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PACIFIC GAS AND ELECTRIC COMPANY

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April 11, 1984

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

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Dr. John H. Buck
Atomic Safety and Licensing
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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

In the Matter of
PACIFIC GAS AND ELECTRIC COMPANY
(Diablo Canyon Nuclear Power Plant, Units 1 and 2)
Docket Nos. 50-275 OL and 50-323 OL

Dear Members of the Appeal Board:

On April 7, 1984, we informed you by letter that there was an error contained in Attachment A of Pacific Gas and Electric Company's answer to Joint Intervenors' Motion to Reopen the Record on Design Quality Assurance. The April 7 letter was predicated on information relayed to DCP personnel by the NRC Staff that the Staff had measured radii of tube steel used in piping supports that was less than 2T at Diablo Canyon during the week of April 1, 1984.

As stated in the April 7 letter, the DCP has been conducting an extensive investigation into the matter since being informed of the potential problem by the NRC. The results of that investigation are set forth in the attached letter report being submitted to the NRC Staff contemporaneously herewith. The DCP investigation confirms that there is no tube steel with less than 2T radii and, therefore, the allegation of Mr. Stokes that PGandE had purchased and used Japanese steel with radii of 1.5T remains totally false.

Respectfully submitted,

Bruce Norton

Bruce Norton
Attorney for Pacific Gas
and Electric Company

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
PACIFIC GAS AND ELECTRIC COMPANY	)	Docket No. 50-275
	)	Docket No. 50-323
Diablo Canyon Nuclear Power Plant, Units 1 and 2	)	
	)	

CERTIFICATE OF SERVICE

The foregoing document(s) of Pacific Gas and Electric Company has (have) been served today on the following by deposit in the United States mail, properly stamped and addressed:

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Date: April 11, 1984

Bruce Norton

COPY

PACIFIC GAS AND ELECTRIC COMPANY

PG&E

77 BEALE STREET, SAN FRANCISCO, CALIFORNIA 94106 TELEPHONE (415) 781-4211

April 11, 1984

PGandE Letter No.: DCL-84-141

Mr. John B. Martin, Regional Administrator
U. S. Nuclear Regulatory Commission, Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Re: Docket No. 50-275, OL-DPR-76
Diablo Canyon Unit 1
SSER 22, Allegation No. 92/93 -- Pipe Support Tube Steel

Dear Mr. Martin:

Enclosed is PGandE's response to the April 6, 1984 request by the Region V staff for information concerning tube steel used in pipe supports at Diablo Canyon.

Kindly acknowledge receipt of this material on the enclosed copy of this letter and return it in the enclosed addressed envelope.

Sincerely,

W. A. Raymond

for J. O. Schuyler

Enclosure

cc: D. G. Eisenhut
D. F. Kirsch
H. E. Schierling
Service List

ENCLOSURE

At the Staff's request, this letter provides additional information on corner radii in the design of pipe support welds to tube steel (SSER 22, Allegation 92/93). In a letter to the NRC dated February 29, 1984 (DCL-84-083), PGandE provided the Project criterion for the associated weld design. This criterion uses 5/16 R as the effective throat of flare bevel welds, where R is defined as the outside corner radius of the tube steel which is equal to twice the tube wall thickness, 2.0 t. Thus, the designers use 5/8 t as the effective throat of the flare bevel welds.

During the week of April 1, 1984, the NRC Staff's contractor, Mr. M. Eli, examined the corner radii of pipe support tube steel installations. His measurements apparently indicated that some of the smaller size tubes (those with a perimeter less than 14 inches) had been manufactured with corner radii of 1.5 t. An exit meeting was held on April 6, 1984, and all facts that were known at that time were discussed and several questions were raised. Subsequently, in a letter dated April 6, 1984, the NRC staff formally requested PGandE to respond to these questions.

In responding to these questions, PGandE has investigated the methods used to measure corner radii to determine their validity, and has performed weld tests on tube sections with apparent radii less than 2.0 t (measured by the tangent intersection method) to demonstrate that the actual weld throat thickness achieved is at least equal to that used in the design calculations.

Measurement of Corner Dimensions

The curved portion of the tube corner is not fabricated to be exactly one quarter of a circle, as indicated by the dotted line in Figure A. Instead, it is actually less than a quarter of a circle as indicated by the solid line in the same figure. Therefore, different radii can be measured for the tube corner dependent upon the measurement method used.

If a straight ruler or mechanic's square is used, as shown in Figure B, a corner dimension, D, is measured. This is considered to be the tangent intersection method. Based on this D dimension, an apparent corner radius of R_D is implied. As shown in Figure B, this may not be the actual radius of curvature. Alternatively, if a concave radius gauge is used, the measured radius is R_A, as shown in Figure C. R_A is the appropriate measurement of the actual curvature. Only when the tube corner is a quarter circle will the two measurement methods yield the same radius. Examples of tubes with the smallest corner dimension, D, were selected by the site piping contractor's QC personnel (Pullman QC) for further measurement. The resulting measurements are summarized in Tables 1A and 1B. The difference between R_D and R_A is clearly shown in these tables. For the 3 x 3 x 1/4 tubes, the apparent radius, R_D, is approximately 1.25 t to 1.5 t and the R_A is always 2.0 t or slightly larger. For the 3 x 3 x 1/2 tubes, R_D is approximately 1.0 t and R_A is again 2.0 t. The NRC staff's contractor used the tangent intersection method of measurement.

Weld Tests

The tubes that had been selected by Pullman QC (the "D" dimension apparently less than 2.0 t) were used for weld tests. The weld tests were performed using both 3/32" and 1/8" diameter electrodes in four welding positions. The test coupons were cross sectioned and the flare bevel weld effective throats were measured. The effective throat was measured as flush with the side of the tube. No credit was taken for weld reinforcement. The actual weld effective throat, as shown in Tables 2A and 2B, clearly demonstrates that the weld effective throat is at least equal to the 5/8 t dimension used in the design calculations.

The above discussion provides the bases for the following responses to the three questions raised in the NRC's letter of April 6, 1984.

1. Consider the effects of a 1.5 t tube steel radius on pipe support and flare bevel weld adequacy.

   The use of tube steel with corner dimensions of 1.0 t, 1.25 t or 1.5 t, measured by the tangent intersection method, has no effect on the adequacy of pipe supports or their flare bevel welds. As demonstrated by weld tests, corner dimensions less than 2.0 t have no adverse effect on the effective weld throat. The 5/8 t effective throat used in the design calculation is always achieved with margin.

2. Explain the apparent discrepancy between the Staff's observations (corner radius = 1.5 t) and the statement in PGandE's February 29, 1984 letter relating to the fact that tube steel at Diablo Canyon had an outside corner radii of 2.0 t or greater.

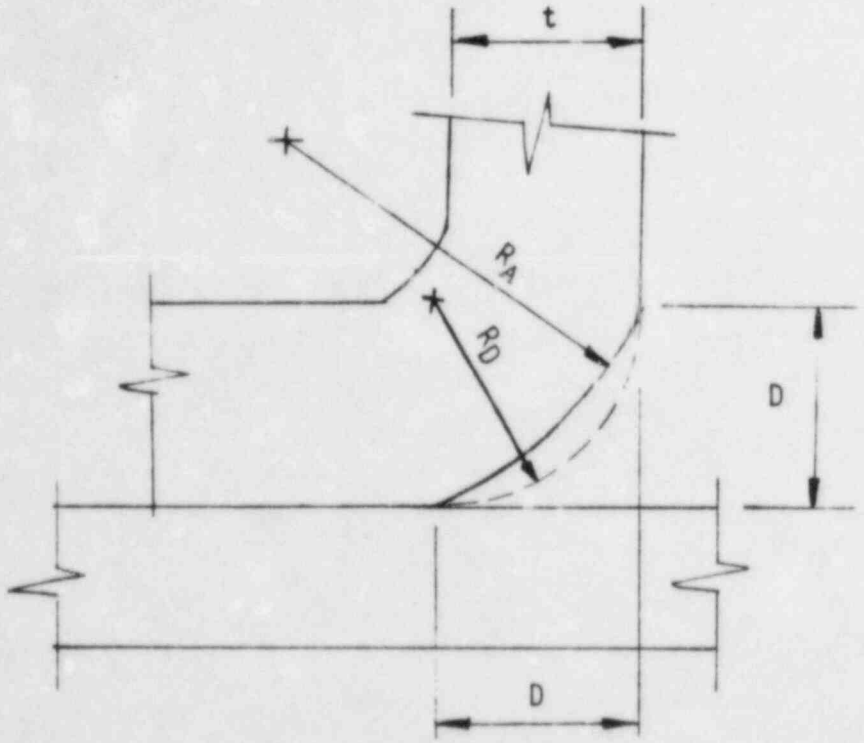
   The NRC Staff and Pullman QC have reported corner dimensions, as measured by the tangent intersection method, rather than measured by a curvature gauge. As discussed above and as shown in the attached figures, these measurement techniques lead to different conclusions. Although measurement of corner radii had never been an inspection requirement, a few jobsite measurements had confirmed the radius was 2.0 t or greater. The recent measurements made using a curvature gauge and the weld testing that measured the effective throats of the associated flare bevel welds reconfirmed the validity of the 2.0 t or greater radius.

3. Determine and explain the full scope of any necessary corrective actions.

   Regardless of how the tube corners are measured, the flare bevel welds are more than adequate, and no corrective action is required.

Conclusion

This letter has provided the results of PGandE's investigation into the subject of tube steel corner radius and radius effect on the adequacy of flare bevel weld effective throat. The weld test data shows that significant margins exist. No further actions are required.



t = wall thickness of the tube

R_D = implied radius

R_A = actual radius of the corner curvature

D = corner dimension

Fig. A

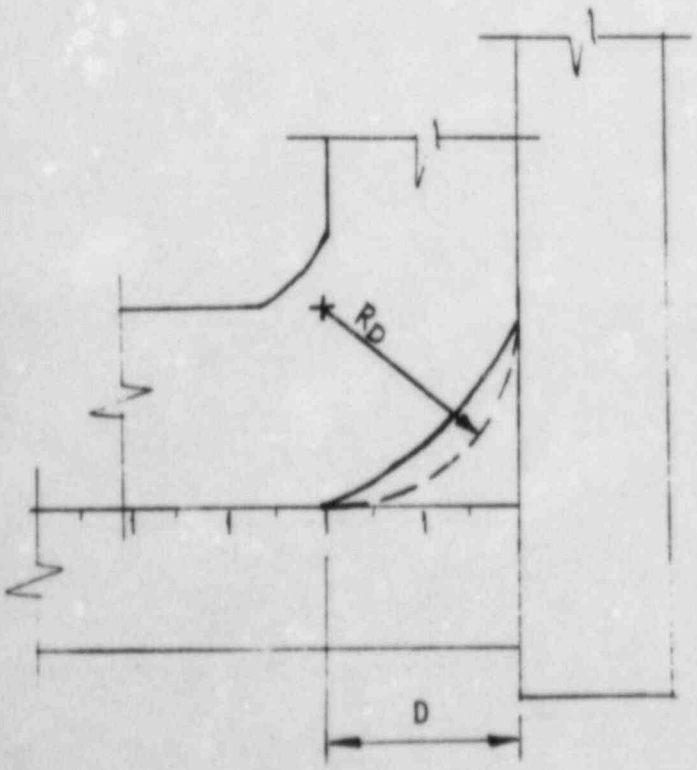


Fig. B

Straight Ruler Method

The implied radius R_D is taken as the measured D dimension

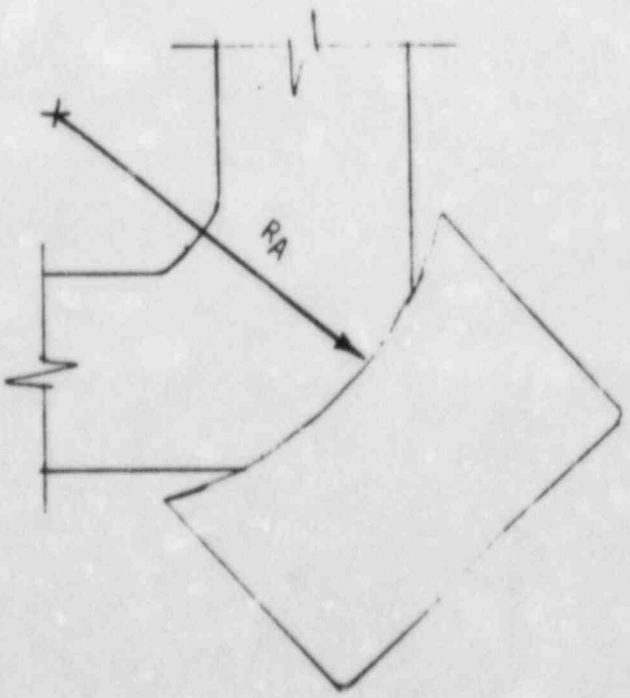


Fig. C

Concave Radius Gage Method

The actual radius of the curvature is measured

TABLE 1A

3 x 3 x 1/4 SQUARE TUBING

Number	Sample	Corner Dimension (D)*		Radius of Curvature (R_A)**
#1	A	11/32	13/32	1/2
	B	7/16	3/8	1/2
	C	3/8	7/16	1/2
	D	13/32	11/32	1/2
#2	A	11/32	13/32	1/2
	B	13/32	3/8	17/32
	C	3/8	13/32	17/32
	D	3/8	11/32	17/32
#3	A	3/8	13/32	17/32
	B	13/32	11/32	1/2
	C	15/32	13/32	1/2
	D	13/32	3/8	17/32
#4	A	3/8	7/16	17/32
	B	7/16	11/32	1/2
	C	3/8	3/8	1/2
	D	7/16	3/8	17/32

*Corner dimension, D, equals implied radius, R_D. (Tangent Intersection Method)

**Radius of curvature, R_A, always equals or exceeds 2.0 t.

TABLE 1B

3 x 3 x 1/2 SQUARE TUBING

Number	Sample	Corner Dimension (D)*		Radius of Curvature (R_A)**
#1	A	17/32	15/32	1
	B	1/2	17/32	1
	C	9/16	17/32	1
	D	17/32	9/16	1
#2	A	1/2	1/2	1
	B	17/32	9/16	1
	C	15/32	7/16	1
	D	7/16	15/32	1
#3	A	1/2	15/32	1
	B	9/16	1/2	1
	C	9/16	17/32	1
	D	15/32	9/16	1

*Corner dimension, D, equals implied radius, R_D. (Tangent Intersection Method)

**Radius of curvature, R_A, always equals or exceeds 2.0 t.

TABLE 2A

TEST RESULTS OF EFFECTIVE THROAT OF FLARE BEVEL WELDS

3 x 3 x 1/2 TUBE, CORNER DIMENSION = 1/2" (NOMINAL)

Position	1/8 Dia. Electrode	3/32 Dia. Electrode
1G	31/64, 30/64, 32/64	27/64, 26/64, 26/64
2G	28/64, 28/64, 29/64	26/64, 26/64, 27/64
3G	32/64, 31/64, 34/64	26/64, 24/64, 26/64
4G	31/64, 28/64, 30/64	26/64, 24/64, 25/64

NOTES:

1. Effective throat used in design calculations = 20/64".
2. Above test results show that the actual weld effective throats exceed the value (20/64") used in the design calculations.

TABLE 2B

TEST RESULTS OF EFFECTIVE THROAT OF FLARE BEVEL WELDS

3 x 3 x 1/4 TUBE, CORNER DIMENSION = 5/16" (NOMINAL)

	1/8 Dia. Electrode	3/32 Dia. Electrode
1G	14/64, 14/64, 16/64	17/64, 18/64, 17/64
2G	16/64, 16/64, 17/64	19/64, 18/64, 19/64
3G	18/64, 18/64, 17/64	19/64, 19/64, 14/64
4G	18/64, 19/64, 19/64	21/64, 20/64, 19/64

NOTES:

1. Effective throat used in design calculations = 10/64".
2. Above test results show that the actual weld effective throats exceed the value (10/64") used in the design calculations.