line is 1415 psig at 600 degrees F, which envelops all modes of operation. To date, this line has experienced less than one hundred thermal cycles. A cycle is defined as a heatup from Mode 5 to Mode 4 (Hot Shutdown) and subsequent return to Mode 5.

Evaluation of Flaw

The flaw is at the toe of the socket weld of the 3/4 inch pipe to the SG 2-3 nozzle. It appears to be a pinhole type leak based upon a visual inspection. There is no evidence of any linearity to the leak opening. The flaw is believed to have originated in the inner diameter of the pipe. The flaw is believed to be due to the result of a very localized weld defect present since initial construction that recently progressed through the remaining weld material.

Wall thickness of the upstream and downstream piping were determined volumetrically (see Attachment 1). Comprehensive ultrasonic testing (UT) examination and other nondestructive examination (NDE) methods were not feasible due to the temperature of the pipe, presence of a steam leak, configuration of the socket weld, and proximity to the main SG.

Due to the lack of NDE results available to characterize the flaw, an evaluation of susceptible failure mechanisms was performed to provide assurance that the structural integrity of the line is maintained. This review considered fatigue from vibration and thermal cycling, sustained over-stress, erosion/corrosion, and steam flashing with the following results:

- Fatigue

  A walkdown of the Units 1 and 2 narrow range SG level instrument sensing lower tap piping for the similar (redundant sensing line) locations (24 total), was performed to determine if there are any other leaks and assess the potential for piping fatigue due to vibration. No pressure boundary leakage or vibration was found.

The potential for thermal cycling was assessed. The socket welded connection is within close proximity of the main SG such that the connection is at the same temperature as the main SG shell. The SG 2-3 insulating material surrounds the integral SG nozzle. The 3/4 inch piping extension is self supporting and uninsulated. However, due to the stable bulk SG temperature and the stable free air cooling provided to this location, the temperature transition area of this location is considered stable. Therefore, thermal cycling of this area is limited to a heatup from Mode 5 to Mode 4 (or above) and subsequent return to Mode 5.

A typical fatigue crack would exhibit readily visible linearity in a generally circumferential direction. These cracks typically initiate at the root of the weld and propagate to the outside emerging on the weld face. There are cases where a fatigue crack initiates on the outside surface of a pipe. These later cracks will be located at the toe of the weld since it is the stress riser. In this case, the crack is quite long on the outside surface before the leak occurs. The SG 2-3 leak does not exhibit any linearity that would be indicative of the existence of a crack. A similar pinhole leak in the isolatable portion of the SG blow down line was previously removed and destructively analyzed. The analysis found a thread like defect due to a 70% through-wall flaw that existed from initial construction. The pinhole exit to the full through-wall condition is believed due to a very localized corrosion cell attack at the defect.

Based on the leak characteristics, lack of vibration, and limited NDE examination of the flaw; fatigue at this location due to vibration or thermal cycling is not considered to be significant.

- Sustained Over-Stress

The stress calculation of record was reviewed to determine the state of stress in the line. The various design parameters including deadweight, pressure, thermal and seismic were reviewed. The line meets design requirements which are within ASME Code allowable values.

- Erosion/Corrosion

The instrumentation sensing line does not require any significant flow to perform its function. A limited UT inspection showed no wall thinning in the areas of piping upstream or downstream of the leaking weld location. Flow is a necessary condition to have pipe wall thinning due to the erosion/corrosion mechanism. Since this line is almost always stagnant, erosion/corrosion is not considered as the failure mechanism.

The secondary water chemistry of the SG is maintained in accordance with the recommendations of the NSSS vendor and industry experience. The maintenance of water chemistry within these guidelines prevents the potential for significant accumulation of corrosion agents in the SGs. The suspected weld flaw could be a localized lack of penetration of the weld with the nozzle. This area of lack of penetration could be characterized as a crevice. Although secondary water chemistry is controlled to minimize the amount of corrosion agents, some corrosion agents do settle in the SGs. The sensing line is an area where corrosion agents (chloride ions, corrosion products or other solids) could accumulate, due to the stagnant flow condition and the geometry of the connection. The crevice with the presence of a corrosion agent could cause the formation of a concentrated corrosion cell. Crevice corrosion is a specialized case of pitting corrosion. Pits usually grow in the direction of gravity. The formation of a pit and its continued growth through the weld/nozzle material at the bottom of the connection is also a possible explanation for the leak. Therefore, crevice corrosion or pitting corrosion could be possible failure mechanisms for this through wall pinhole leak.

- o Flashing

  This location is continuously maintained at the main SG pressure. Therefore, significant phase change/flashing will not normally occur.

The review of the above mechanisms provides reasonable assurance that the structural integrity of the SG level sensing line is maintained; and when combined with the results of the limited UT inspections, it has been concluded that the leak is a result of a localized weld defect.

Code Case N-523 Repair

- o Description

  An engineered mechanical clamp, designed to meet the load requirements of the piping, was installed September 25, 1995, consistent with the requirements of Code Case N-523 and verbal NRC approval of DCL-95-201, dated September 21, 1995. The clamp design with its associated strongback is shown in Attachment 2.

  The clamp is designed for the line design condition of 1415 psig at 600 degrees F and sealant injection pressure of 2122 psig, which is 1.5 times the design pressure (1415 psig).

  The clamp is designed to meet the load requirements assuming a complete through-wall 360 degree flaw. The highest stresses in the

clamp assembly are below Code allowables and below yield stress for the design temperature. The maximum stress in the clamp is less than 2/3 of yield.

Due to the erosion effects of steam cutting, it is desired to minimize the leakage as much as possible. In order to accomplish this, the engineered mechanical clamp is injected with thermal-setting sealant which fills the small space between the clamp and the piping. No credit is given to this sealant for structural integrity, and its only function is to eliminate leakage.

Temporary additional support of the clamp, and/or attached lines, is not necessary due to adequate structural support and bearing area available for the clamp attachment.

- Stress Evaluation

A stress evaluation of the piping configuration, with the additional mass of the engineered mechanical clamp and associated strongback, was performed. The evaluation considered all design basis loading conditions including deadweight, pressure, thermal and seismic. The results of the evaluation were acceptable. Attachment 3 provides the piping stress analysis results. In all cases, the piping stresses are below Code allowables and below yield stress for the design temperature.

- Design/Installation

The engineered mechanical clamp was designed and analyzed by TEAM Environmental Services, Inc., who is qualified and experienced in designing engineered mechanical clamps. TEAM Inc. is on the PG&E Approved Qualified Suppliers List. The engineered mechanical clamp is fabricated using safety-related qualified material as required by Code Case N-523 using ASME Section III, 1989 Edition, Code allowables. The clamps have no fabrication welds. A system leakage test was performed upon installation of the clamp.

- Personnel Safety

Appropriate protective clothing was worn by personnel during the installation of the clamp assembly. The installation of the engineered mechanical clamp was performed by qualified contract personnel, supplied by TEAM Environmental Services, who have previously performed this type of repair.

o Duration/Removal

The engineered mechanical clamp will be inservice until the next Mode 5 shutdown of sufficient duration; but not later than the seventh refueling outage (2R7), scheduled to begin March 16, 1996. During 2R7 the temporary repair will be removed, the piping weld repaired, and the area of connection returned to acceptable surface condition in accordance with PG&E's Section XI repair program. The repair plan will include light grinding to remove clamp teeth marks from the affected piping. If Unit 2 were to cooldown to Mode 4 (Hot Shutdown), retorquing of the bolting will be evaluated to assure the installation torque specified by the vendors design.

Safety Evaluation

The following safety evaluation addresses the effects of a through-wall 360 degree flaw. The radiological and environmental qualification effects of this condition were reviewed for impact on the following design basis accidents as described in the Updated Final Safety Analysis Report (UFSAR).

- UFSAR Section 15.2.11, "Excessive Load Increase Incident"
- UFSAR Section 15.2.13, "Accidental Depressurization of the Main Steam System"
- UFSAR Section 15.3.2, "Minor Secondary System Pipe Breaks"
- UFSAR Section 15.4.2, "Major Secondary System Pipe Rupture"

The safety evaluation concluded the following: 1) installation of the engineered mechanical clamp does not increase the probability of occurrence, or the consequences of an accident or malfunction of equipment important to safety as previously evaluated in the UFSAR, 2) no new possibility for an accident or malfunction of a different type than previously evaluated in the UFSAR, and 3) no reduction in the margin of safety as defined in the basis for any TS.

System Interaction and Hazards Review

A system interactions and hazards review was performed, which included a walkdown of the area to identify any safety related components that could be affected. This review postulated a complete 360 degree circumferential break at the leak location and the failure of the leak repair clamp. The effects of pipe whip, jet impingement/fluid spray, flooding and environmental qualification were reviewed with the following results:

- Pipe Whip

  The location of the socket weld prevents creation of a pipe whip because there is no lever arm between the SG and the break. The jet would add a force of about 500 pounds to the SG at the break location, which is not significant. The leak repair clamp attached to the pipe could become a missile. This clamp and piping assembly would be propelled towards the SG cubicle wall while remaining connected to the stainless steel instrument tubing line. The assembly could hit the generator cubicle wall and fall inside the cubicle, or be ejected over the shield wall. While the fall inside the cubicle could damage instrumentation associated with SG 2-3, and could cause a reactor trip; this is bounded by the previously analyzed inadvertent reactor trip. If the missile is ejected over the shield wall, it could not disable any components, which would prevent the safe shutdown of the unit.

- Jet Impingement/Fluid Spray

  The nominal size of the nozzle is 3/4 inch. This is less than the 1 inch minimum diameter criteria used in the DCPP high energy and moderate energy line break analyses. As a result, a new evaluation was performed limiting the scope to the welded joint currently leaking. A walkdown of the area identified no targets within the jet's zone of influence. The jet dissipates quickly and would have no significant energy by the time it reaches any targets.

- Flooding

  The flooding, which could occur as a result of the break, is enveloped by other previously analyzed steam and feedline breaks in the area. Therefore, it is concluded that flooding would not disable any safety related equipment necessary for safe shutdown following the break.

- Environmental Qualification

  The general area ambient temperature was not noticeably affected by the steam leak. If the leak were to increase as a result of the socket weld separating, the conditions would become worse; but would be bounded by the conditions of the main steam line break and loss of coolant accident for which the devices are already qualified.

- Loss of Fluid

  The break would result in a system transient less severe than the previously analyzed UFSAR Section 15.2.11, "Excessive Load Increase Incident," and has, therefore, been determined to be acceptable. Loss of

the instrument would result in tripping one channel of a 2 out of 3 reactor trip logic. This instrument is not required to achieve safe shutdown following the break. Additionally, a fire is not postulated in conjunction with this break. As such, indication at the dedicated shutdown panel is not required following the break.

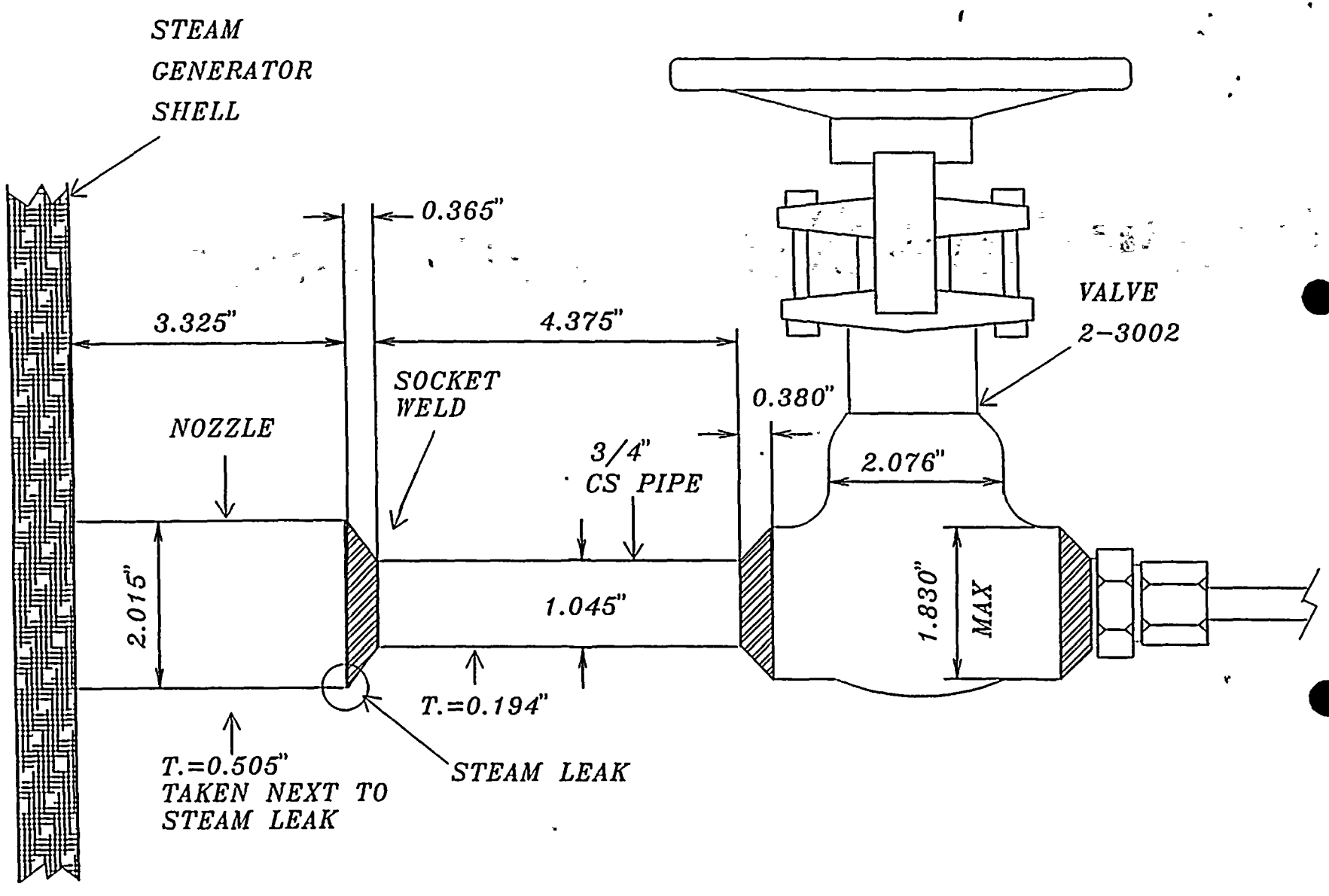
Visual Inspections

Visual VT-2 leakage examinations were performed at the similar locations of the SG narrow range level instrumentation lower sensing line connections (three per SG for the four SGs, i.e., 12 locations). No evidence of pressure boundary leakage or piping degradation was found. Leakage monitoring will continue to be provided by containment leakage collection monitoring required by TS 4.4.6.2.1.b at least once per 12 hours; therefore, a significant change in containment leakage from any location would be detected within a 24 hour period. A remote camera is being used to visually monitor the repair clamp for continued structural integrity of the clamp and leakage on a daily basis. This camera is capable of an accurate display of the leakage integrity of the clamp without repeated personnel exposure to the approximately 250 mRem field at the clamp location.

Conclusion

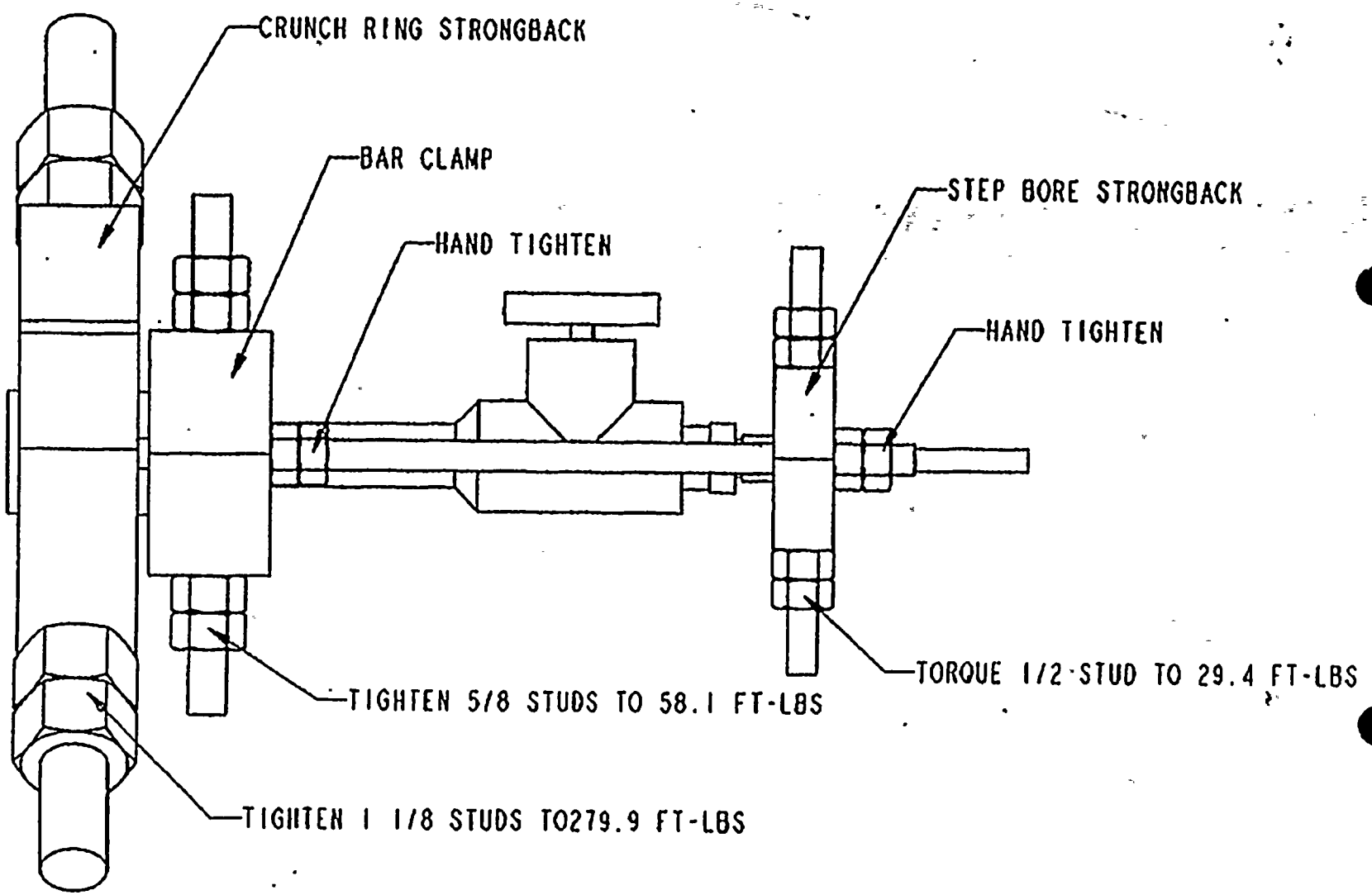
The structural integrity of the Unit 2 SG 2-3 narrow range level sensing line tap will be maintained by the installation and continued monitoring of the engineered mechanical clamp. This clamp is designed to meet the load requirements of the piping as provided by Code Case N-523. Therefore, it is requested that the NRC grant relief for the temporary repair until the piping can be Code weld repaired during the next Mode 5 entry of sufficient duration; but not later than the next refueling outage, scheduled to begin March 16, 1996.

ATTACHMENT #1



DCPP 2 STEAM GENERATOR LEVEL INDICATOR "STEAM LEAK 9-8-95

AR# A0377877



MAXIMUM INJECTION PRESSURE 2122 PSI + STATIC
A/R #A0377877
EQUIP #LT-536 & 537

ATTACHMENT #2

PIPING STRESS SUMMARY CHECK AND COVER SHEET PG&E/2 (EK2831) 09/14/95 EK2831 PAGE 141

ANSI-B31.1

PROJECT D C UNIT # 2

JOB NO. 18269 PLANT DESIGN GROUP

SYSTEM VENT TO STEAM GENERATOR 2-3 / LT - 537 w/ Mechanical Clamp

CALC NO 2001/RO ISO NO A0377877/P12-819-LRN REV NO —

DESIGN CONDITION	LEVEL	LOCATION OF MAXIMUM END	ELEMENT	MAXIMUM COMPUTED STRESS(PSI)	ALLOWABLE STRESS (PSI)	COMPUTED / ALLOWABLE
SUSTAINED LOADS EQN. 11		20	20 25	3833	SH 15000	.256
OCCASIONAL LOADS EQN. 12	B	20	20 25	5811	1.2 SH 18000	.323
OCCASIONAL LOADS EQN. 12	C	20	20 25	7138	1.8 SH 27000	.264
OCCASIONAL LOADS EQN. 12	D	20	20 25	7523	2.4 SH 36000	.209

REFERENCE CALCULATIONS:

WEIGHT 2001/RO SEISMIC-INERTIA PORTION N/A OTHERS N/A

THERMAL EXP N/A SEISMIC-ANCHOR MOVEMENT 2001/RO

DYNAMIC N/A

	NAME	SIGNATURE	DATE
PREPARED BY	SURESH G. KHATRI	Skhatri	9/14/95
REVIEWED BY	J.A. BLANCO	Blanco	9/14/95
APPROVED BY	R.L. Klimczak	R. Klimczak	9/15/95

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