5/14/84

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of TEXAS UTILITIES GENERATING COMPANY, et al. (Comanche Peak Steam Electric Station Station, Units 1 and 2)	Docket Nos. 50-445-1 and 50-446-1

CASE'S ANSWER TO APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE

1. Applicants make the statement:

"Both the AWS and ASME Codes include requirements for welding procedures that will result in welds that are adequate for their intended uses."

Their facts are incorrect because they present the illusion that either code in and of itself is complete. It further implies that as a result of this independence of codes, ASME does not require consideration of the design restrictions outlined in AWS. Further, this argument of code independence is not borne out in the affidavit of Messrs. Baker, Muscente, et al. where at page 3 they state (last sentence):

> "However, specific and complete design details are not included in either code."

By Applicants' own statement as quoted above, and under the mandate of 10 CFR Part 50, Appendix A, Criterion 1, those items of concern under the provisions of AWS which are applicable to welding in general must also be considered as concerns in reference to the establishment of design parameters and fabrication procedures for ASME.

Further, NRC Staff witness Smith confirmed that the AWS Code is a how-to code, much more specific than the requirements and oriented

towards the welder, providing guidelines (see Tr. 12,176/13-12,177/3).

2. Applicants state:

> "The ASME Code requires that all welding procedures used for the fabrication and installation of components and their supports be qualified by test pursuant to the requirements of Section IX of the ASME Code. In order to satisfy these ASME requirements, each manufactuer or installer performing Code welding must conduct tests necessary to qualify each welding procedure."

This statement is incomplete and misleading, since by inuendo if not by words per se it implies that procedures may be established by tests, even when such tests negate or fail to include a provision of another code such as AWS which is still applicable when the purpose of the code restriction is considered.

3. Applicants state:

> "The AWS Code provides for the use of either prequalified welding procedures (i.e., not requiring qualification testing prior to their use) or welding procedures which are qualified by test."

The Applicants' statement fails to recognize that the design requirements of AWS, whether for qualified or prequalified procedures, must still be considered by those designing welded joints at Comanche Peak. (See NRC Staff Witness Smith, Tr. 12,176/13-12,177/3.)

4. Applicants state:

> "Although its provisions for prequalification are generally applicable to any steel structure, the drafters of the AWS Code have acknowledged the limitations of that Code in stating that 'when using the Code for other structures, owners, architects and engineers should recognize that not all of its provisions may be applicable or suitable to their particular structure.' (AWS D1.2, Commentary on Structural Welding Code, Section 1.1.) (It should be noted that the AWS Code is not applicable to pressure retaining boundaries such as pressure vessels or piping systems (AWS D1.1, Section 1.1.1).)"

This statement is inaccurate and misleading in several respects. First is the fact that while AWS does acknowledge that limitations may exist in discrete areas for some applications (which is a disclaimer

by AWS presuming that there may be more restrictive provisions required for some applications by jurisdictional codes), this disclaimer does not relieve those who establish the design criteria and fabrication procedures from the responsibility of including the areas of AWS (for example, and Blodgett being another example) which are applicable to any structure being welded regardless of the code of record.

The reference in item 4 to the inapplicability of AWS to pressure boundaries is a smoke screen, since the majority of the welding of concern in the allegations is not in reference to the pressure boundary but to supports. But in the event that welding of attachments to piping is applicable, then the restrictive sections of AWS (Beta ratio, for example) still must be utilized by the designer because it is not strength alone that is of concern but whether the weld can be made to the geometry required and whether there are gap problems. (See NRC Staff Witness Collins, Tr. 12,227/17 through 12,228/8, in reference to the notch effect created by gaps in fitup.)

5. Applicants state:

"In qualifying welding procedures in accordance with the requirements of Section IX of the ASME Code (as well as Section 5 of the AWS D1.1 Code), a draft welding procedure is first written describing the precise status of certain variables specified in Section IX of the ASME Code (essentially the same specified in the procedure qualification section of the AWS Code). A test plate or pipe is prepared and welded in strict accordance with the draft welding procedures. Mechanical tests are then performed in accordance with the requirements of Section IX of the ASME Code to determine if the welding process and parameters are acceptable and adequate to produce welds that will withstand design and operating loads."

Applicants' statements contain a mistatement of fact. The test indicates only that the weld produced by the established procedure

does not fail the required test. That has nothing to do with the implementation of the procedure. Problems with residual stress, notch effects, grinding gouges, overheat and underheat and other such problems of the real world are avoided like the plague in tests to establish ASME Section IX procedures. It is not the tests or procedures that determine weld quality, but rather the quality of the welder. (See NRC Staff Witness Collins, Tr. 12,186/8-11.)

6. Applicants state:

"The tests are performed using specimens removed from the test plate or pipe. Each test has a separate purpose in determining whether the weld produced using the welding procedure is structurally sound and capable of withstanding design and operating loads. The tests required by the ASME Code, Section IX (which are essentially the same as endorsed by AWS) are as follows:

"1. Tension tests, used to determine ultimate tensile strength, yield strength and ductility (reported as % elongation and/or % reduction of area);

"2. Guided bend tests, used to determine the degree of soundness and ductility of groove weld joints;

"3. Charpy V-Notch Impact or Drop Weight tests, used to determine the notch-toughness of the weldment (these tests are only performed when fracture toughness is specified in NF-2311, or for integral attachments, when required by other sections of the ASME Code); and

"4. Fillet-weld tests, used to determine the size, contour, and degree of soundness of fillet welds (This test is used to qualify welding procedures when only fillet welds are to be produced using that procedure)."

Applicants' statements here are also misleading in their implications, for the same reasons discussed in answer 5. preceding.

7. Applicants state:

"If acceptable results are obtained from the testing, the procedure has been qualified and a Procedure Qualification Record (PQR) is prepared listing the specified parameters used for the welding."

This statement is not fully responsive to the requirements of

Criterion 1 of 10 CFR Part 50, Appendix A, in that the design restrictions that limit the procedure's indiscriminate use are not listed nor are the design guides outlining the limitations to the welding conditions which would disqualify the procedure; for example, failure to comply with fit-up gaps.

8. Applicants state:

> "All welding procedures qualified by test pursuant to the ASME Code for use at CPSES follow the requirements of Section IX of the ASME Code. This includes following requirements regarding test procedures, testing of specimens, and all other aspects which could affect the procedure qualification process."

As has been the case for several of the items listed above, the limitations for the procedure are not included with the procedure, nor are these limitations incorporated elsewhere (for example, in the design guidelines. This is a failure to consider the back-end requirements for the use of welding procedures; that is, implementation. Rather, at Comanche Peak Applicants are considering the front-end establishment of procedures as encompassing all of the requirements necessary to produce acceptable welds for the life of the plant. This failure in philosophy is best noted in the belated revision of Section XI to the PSE Guidelines in the CPSES Design Manual (see CASE Exhibit 716, attached).

9. Applicants state:

> "If a welding procedure is qualified by test in accordance with each provision of Section IX of the ASME Code, use of that procedure will produce welds that are structurally sound and as adequate for their intended use as welds produced using either prequalified procedures of the AWS Code or procedures qualified by test in accordance with the AWS Code."

The redundancy of Applicants' Statements makes one wonder what is intended. Is the purpose to show that the overall welding program

is adequate and in compliance with the intent of the codes, laws, and standard practices? Or is there some other purpose -- perhaps this is a wish list? For example, item 9 begins with the word "If" and leaves the impression that this is the precise manner in which Comanche Peak conducted their establishment of procedures. I cannot agree that a statement based on a qualifier "If" can be deemed as a fact as to which there is no genuine issue.

10. Applicants state:

"With respect to 'preheat requirements for welds over 3/4-inch thick,' the AWS D1.1 Code addresses preheat requirements for prequalified procedures in Subsection 4.2, 'Preheat and Interpass Temperature Requirements.' (If procedures are to be qualified by test pursuant to the AWS Code, the preheat requirements specified in subsection 4.2 need not be used.) For these prequalified procedures, Table 4.2 establishes preheat requirements based on the type of material and the welding process used. While Appendix D of the ASME Code, Section III, provides guidance for preheat requirements (very similar to that provided in the corresponding sections of AWS), the Code states that during welding procedure qualification, the preheat requirements which have been actually tested and produce acceptable welds are the ones to be specified in the applicable procedures."

The remarks made in this statement are in reference to procedures. Again, we must state that procedures are one world; implementation is yet another. For example, CASE witness Henry Stiner stated that preheating was seldom used (see Testimony of CASE Witnesses Darlene Stiner and Henry Stiner, pages 9/1-3 and 7-9, and 12). Applicants' witnesses indicated that preheating was rigorously adhered to and the impression was given that preheat bottles with torches were readily available and were all over the place (see testimony of Applicants' Witnesses: Brown, Tr. 11464/6-11465/1; Coleman, Tr. 11534/21-11535/8, 11536/1-3, 11536/18-19 -- it should be noted that Mr. Coleman's testimony was at a minimum shifting in this regard, see Tr. 11537/1-20

and 11569/14-11571/20; Pickett, Tr. 11617-9-24, 11643/1-13, 11647/23-11649/12, 11650/25-11651/12; Braumuller and Fernandez, Tr. 11668/10-11670/5). According to Applicants' Witness Coleman, there was at least one bottle for each five welders (Tr. 11567/25-11568/1). Yet the Applicants' chief engineer, who over a period of years with much of this time spent in the field observing welders, had never seen the five-gallon bottles (Tr. 11955/14-11957/13). Mr. Muscente, Applicants' metallurgical expert, testified that one of the reasons for preheating on days on which the temperature was below zero degrees, was to remove condensate from the steel to be welded (at zero degrees, there is no condensate; the problem becomes one of frost) (Tr. 10027, line 16, through 10028, line 9). Beyond this, Mr. Muscente failed to recognize that condensate forms at the dew point and this could very well be at 75 degrees F. at which point preheat is not required because the metal is already in excess of the 70 degree preheat requirement.

11. Applicants state:

"Qualification of procedures in accordance with the ASME Code has resulted in preheat requirements in the applicable CPSES welding procedures that in <u>all</u> cases either meet or exceed those preheat requirements set forth in the AWS Code."

Again, the Applicants address the procedures. One more time, we will state, it is the implementation with which we find fault. As indicated during the NRC Staff's recent investigation into the matter of preheat temperature control:

> "We conclude that although welders in the Hanger Section that we spoke with are aware of preheat requirements, the welders were using subjective judgment to determine temperature rather than a precise measurement."

(See pages 8-12 of Joint Affidavit of William J. Collins, Leslie D. Gilbert, David E. Smith and Robert G. Taylor on Board Inquiries Regarding Welding Fabrication, received by CASE on 4/14/84.)

This is another example where implementation did not match procedures. The fact that procedures exist is not proof that procedures are followed.

12. Applicants state:

"With regard to 'Drag Angle and Work Angle' (which limit the space allowed for the welder to function), neither the AWS nor ASME Codes refer to, or in any way mention 'drag angle' or 'work angle' requirements or restrictions."

The fact that the codes do not mention this item specifically is irrelevant, since it is covered in the AWS handbook, as is conceded in the affidavit of Messrs. Baker, et al. at page 12, third paragraph, continued on page 13, by Mr. Baker:

> ". . . that very portion of the Welding Handbook referenced by CASE and attached to the Doyle Affidavit states that proper work orientation of the weld rod (e.g., drag and work angle) are 'automatically taken into account' by the trained welder."

(It should be noted that, although Applicants now seek to rely upon the training of the welder, CASE was precluded from pursuing this issue with the individuals who actually perform(ed) the welding at Comanche Peak; see Tr. 9934/7-9937/12, 10,091/14-10,092/8, and 11,504/16-23.)

Beyond this, as was stated above, the Applicants' experts have already conceded that neither code contains specifically all of the requirements to design or produce a weld.

13. Applicants state:

"CASE's stated concern regarding improper work angle and drag angle is that it may cause slag entrapment, porosity and undercut. These defects are no different than potential concerns regarding any other weld."

The reference by CASE is to limited access welds in which the angles of the electrode could become critical insofar as slag inclusion. The problem here is far more severe than for welding in unrestricted areas, which is why welding in limited access areas requires special qualification. Therefore, the statement by the Applicants that these defects are no different than potential concerns regarding any other weld is inaccurate. Beyond this, visual inspection cannot detect slag or cracks which are not on the surface (see NRC Staff Witness Collins, Tr. 12,158/14-12,159/8 and 12,187/2-21).

14. Applicants state:

"With regard to 'Beta Factor for Tube-to-Tube Welds,' the Beta Factor (the ratio of the diameters of two adjoining tubes) is referenced in Section 10 of AWS D1.1 Code, subsection 10.12.5, 10.13.5 and Figure 10.13.5. In essence, these references provide that if the Beta Factor is greater than 1/3 for tube-to-tube (circular) connections and greater than 0.8 for box (rectangular) connections, the weld procedure used must be qualified by test (the greater the Beta factor, the more likely that stresses at the joint will be higher). In short, where the likelihood of greater stresses is present, the Beta Factor is used in the AWS Code to indicate that qualification of a procedure by test is required. Significantly, the ASME Code requires that all weld procedures be qualified, without consideration of the likelihood of greater stresses."

This is not an accurate statement, since the AWS Code establishes a reduction factor out to a Beta factor of approximately 2/3 for round tubes. For Beta factors of over 2/3, no credit is taken, which is in line with the recently introduced provisions to the PSE design guide. Tests are not required to establish factors which already exist and will not prove that geometry which cannot be produced is adequate.

15. Applicants state:

"In Mr. Doyle's testimony (CASE Exhibit 669, Vol. I, p. 112), he states as his concern that the Beta factor limit of 1/3 should apply to shielded metal arc fillet welds used when welding trunions to pressure boundary piping. Since such a trunion would be an 'integral

attachment' to the piping, the AWS Code does not apply and the weld must be designed to the applicable pressure boundary subsection in ASME, i.e., NB, NC, or ND. AWS D1.1 (as stated in paragraph 1.1.1) clearly does not apply to this case (i.e., pressure boundary piping)."

The fact that AWS procedures are not applicable does not preclude the consideration of the effects resulting from exceeding the Beta factor of 1/3. The adverse effects of exceeding Beta of 1/3 are conceded by Applicants' experts (see Applicants' statement in item 14 preceding: "the greater the Beta factor, the more likely that stresses at the joint will be higher").

16. Applicants state:

"With regard to 'Lap joint requirements,' Subsection 8.8 of the AWS D1.1 Code provides lap joint requirements for building structures. These requirements are the same as those set forth in Paragraphs XVII-2431, 2452.3(c), 2453.1, 2452.9 and 2283.1(c) of Appendix XVII of the ASME Code (mandatory to CPSES welding in conformance to ASME requirements). (Subsection 9.10 of the AWS D1.1 Code provides corresponding lap joint requirements for bridges, subjected to continuous dynamic loading.)"

The Applicants neglect to note the prohibitions for welded lap joints which may be welded all around on a common plane, which is a prohibited procedure. See CASE Exhibits 1,022, page 89, Structural Details, Figure 8.8.5., and 911, indicating welds at A, B, C, and D on Sketch C, which is a compound of the lap joint shown in Sketches A and B; copies of both Exhibits are attached.

17. Applicants state:

"With regard to 'Limitation on weld size relative to plate thickness,' limitations are addressed by AWS D1.1 Code in Subsections 2.7 (fillet welds) and 2.10 (partial penetration groove welds). These subsections basically provide that with regard to fillet and groove welds, welds to be made without qualifying the applicable procedure by test shall conform to the minimum size requirements of Tables 2.7 and 2.10.3, respectively. These requirements are identical to or less stringent than those required at CPSES by the ASME Code in Appendix XVII, Table XVII-2452.1-1."

The statement is made by Applicants "These subsections basically provide that with regard to fillet and groove welds, welds to be made without qualifying the applicable procedure by test shall conform to the minimum size requirements of Tables 2.7 and 2.10.3, respectively." This statement refers to controlling heat input which by Applicants' procedures is not controlled to ensure minimum weld heat input. The requirements also appear in the ASME Code, Appendix XVII, Table XVII-2452.1-1, which is in a Code that recognizes that the welds to be used require qualification testing and yet must also meet minimum size criteria.

The purpose of the ASME requirement is the same as the AWS requirement. (See AWS Commentary, 2.7.1., CASE Exhibit 909, attached, ". . . to reduce the possibility of cracking in either the heat affected zone or the weld metal.") Therefore, once violated, this minimum weld requirement cannot be rectified by capping the weld.

18. Applicants state:

"Neither the AWS nor ASME Codes establish specific requirements limiting weave or oscillating pattern welding. Accordingly, there are no specific Code requirements."

The ploy by Applicants that something is not prohibited by code is irrelevant. It might also be stated that the AISC code does not prohibit construction of joints in steel structures by the use of nails. The Code does not always include prohibitions which are obvious or known in the industry to result in less than desired end products. Merely because the code does not prohibit does not therefore mean that the code condones. The AWS Handbook, Sixth Edition, Section 4, page 63.25, lists the stringer bead as the

preferred procedure (see CASE Exhibit No. 886, attached). The AWS Code, by inference (size of rods vs. size of welds), indicates that the stringer bead is the intended procedure. Beyond this, the unrestricted four core wire diameter established at CPSES allows the craft to produce weld beads which are larger than allowed by Code, particularly when considering the welding of cable trays, for which the welding jurisdiction is AWS. (See NRC Staff Witness Collins, Tr. 12,215/18 through 12,216/2, weave bead welding is also restricted by this limit.) Beyond this, the crafts have assumed that the four core wire diameter parameter applies to the leg (or weld size) when in fact it refers to the face width (see NRC Staff Witnesses Gilbert and Taylor, Tr. 12,217/4 through 12,218/1.)

19. Applicants state:

> "Neither the ASME nor AWS Codes exclude use of downhill or uphill welding. However, the ASME Code and the AWS Code specify that the direction of travel must be listed. At CPSES, Brown & Root welding procedures state that in all instances the direction of progression will be upward. Other contractors, in a few instances, use downward progression as specified in their welding procedures."

This is not a fully accurate statement. The AWS Code for prequalified welding at 4.10.7 states that the weld progression for vertical welding will be uphill (see CASE Exhibit 971, attached; see also Applicants' Exhibit 141-N through 141-V; attachments to Applicants' Witness Brandt's prefiled testimony in September 1982 hearings). (Section 5 introduces a qualifier but this is for qualified welding; see CASE Exhibit 1,022, AWS 5.5.2.1, No. 10, attached.) The unqualified statement made by Applicants is therefore inaccurate.

Beyond this, if downhill welding is not a qualified procedure at Comanche Peak, Section 5 of AWS would not apply. Therefore,

progression must by code be uphill.

20. Applicants state:

"Cap welding is not terminology common to welding. Code requirements for other welding apply equally to cap welding. Indeed, the AWS Code at Section D1.1, subsections 3.7.1, (1975 Revision) specifically endorses it."

This statement is inaccurate in its inference. The intent of this code requirement is to add welds to a first pass which is structurally inadequate, not to add weld to a pass which may have cracks within the weld metal due to a minimum weld violation (see CASE Exhibit 1,022, AWS 3.7.1., attached). See also AWS Commentary 2.7.1., Single Pass Requirements for Minimum Welds (CASE Exhibit 909, attached).

21. Applicants state:

"Neither Code provides any unique restrictions in placing new weld material on an old weld, or even requires its consideration as an essential or non-essential variable."

This is not an accurate statement. See 2.7.1., AWS Commentary (CASE Exhibit 909, attached) which states: "Each individual pass of a multiple pass weld must have the same heat input as provided by the minimum fillet weld sizes as required by Table 2.7."

22. Applicants state:

"CASE's apparent concern regarding this issue is that some fillet welds in the plant were found to be approximately 1/16 inch below the minimum size specified in the ASME Code. These welds were subsequently corrected. It should be noted that in no instance did any welder or QC inspector report a crack in any of the welds."

Correction of such welds cannot be achieved by capping, as discussed in the preceding answers. Applicants did not state how their QC inspectors or welders could have detected cracks at the root of the weld or other internal cracks; such detection would have been impossible, since if a weld has been ground down, visual inspection is

not adequate to insure the integrity of the weld (see NRC Staff Witness Collins, Tr. 12158/14-12160/14 and 12163/12-25).

23. Applicants state:

> "The apparent welds of concern to CASE were designed to resist extensive and substantial seismic loading well in excess of any external loading that likely did occur from the time that the welds were made until they were built up. In this regard, it should be noted that even with undersized welds, the AWS Code states that the weld is still acceptable even if undersized 1/16 of an inch for 10 percent of the weld length (AWS Code, Sections 8.15.1.6 and 9.25.1.6). The ASME Code added this provision to Subsection NF in the winter 1983 addenda."

The statement by the Applicants in reference to the design loads is irrelevant, since the problem created in the weld occurs during the transition from a molten through a plastic to a solid state. The design loads never occur when the weld is in this state or in this transition. They only occur at such time that the weld is in a solid state. The statement that the AWS code states that the weld is still acceptable with 10 percent of its length undersized by 1/16 of an inch first refers to welds designed on basis of strength, not to minimum weld requirements. Beyond this, the reference is to 10% of the weld being undersized, not to the full weld being undersized. (See CASE Exhibit 1,022, AWS 8.15.1.6, attached.) This is yet another statement by the Applicants which is in error.

24. Applicants state:

> "The primary reason for internal cracking is not an undersized pass, but rather a weld pass that is too thick."

This is another area where the Applicants are at best incorrect in relation to the minimum weld problems. The thick weld to which Applicants refer is based on the depth of weld to weld face ratio problem (see page 7.2-8, Figure 9; also paragraph 2 of Section 10, Internal Cracks and Weld Width to Depth of Fusion Ratio, CASE Exhibit

950, copy attached). The problem for minimum weld violations is also covered in the Commentary for AWS 2.7.1. (CASE Exhibit 909, attached), as discussed above. See also AWS Handbook, Section 2, 5th Edition, pages 25.14, 25.18, and 25.19.

25. Applicants state:

> "To prevent underbead cracking, only low hydrogen type electrodes are utilized and the bulk of the pipe support fabrication employs low carbon steels not susceptible to underbead cracking problems. For those special items utilizing steels which may be subject to underbead cracking, welding procedures are utilized which contain the necessary preheat or post weld heat treatment requirements to eliminate the metallurgical conditions which are nec ssary for underbead cracking to occur."

We do not totally agree with the statements made. For example, low carbon steels may be less susceptible to underbead cracking but we do not concur that they are not susceptible. Also, the procedures outlined don't necessarily indicate the level of implementation achieved. (See NRC Staff Witness Collins: Tr. 12,169/10-20, when slag is entrapped, it produces a notching effect in the weld; 12,170/20-25, and 12,171/1, due to its nature, a slag inclusion itself would have a series of cracks in it and would create a notch; 12,173/2-10, slag induces a potential stress raiser; 12,227/17-25 and 12,228/1-8, included slag is similar to fitup gaps in that it produces a notched effect; 12,266/5-13, unlike the Applicants, NRC Staff Witness Collins states that underbead cracking, although unlikely, can occur. These statements by the NRC Staff are all based on the assumption of idealized implementation of procedures.)

In addition, NRC Staff's Mr. Collins is in conflict with the Applicants' position that with low carbon steels and low hydrogen rods, hydrogen embrittlement is no problem (see Tr. 12,264/21-12,265/5).