PACIFIC GAS AND ELECTRIC COMPANY

PG&E 77 BEALE STREET • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211 • TWX 910-372-6587

J. O. SCHUYLER
VICE PRESIDENT
NUCLEAR POWER GENERATION

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,

J. O. Schuyler

Enclosure

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

8404170468

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. H. 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.

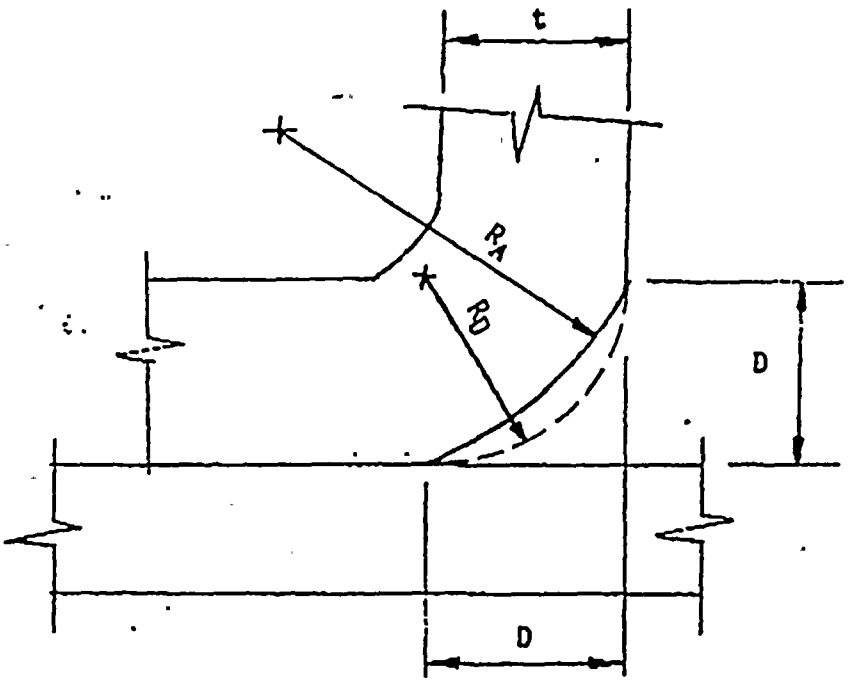
   The NRC Staff and Pullman QC have reported corner dimensions, as measured by the tangent intersection method, rather than measured by a curvature gauge. As discussed above and as shown in the attached figures, these measurement techniques lead to different conclusions. Although measurement of corner 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

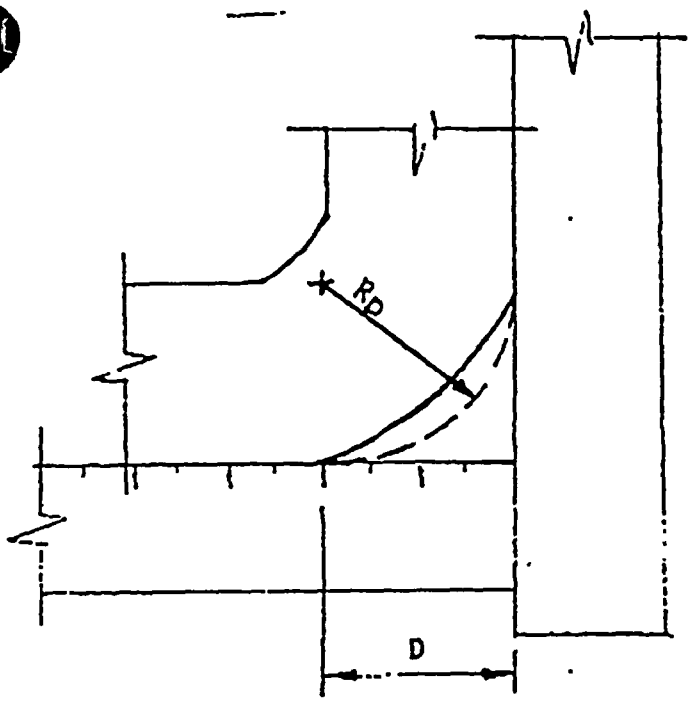


Fig. B
Straight Ruler Method
The implied radius R_D is taken as the measured D dimension

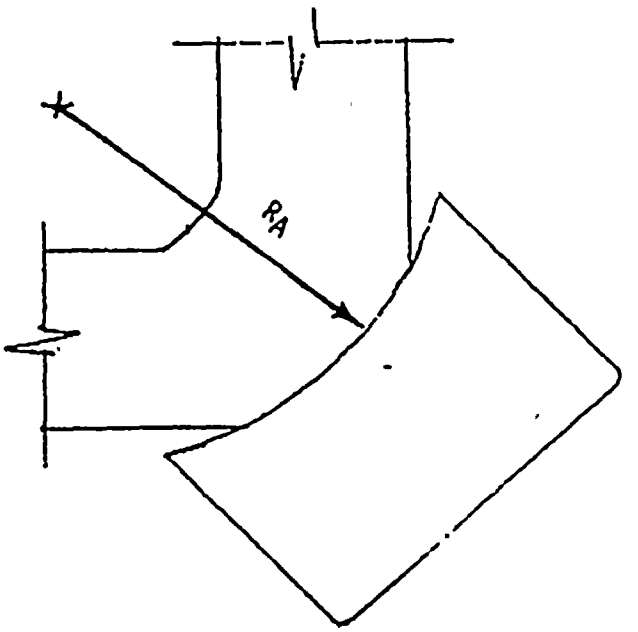


Fig. C
Concave Radius Gage Method
The actual radius of the curvature is measured

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.

INTEROFFICE CORRESPONDENCE

DATE July 30, 1982

TO H. Karner, QA/QC Manager

FROM H. Hudson, Internal Auditor

SUBJECT Exit Conference with PG&E Auditors concerning Program Audit #20705, "Quality Assurance Program".

The Exit Conference with PG&E Auditors was held on 7-29-82 and audit findings were discussed. It was stated that the scope of the audit was a Supplier and Program audit. The main concern was the implementation of the administration of Quality Assurance. See the attached list for conference attendees. The following items were discussed:

1. Previous audit findings were looked at. Noted that the Internal Audit schedule was very effective. Noted that Management audits were okay and that QA interface was okay.

2. Internal Audits were adequate. Stated that the last two years, a good audit program was in effect. Two recommendations:

   A. Cases where Inspectors or others did not follow procedures, the Steps to Prevent Recurrence were to reindoctrinate but there was no documentation to back this up. Recommended Pullman provide form to document reindoctrination as well as use Internal Auditor letters reminding of procedure requirements. RECORDS OF ON THE JOB TRAINING ARE BEING MAINTAINED AND RECORDED IN EACH INDIVIDUALS FILE UNDER OJT. THIS WAS IDENTIFIED TO AUDITORS. WE NEED TO BE SURE AND TAKE HHC 8/6/82 CREDIT FOR IT.

   B. Internal Auditor qualification appears to be to ANSI Standard but no statement that it is. Recommends Pullman state Internal Auditor is qualified to ANSI Standard. N 45.2.23 HHC

3. Training of NDE Inspectors to SNT-TC-1A was adequate. But other Inspectors should be qualified to ANSI N45.2.6 standards. There is no evidence that they are. This will be an open item to re-audit at a later date. P.G.E. HAS NOT STATED IN WRITING THAT PULLMAN MUST COMPLY WITH ANSI N45.2.6. (REF: 8711) WE ARE NOT

4. Organization was okay. IN VIOLATION OF PGE SPEC OR OUR PROCEDURES ESD 235 + 237. HHC 8/6/82

5. Discrepancy Reports were okay except Steps to Prevent Recurrence needs back up documentation when a person has received reindoctrination. A recommendation was made about the use of tape over penciled in circles which PG&E used to mark the recommended disposition they wanted implemented on a Discrepancy Report. The tape was used to preserve the pencil marks from wear. The auditor called this system "hokey".

SEE 2.A ABOVE HHC. 8/6/82

Martin Exhibit 13

TO: H. Karner, QA/QC Manager DATE July 30, 1982

SUBJECT: Exist Conference with PG&E Auditors concerning Program Audit #20705, "Quality Assurance Program".

5. Continued I HAVE ADDED A STATEMENT TO EACH D.R. TO INDICATE APP. BY CIRCLING THE APPROPRIATE "RECOMMENDED DISPOSITION". HK 8/6/82

He recommended that a formatized method be implemented for PG&E to indicate theeir preference in Discrepancy Report Dispositions. The auditor alsso made an observation about the number of open Discrepancy Reports going back to 1978. Pullman responded that these open Discrepancy Reports were Unit #II work still in progress. A REGULAR REPORT IS ISSUED LISTING ALL OPEN D.R.'S AS TOLD TO AUDITOR.

6. Purchase Orders were being let before the QA/QC Manager sign off. Need to establiish management control. The receiving of purchased material was under control. Need to comply with procedure requirements. This would remain as an open item to be reaudited at a later date. An observation was made about Site Approved Vendor's List. There was no approval by PG&E of the list but approval was done on an individual bases by purchase order. HK 8/6/82 ← HANGER 4 RUPTURE RESTRAINT MATERIAL. RHC 8/6/82

7. Design Control was adequately implemented.

8. Drawing Control was adequately implemented.

9. Document Control had an observation made about Isometric packages. Iso packages were complete but documentation not properly arranged into categories per QA Instructions. Stated related documents such as Inspection Check Off Lists were the same way. All information was available but located in different places. Concerned about only one person knowing where documents are located. If he dies, control may be compromised.

Iso packages audited were 1-14-86A, 1-14-85A, 1-14-78A and 1-21-38.

10. Monthly Maintenance Surveillance Reports were audited and only two reports available for July. Pullman response was reports are not turned in until the end of the month.

11. Control of Measuring and Test Equipment had no problems.

12. Control of Inspection and Test Status had an observation concerning piping process sheets. The last two steps on the process sheet were blank due to NDE findings. Recommended that process steps not used have a statement explaining why. THE STEPS WERE CLEARLY NOT REQUIRED DUE TO PREVIOUS COMPLETION OF REQUIREMENTS, ADDITIONAL STEPS SHOULD BE

13. Special Processes of NDE, Welding, Welder Qualification and Welding Material were adequate. N/A HK 8/6/82

Harold Hudson

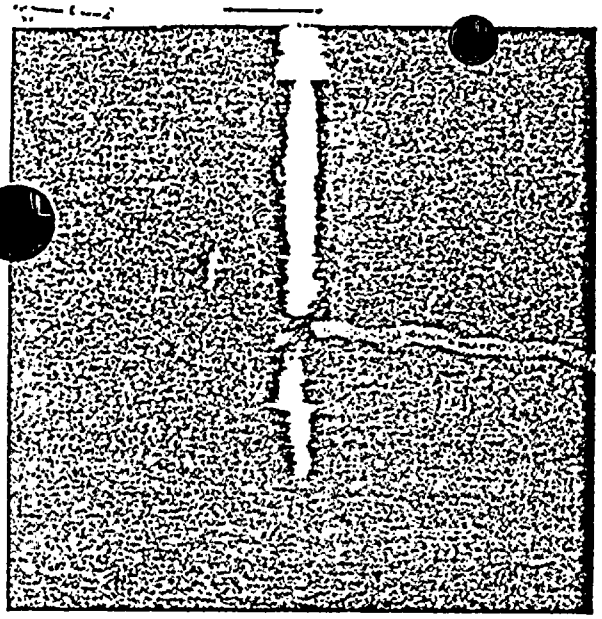
Harold Hudson
Internal Auditor
Diablo Canyon Nuclear Plant

HH/dd
Att.

Pullman Power Products
Program Record Audit

EXIT INTERVIEW 7-29-82

	Name	Position
1.	[illegible]	QA Engr., PG&E
	[illegible]	" "
	J.I. Wilhelmy	" "
	Harold Hudson	PPP [illegible]
	J.A. Ammon	Asst. Mech. Eng. P.G.&E.
	[illegible]	PPP
7.	[illegible]	PPP QC Engineer
	[illegible]	PPP
9.	PETER C. DELLENBACH	BECHTEL - MECH CONST COORD.
10.	Jim Bratton	Lead QC Engineer PG&E
	Harold [illegible]	PPP QA/QC Manager
	Bob Sanderson	HSB AN I
13.	RON KING	PPP Chief Field Eng.



ALLEGER NO. —

DATE: 4/11/84

TIME: 11:02 P.M.

ZONE:

52-264-10

(ESSEX)

DESCRIPTION:

(ESSEX)

PROBLEM DESCRIPTION:

Martin Exhibit 14

TAG NO. 2 ALLEGER NO. 2

UNIT NO. 1 DATE: 4/11/84

ELEV. ~116 TIME: 11:02 P.M.

BUILDING Containment

GENERAL AREA DESCRIPTION:

Line designation No. S2-254-10 (10" line) In the area of PZR & RCP #1-2.

ITEM/COMPONENT/SYSTEM DESCRIPTION:

Weld attaching safety injection accumulator line to nozzle of the cold leg line No. S2-254-10. On the side facing RCP #1 a grinding gouge in the (FW#57) pipe at the pipe weld interface is 3/8" at the widest point and < 1/16" deep. Additionally there appears to be a slight amount of undercut at two locations. The undercut is ~ 5/8 on the weld side facing the RCP and ~ 1" at ~ 120° from the side away from the RCP.

PROBLEM DESCRIPTION: