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USNRC

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

'84 SEP 12 A11:13

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

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

NRC STAFF PROPOSED FINDINGS OF FACT
ON WELD FABRICATION

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September 7, 1984

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ON WELD FABRICATION

I. INTRODUCTION

These findings of fact address issues relating to weld fabrication at the Comanche Peak Steam Electric Station ("CPSES"), located in Somervell County, Texas.

II. BACKGROUND

1. On June 16, 1980, the Board admitted Contention 5 of the Intervenors, Citizens Association for Sound Energy (CASE), as an issue in this proceeding. Order Subsequent to the Prehearing Conference of April 30, 1980 (June 16, 1980) (unpublished). Contention 5 alleges:

> The Applicants' failure to adhere to the quality assurance/quality control provisions required by the construction permits for Comanche Peak, Units 1 and 2, and the requirements of Appendix B of 10 C.F.R. Part 50, and the construction practices employed, specifically in regard to concrete work, mortar blocks, steel, fracture toughness testing, expansion joints, placement of the reactor vessel for Unit 2, welding inspection and testing, materials used, craft labor qualifications and working conditions (as they may affect QA/QC) and training and organization of QA/QC personnel, have raised substantial

> questions as to the adequacy of the construction of the facility. As a result, the Commission cannot make the findings required by 10 C.F.R. 50.57(a) necessary for issuance of an operating licensing for Comanche Peak.

2. To support its allegations, CASE has presented the testimony of two witnesses, Henry A. Stiner and his wife, Darlene K. Stiner. See CASE Ex. 666, Tr. 4203 (Henry A. Stiner); CASE Ex. 667, Tr. 4125 (Darlene K. Stiner). Mr. and Mrs. Stiner have alleged that certain of the welding practices utilized in the construction of the CPSES have created significant safety problems. Specifically, CASE contends that Applicants' widespread and improper use of "weave welds," "downhill welds," and "plug welds" has imperiled the safety of CPSES and constrains the Board from concluding that the facility poses no threat to the safety of the public. Additionally, CASE contends that Applicants' weld rod distribution system does not ensure that defective materials are not utilized in the welding process.

3. In response to the testimony of Mr. and Mrs. Stiner, Applicants presented the "Rebuttal Testimony of C. Thomas Brandt, Ronald G. Tolson, Gordon R. Purdy, Raymond J. Vurpillat and Randall D. Smith Regarding Quality Assurance/Quality Control (Applicants' Exhibit 141, ff. Tr. 4390). Following the close of the hearing sessions on Mr. and Mrs. Stiner's welding concerns, the Board issued a series of decisions which found that Applicants had not presented sufficient evidence on weave welding, downhill welding, "plug" welding and weld rod control. See Proposed Initial Decision (Concerning aspects of construction quality control, emergency planning and Board questions) (July 29, 1983); Memorandum and Order (Emergency Planning, Specific Quality Assurance Issues and Board

Issues) (September 23, 1983); Memorandum and Order (Reconsideration of Order of September 23, 1983). In its January 3, 1984 Memorandum and Order (Additional Scheduling Order), the Board also requested the Applicants and Staff to set forth the "legal context" on weave welding, downhill welding, preheat requirements, and cap welding. Accordingly, all parties were permitted to present additional evidence on these welding issues.

4. For CASE, Mr. and Mrs. Stiner presented additional testimony at the March and April, 1984 hearing sessions. CASE Ex. 919, ff. Tr. 10,333 (Henry Stiner and Darlene Stiner).

5. Applicants' presented ten witnesses to respond to the allegations of Henry and Darlene Stiner. Applicant Ex. 177, ff. Tr. 9976. These witnesses are: William E. Baker, Matthew D. Muscente, C. Thomas Brandt, Fred E. Coleman, Clifton R. Brown, Jimmie D. Green, John E. Hallford, Armand M. Braumuller, Salvador Fernadez, and Isaiah Pickett. See Applicants' Rebuttal Testimony, App. Ex. 177, ff. Tr. 9976.

6. William E. Baker has been employed for the past six years by Brown & Root as the Senior Project Welding Engineer at CPSES. Applicant Ex. 177 at 1. Mr. Baker has more than 28 years experience in the welding industry during which time he worked at several nuclear power plants. Id., Attachment A. As Senior Project Welding Engineer, Mr. Baker is responsible for developing and administering a welding program that complies with the requirements of the ASME Code. Id.

7. C. Thomas Brandt is currently the Quality Assurance Staff Engineer at CPSES. Prior to his selection for this position, Mr. Brandt was the Site Quality Assurance Manager at CPSES. See Attachment to Applicants'

Ex. 141, ff. Tr. 4390. In that capacity, Mr. Brandt was responsible for administering Applicants' quality assurance ("QA") and quality control ("QC") program at CPSES. Id.

8. Matthew D. Muscente is a metallurgical engineer and has served as Brown & Root's Materials Engineering Manager since July 1980. Applicants' Ex. 177, Attachment B. For more than 25 years, Mr. Muscente has been involved in the design, engineering, fabrication, material selection, examination, and emplacement of engineered equipment and systems, including pressure vessel pumps and piping. Id.

9. Fred E. Coleman is currently a QC welding inspector at CPSES. Mr. Coleman has been employed in positions associated with welding for about 18 years, seven of them in the nuclear power industry. During the period August 1976-August 1983, Mr. Coleman was either a structural welder or welding foreman (assisting about 5-15 welders) at CPSES. During this time, Mr. Coleman worked as a welder in the same general area (but not on the same crew) as Darlene Stiner, and was Henry Stiner's welding foreman during much of his first term of employment. Applicants' Ex. 177 at 2.

10. Clifton R. Brown also is a QC welding inspector at CPSES. For the past six years he has been employed in welding related positions. From February 1980-November 1982, Mr. Brown was employed as a structural welder and welding foreman (assisting about 9 welders) at CPSES. Applicants Ex. 177 at 2. Mr. Brown worked as a welder in the same areas as Henry H. Stiner during the latter's first term of employment and was Mr. Stiner's welding foreman during his second term of employment. Id.; Tr. 11,462 (Brown).

11. Jimmie D. Green has been employed by Brown & Root, Inc. at Comanche Peak for about five and one half years and was Mr. Stiner's foreman during his second term of employment. Applicants' Ex. 177 at 3; Tr. 11,725 (Green).

12. John E. Hallford is currently employed by Brown & Root, Inc. as the General Foreman of Pipe Hangers at CPSES. Mr. Hallford was Henry Stiner's General Foreman during his second term of employment. Applicants' Ex. 177 at 3. Because of a death in his family, Mr. Hallford was excused from testifying in this proceeding. Tr. 11,022.

13. Isaiah Pickett has been employed at CPSES for about seven and one half years. For the past four years, Mr. Pickett has worked as a structural welder. Mr. Pickett was on the same crew as Mr. Stiner during the latter's first term of employment at CPSES. Applicants' Ex. 177 at 3.

14. Armand M. Braumuller has been employed as a structural welder at CPSES for about four years. Mr. Braumuller, who has almost more than twenty-eight years of welding experience, worked on the same crew as Mr. Stiner during the latter's first term of employment. Applicants' Ex. 177 at 4.

15. Salvador Fernadez has been employed by Brown & Root, Inc. at CPSES for approximately seven years (as a welder for about five years) and worked on the same crew as Henry Stiner during Mr. Stiner's last term of employment. Applicants' Ex. 177 at 4.

16. The NRC Staff presented four witnesses to address Henry and Darlene Stiner's allegations. See NRC Testimony on Welding Fabrication Concerns Raised by Mr. and Mrs. Stiner ("Staff Testimony"), ff. Tr. 12,146.

The Staff's witnesses were Leslie D. Gilbert, Reactor Inspector (Mechanical), Division of Reactor Safety and Projects, Region IV; Robert G. Taylor, also a Reactor Inspector in Region IV and formerly Senior Resident Inspector for Construction ("SRIC") at CPSES; William J. Collins, Senior Metallurgical Engineer, Office of Inspection and Enforcement; and David E. Smith, a Materials Engineer in the Materials Engineering Branch of the NRC's Division of Engineering. Mr. Smith is also a past Chairman of the American Welding Society's B4 Committee on "Mechanical Testing of Welded Joints." Id., Attachment 1.

III. CONTENTION 5 AND THE LAW APPLICABLE TO MR. AND MRS. STINER'S WELD FABRICATION CONCERNS

1. Contention 5 questions the adequacy of Applicants' construction quality assurance ("QA") and quality control ("QC") programs, based upon alleged construction deficiencies. Applicants are required by 10 C.F.R. § 50.34 to develop and implement a QA program (including QC measures) in accordance with the 23 criteria set forth in 10 C.F.R. Part 50, Appendix B ("Appendix B"). While Applicants may delegate the task of establishing and implementing the QA program to their subcontractors or consultants, Applicants retain ultimate responsibility for the adequacy of their QA program. Appendix B, Criterion I; see Commonwealth Edison Company (Byron Nuclear Power Station, Units 1 and 2), LBP-84-2, slip op. at 4 (January 13, 1984), remanded on other grounds, Commonwealth Edison Co. (Byron Nuclear Power Station, Units 1 and 2), ALAB-770 (May 7, 1984).

2. Applicants' QA organization must be insulated from cost and scheduling influences and vested with sufficient authority to identify nonconforming conditions, recommend or initiate corrective action,

and verify that identified non-conformances have been corrected. Criterion I, Appendix B. The QA program must be established at the earliest practicable time, and documented in written procedures, policies and instructions. Criterion II, Appendix B.

3. Applicants' QA program must establish procedures and criteria for the control of "special processes" such as welding, such that only "qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria and other special requirements" are utilized in these special processes. Criterion IX, Appendix B.

4. Criteria X and XIV establish requirements for inspection and testing of, inter alia, fabricated components, structures and systems, to assure identification and correction of deficiencies, and to prevent inadvertent operation of those structures, systems, and components.

5. Criteria XV and XVI set forth requirements on the procedures controlling the disposition of nonconforming materials, parts, or components, including notification of the appropriate organization of the nonconforming conditions. Moreover, these nonconformances must be "promptly identifi[illegible] and corrected," and the cause of the nonconformance identified to preclude recurrence. Crit[illegible] XVI, Appendix B.

6. The overall ta[illegible] the Board is to determine whether Applicants have complied with these provisions of Appendix B to a sufficient extent to enable the Board to make the findings required by 10 C.F.R. § 50.57(a). In particular, 10 C.F.R. § 5[illegible] 57(a) requires the Board, to make the fol-

lowing findings before it may grant Applicants' request for an operating license:

> (1) Construction of the facility has been substantially completed, in conformity with the construction permit and the provisions of the act as amended, and the rules and regulations of the Commission;
>
> (2) The facility will operate in conformity with the application as amended. . . .;
>
> (3) There is reasonable assurance (i) that the activities authorized by the operating license can be conducted without endangering the health and safety of the public. . .

7. It is not necessary that Applicants demonstrate perfection in building CPSES. The existence of construction defects due to QA lapses is, by itself, not sufficient cause for denying an operating license. Union Electric Co. (Callaway Plant, Unit 1), ALAB-740, 18 NRC 343, 346 (1983); see also Cleveland Electric Illuminating Company (Perry Nuclear Power Plant, Units 1 and 2), LBP-83-77, 18 NRC 1365, 1366-67 (1983). Rather, the ultimate question to be answered is whether there has been a breakdown in the QA program at CPSES "of sufficient dimensions to raise legitimate doubt as to the overall integrity of the facility and its safety-related structures and components." Callaway, 18 NRC at 346; see also Perry, 18 NRC at 1368, and n.6.

IV. FINDINGS OF FACT

A. MR. AND MRS. STINER'S WELDING BACKGROUND AND QUALIFICATIONS

A.1. Henry A. Stiner was hired by Brown & Root on December 5, 1979, Applicants' Ex. 177 at 5 (Baker), and shortly thereafter was assigned to Applicants' welder training program. Tr. 11,880 (Baker). Darlene Stiner was hired by Brown & Root on August 26 1977 as a substation attendant, a clerical position. Tr. 4128. Her duties as a substation attendant were to verify that welders accounted for the weld rods issued to them during their shift. Id. Ms. Stiner remained in that position until she finished welder training school in February 1979, at which time she transferred to the hanger department. Id. Mrs. Stiner worked as a welder from February 1979 until July 1980. Tr. 4130. Shortly thereafter, she took a position as a QC inspector. Id.

A.2. Mrs. Stiner had no previous welding experience prior to her employment at CPSES. See Tr. 4126-28. Mr. Stiner, however, had been a self-employed welder for two years before he came to work for Brown & Root at CPSES. Tr. 4255.

A.3. At CPSES, before a welder is assigned to work in the field, he must be qualified. Tr. 9982-86 (Baker). A welder may not use a welding technique for which he has not been qualified. See Tr. 9982 (Baker).

A.4. Brown & Root operates a Welder Training and Qualification Test Center (WTQC) which provides instruction in the welding techniques and procedures used by Brown & Root at CPSES and administer qualifying examinations. See Tr. 4234 (H. Stiner). The WTQC is staffed by experienced welders who provide hands-on instruction. See Tr. 4211 (H. Stiner).

A.5. A welder must be qualified to use weld procedure 11032 (ASME) to weld on hangers and pipe supports at CPSES. On the other hand, qualification on procedure 10046 (AWS) is sufficient for welding on cable tray supports. Tr. 12,173 (Taylor); Tr. 11,247 (Brandt).

A.6. Henry Stiner was qualified to use Procedures 11032 and 10046 on February 11, 1980. Applicants' Ex. 177 at 5 (Baker). Mr. Stiner worked as a structural welder at CPSES from that date until he was terminated on November 26, 1980. Id. He was rehired in June 1981, and after requalifying to use Procedures 11032 and 10046, worked for approximately three weeks before he was terminated again in July 1981. Id. Darlene Stiner received her certification to use those procedures on February 27, 1979. Id.

B. WEAVE WELDING

B.1 Mr. and Mrs. Stiner's Understanding of Weave Welding

B.1.1. Henry and Darlene Stiner allege that "weave" welding or "weave bead" welding is a common practice at CPSES. Tr. 4210-11 (H. Stiner); Tr. 4147, (D. Stiner). According to the Stiners, a weld that was made by "weave welding" is structurally unsound. See CASE Ex. at 5-14; CASE Ex. 667 at 13.

B.1.2. A "weave" weld is defined in the 1974 ASME Code (the Code of record in this proceeding) as a weld containing an oscillating, or weaving, pattern. Staff Testimony at 4-5 Tr. 12,153 (Collins, Smith). In this respect, it is distinguishable from a "stringer bead" weld which is one made without appreciable transverse oscillation. Staff Testimony at 5 (Collins and Smith). The ASME Code states only that a weave weld is one made with "significant" transverse oscillation. Id.; Tr. 12,153 (Collins). Similarly, the AWS Code does not quantify the degree of oscillation necessary to constitute a weave weld. Id. The nuclear industry, however, generally regards a weave weld to be a weld which has transverse oscillation (i.e., bead width) greater than four times the width of the weld rod used to make it. Tr. 12,155; Tr. 12,209 (Collins).

B.1.3. Weave welding is not in itself prohibited by the 1974 ASME Code. In fact, weave welding is regarded by the Code as a "nonessential variable," which means that a change in welding procedure from a stringer bead (i.e., non-oscillating) pattern to a weaving (i.e., oscillating) pattern may be made without having to requalify the entire procedure. Tr. 12,156; Staff Testimony at 5 (Gilbert and Taylor). The only instance in which a change from stringer bead welding to weave welding is not permitted is where the base metal involved is required to be Charpy impact tested for notch toughness. Id.; Tr. 12,156 (Collins).

B.1.4. Henry Stiner and Darlene Stiner testified that weave welding is not permitted at CPSES. Tr. 4147 (D. Stiner); Tr. 4211 (H. Stiner). The Stiners testified that they were advised of the prohibition against weave welding by their instructors at the WQTC. Tr. 4211 (H. Stiner); Tr. 4147 (D. Stiner). Mr. and Mrs. Stiner state that after they were assigned to weld in the field, however, they were ordered by their supervisors to weave weld in violation of procedures. Tr. 4211 (H. Stiner); Tr. 4148 (D. Stiner). According to the Stiners, only stringer bead welding is permitted by procedures 11032 and 10046. Tr. 4147-48 (D. Stiner); Tr. 4210(H. Stiner).

B.1.5. Mr. and Mrs. Stiner are correct that "weave" welding is not permitted at CPSES. On this point there is no dispute. See e.g., Tr. 11,625 (Pickett) (weave welding was "against regulations"). The critical issue is the applicable definition of a "weave" weld. Neither the ASME Code nor the AWS Code provides a clear guide on this point. The ASME Code states that a weave weld is one made with "significant transverse oscillation," Tr. 12,155; Staff Testimony at 5, while the AWS Code defines a weave weld as one made "with transverse oscillation." Id. Neither code sheds further light on how to distinguish a "weave" weld from a "stringer bead" weld which is defined as a weld made without "appreciable" transverse oscillation. Id. Rather, the Codes' definitions are intended only as a guideline. See Tr. 12,154-156 (Collins). A weave weld is regarded by the nuclear welding industry as a weld with a bead width in excess of four times the diameter of the weld rod. Tr. 12,154 (Collins); Tr. 11,227 (Brandt); Tr. 9994 (Baker). That definition is also the one applied at CPSES. Tr. 9994 (Baker); Tr. 11,305 (Brandt); Tr. 11,675-676 (Braumuller, Fernandez). Darlene and Henry Stiner, however, contend that a weave weld is a weld made with any degree of oscillation.

B.1.6. Welders at CPSES are taught that it is permissible to use oscillation up to four core diameters. E.g., Tr. 9991 (Baker); Tr. 11,626 (Pickett); Tr. 11,225 (Brandt).

B.1.7. Applicant Exhibit 186 substantiates Applicants' position that only oscillation patterns exceeding four core diameters are prohibited at CPSES. In this regard, it should be noted that Applicants' Exhibit 186, under the heading "Weld Parameters" specifies the types of weld filler metal (i.e., weld rods) and maximum permissible bead widths. Applicants Ex. 186. The form specifies three sizes of weld rods, (i.e., electrodes), which the welder may utilize in making the weld pursuant to procedure 11032: 3/32" E7018; 1/8" E7018; and 5/8" E7018. Id. The form indicates that the maximum bead width permitted for a 3/32" electrode is 3/8"; for 1/8" and 5/32" electrodes, the maximum bead widths are 1/2" and 5/8," respectively. Id. The specified bead width are exactly four times the width of the corresponding electrode. Thus, to reconcile Applicant

Exhibit 186's prohibition against "weave" welds with its acceptance of a bead widths four times greater than the width of the weld rod, the conclusion must be drawn that a weld whose bead width is four core diameters or less is considered a "stringer" bead weld at CPSES. With the exception of the Stiners, this is the understanding of every witness who testified regarding this issue. See Applicant Ex. 177; Staff Testimony at 6. Thus, while it is true that weave welds, (i.e., bead widths in excess of four core diameters) are not permitted at CPSES, it is not true that the use of any degree of oscillation in the making of weld is forbidden.

B.2 Mr. Stiner's Allegation That Excessive Weave Welding Was Common Practice at CPSES

B.2.1. Henry Stiner ultimately acknowledged that weave welding was not impermissible at CPSES if the bead width does not exceed four core diameters. See Tr. 10,590, (H. Stiner); CASE Ex. 919 at 6 (H. Stiner). Although Henry Stiner was not even aware until well after the commencement of this proceeding that oscillation was permitted at CPSES, he insists now that his concern all along was directed toward "excessive" oscillation. Tr. 10,590 (H. Stiner). According to Mr. Stiner, excessive weave welding, (i.e., bead width in excess of four core diameters) was a "common practice" at CPSES. CASE Ex. 919 at 6. Mr. Stiner testified that he had observed welders using excessive oscillation "many times" and had engaged in the practice himself. Id.

B.2.2. Henry Stiner first reported his concern about widespread welding at CPSES to the NRC in a telephone conversation with the Duty Officer at the NRC Region IV office on July 21, 1981. See Staff Ex. 178 at 3, ff. Tr. 2336. On September 8, 1981, Mr. Stiner met with NRC

Investigator Donald D. Driskill. Id. at 4. According to Mr. Driskill's report, Mr. Stiner expressed the concern that "literally thousands of weave welds exist at various locations on the [CPSES] site." Id. Mr. Stiner informed Mr. Driskill that "weave welding was not to be used at any job on the site." Id. Mr. Driskill was told by Mr. Stiner that "numerous examples of weave welding on pipe supports could be found in the South Yard Tunnel." Id.

B.2.3. Two days later, on September 10, 1981, the Staff conducted field investigation of Mr. Stiner's allegation. Staff Ex. 178. Mr. Taylor, then the NRC Senior Resident Inspector at CPSES, accompanied Mr. Driskill on an inspection of the South Yard Tunnel. Id.; Tr. 12,219 (Taylor). Approximately 10-12 welds were examined during the course of Mr. Driskill's inspection, Tr. 12,275 (Taylor), but no illegal weave welds were found. Staff Ex. 178 at 5. Mr. Driskill also interviewed five individuals referred to him by Mr. Stiner. Id. None of these welders were aware of any illegal weave welds. Id.

B.2.4. Mr. Stiner testified that he learned that weave welding was a widespread practice at CPSES in part from hearing "other welders constantly complain about having to work and rework other people's bad welds all the time and putting our [sic] symbols on them." Tr. 4213 (H. Stiner). However, Mr. Stiner did not identify any of these welders or describe a single instance of excessive weave welding about which these welder complained. More importantly, this unsubstantiated hearsay, even if credited, is not evidence of a practice of excessive weave welding. The fact that Mr. Stiner may have overheard other welders complain about having to repair bad welds made by others is not significant in the absence of a showing that the bad welds which the welders allegedly were repairing were caused solely by excessive weave welding. There is no evidence, however, that this is the case. A weld may be rejected for defects other than excessive bead width. For example, overlap is a rejectable defect if it interferes with non-destructive testing. Tr. 11,215 (Brandt). Similarly, excessive amounts of porosity is a rejectable defect in any weld, stringer or weave. Id.

B.2.5. Mr. Stiner also states that he was ordered to weave weld "by every foreman he ever worked for." See e.g., Tr. 4211. On cross-examination, however, Mr. Stiner admitted that this was not true, stating that the only foremen who ever told him to weave weld was Fred Coleman. Tr. 10,090. According to Mr. Stiner, Mr. Coleman advised him "that rather than run a bunch of little stringer beads to weave it in to build a floor since it was impossible to run stringer bead root passes because of the size of the fit-up gap." Id.

B.2.6. Mr. Coleman, for his part, did not deny that he instructed the welders on his crew that it was permissible to use an oscillating motion provided that the bead width of the weld did not exceed four core diameters. Tr. 11,581 (Coleman). Mr. Coleman stated that he would recommend an oscillating pattern when "you have got a 3/16" gap or so." Tr. 11,578. This is because without oscillation "all of your heat is going straight in the gap. . . You have got to turn your rod to the steel to burn in and get good penetration." Id. The technique described by Mr. Coleman and Mr. Stiner can be performed without exceeding the maximum bead width parameter using a 1/8" weld rod (4 x 1/8" rod = 1/2" maximum bead width). Tr. 11,579.

B.3 <u>Mr. Stiner's Observation of Weave Welding (CT-1-017-005-Y35R)</u>

B.3.1. On cross-examination, Mr. Stiner could recall only one instance where he had witnessed excessive weave welding. Tr. 10,592. According to Mr. Stiner, he noticed that the hanger on which a welder named Armand Braumuller was welding had turned blue approximately 4-5" from the weld joint. CASE Ex. 919 at 8. In Mr. Stiner's view, the blue discloration was due to overheating of the base metal caused by excessive weave welding. Tr. 10,592.

B.3.2. The steel used at CPSES to construct hangers, A36 steel, has a carbon content of less than 0.3 percent and is considered "low-carbon" steel. Staff Testimony at 6-8 (Taylor, Gilbert). Low carbon steel, which changes color during oxidation, <u>id</u>. at 8; Tr. 10,020 (Baker), "turns blue on the surface at 600°." Tr. 10,020 (Baker). This surface discloration is not an indication of embrittlement, or a loss of ductility or tensile strength. Tr. 10,020-24 (Baker, Muscente). Thus, the fact that Mr. Stiner may have observed a blue discoloration on the hanger at issue does not mean that the bead width of the weld made by Mr. Braumuller exceeded four core diameters.

B.3.3. It is noteworthy in this regard that Mr. Braumuller, a man with 28 years welding experience (Applicants' Ex. 177 at 4), denied that Mr. Stiner ever assisted him on a welding job and had no recollection of the incident described by Mr. Stiner. Tr. 11,694-95. Mr. Coleman, who was Mr. Stiner's foreman at the time, stated that Mr. Stiner was a welder "like all the rest", Tr. 11,539, and denied that Mr. Stiner was assigned the task of walking around correcting other welder's work. <u>Id</u>. Clifford Brown, who was a member of Mr. Stiner's welding crew, also controverted

Mr. Stiner's statement that he and Mr. Stiner were roving repairman, responsible for getting "bad welds" bought off by QC. Compare Tr. 11,467 (Brown) with Tr. 10,606; Tr. 10,622-23 (H. Stiner). Indeed, Mr. Stiner himself admitted on cross-examination that Mr. Coleman's and Mr. Brown's testimony on this point is correct. Tr. 10,974-75.

B.3.4. Mr. Stiner was afforded the opportunity to visit CPSES to identify for the Board the hanger which contained the improper weave weld made by Armand Braumuller. Tr. 11,118. Mr. Stiner identified hanger CT-1-017-005-Y35R as the offending hanger. Tr. 11,023. The weld package for hanger CT-1-017-005-Y35R, however, indicates that neither Mr. Stiner nor Mr. Braumuller ever welded on hanger CT-017-005-Y35R. Tr. 11,023.

B.3.5. The Staff inspected hanger CT-1-017-005-Y35R, and two adjacent hangers, Nos. CT-1-017-004-Y35R and CT-1-017-006-Y35R, to determine whether any of them contained excessive weave welds. Staff Testimony at 13 (Taylor). The welds did not appear to have been ground down and thus the longitudinal ridges and valleys of welds could be observed. Id.; Tr. 12,224 (Taylor). The ridges and valleys of these welds were "indicative of properly-made stringer beads well within the 4 rod diameter limitation." Staff Testimony at 14 (Taylor).

B.3.6. The Staff also reviewed the construction package for hanger CT-1-017-005-Y35R to determine whether it had been removed or replaced subsequent to the July-August 1980 time period that Mr. Stiner claims he and Mr. Braumuller welded on it. The construction package for this hanger indicates that welding took place only in June 1979, January 1981, and October 1983, and nothing in the construction package or in the Staff's inspection of the hanger indicates that the hanger has ever been removed or replaced. Id.

B.4 Mrs. Stiner's Observation of Excessive Weave Welding

B.4.1. Mrs. Stiner testified that on March 26, 1981, she made an initial inspection of hanger TWX-034-714-A35K and noted that it contained excessive weave welds which were still present when she returned later for final inspection. Tr. 4149. She stated that she instructed the welder working on the hanger to discontinue work while she sought out George Willis, an ASME QC supervisor. Id. She testified that she showed the excessive weave welds to Mr. Willis who instructed her to order the hanger cut down, which she did. Id.; Tr. 10,143 (D. Stiner). When Mrs. Stiner returned to the hanger a few days later, she noticed that the faces of the welds had been ground down thus making it impossible for her to determine whether the weld had been ground to the base metal and rewelded with "stringer" beads. Id. at 4149-50. At this point, Mrs. Stiner stated she placed a hold tag and applied for a non-conformance report number (NCR) on the hanger. Id. at 4150. Mrs. Stiner never saw the NCR written on the hanger but testified that she was told by her supervisors that it had been "voided." Tr. 4153.

B.4.2. A review of the package for hanger TWX-034-714-A35K does not confirm Mrs. Stiner's allegation that the hanger contained excessive weave welds. Moreover, there is nothing in the package that reflects that Mrs. Stiner wrote an NCR on this hanger. Indeed, Applicants' Ex. 180, Tr. 11,789, is a copy of an inspection report written by Mrs. Stiner on April 8, 1981. This inspection report contains no suggestion that excessive weave welds were observed on the hanger. See Applicants' Ex.

180. On the contrary, the inspection report indicates that Mrs. Stiner found the hanger satisfactory and initialed her approval. Tr. 10,266 (D. Stiner).

B.4.3. The Staff conducted an investigation of Mrs. Stiner's allegation, Staff Testimony at 16 (Gilbert, Taylor), but did not attempt to determine by physical inspection whether excessive weave welding had occurred because if, as Mrs. Stiner had stated (Tr. 10,144), the welds have been ground down and rewelded, no longer would there be any trace of excessive weave welding. Id.

B.4.5. The Staff, however, interviewed Mr. Willis, the QC supervisor alleged to have told Mrs. Stiner to order the hanger cut down, to determine whether he could corroborate Mrs. Stiner's allegations. Id. at 17. Although Mr. Willis had no recollection of the incident recounted by Mrs. Stiner, he told the Staff that he did not believe QC personnel were not authorized to order that a hanger be cut down. Id. The correctness of Mr. Willis' position was confirmed by other witnesses. See also Tr. 11,796 (Baker); Tr. 12,273-74 (Taylor).

B.4.6. The Staff also interviewed Don Fields, the welding foreman responsible for the hanger containing the alleged excessive weave weld. Staff Testimony at 17 (Gilbert, Taylor). Mr. Fields informed the Staff that although Mrs. Stiner had ordered him to have the hanger cut down, he did not do so because he did not agree that the weld exceeded the four core diameter limit, an assessment shared by his foreman. Id. To avoid further confrontation with Mrs. Stiner, however, Mr. Fields "directed that the weld be ground and covered with a cover pass." Id.

B.4.7. The Staff also investigated Mrs. Stiner's allegation (Tr. 10,253, 314) that she was directed by her foremen, Clay Andrews, Fred Coleman, Roger Trotter, and Gary Pepples to weave weld in excess of the four core diameter limit. Staff Testimony at 11 (Gilbert, Taylor). The Staff was unable to confirm Mrs. Stiner's allegations by physical inspection because she was could not identify any specific hangers or locations where the alleged excessive weave welding occurred. See Tr. 10,312. The Staff interviewed Messrs. Coleman, Peppers, and Trotter, see Staff Testimony at 12; Tr. 12,221, each of whom denied ever directing Mrs. Stiner to weave weld in excess of four core diameters. Id. Mr. Andrews is no longer employed at CPSES and the Staff has not succeeded in locating him. Staff Testimony at 12.

B.4.8. The Staff also investigated Mrs. Stiner's allegations (CASE Ex. 667, Tr. 4153-54) that hanger BR-X-181-707-A45R contained a excessive weave weld. This condition was uncovered by Applicants' quality control program and is reflected in Non-Conformance Report No. M-82-005-84. See CASE Ex. 667Q. Because the hanger involved was not part of a system requiring Charpy impact testing, the welding engineering department, after reviweing the NCR, determined that there was not cause for concern regarding the structural adequacy of the weld and concluded that it was acceptable "as-is." Staff Testimony at 18 (Taylor, Gilbert).

B.5 Applicants' Testimony on the Practice of Weave Welding

B.5.1. Only one instance of weave welding in excess of four core diameters has been confirmed. However, even if the three other examples of alleged excessive weave welding cited by Mr. and Mrs. Stiner were to be accepted by the Board, the pervasive and systematic practice of excessive weave welding alleged by them hardly can be inferred. This is particularly true in view of the other testimony presented in this case. For example, Isaiah Pickett, Salvador Fernadez, and Armand Braumuller each worked in the same general areas as Henry Stiner during his tenure of employment at CPSES, Applicant Ex. 177 at 4, and thus are as competent as Henry Stiner to relate the general welding practices in those areas. Fred Coleman worked in the same general area as Darlene Stiner. None of these witnesses ever observed another welder make an excessive weave weld, Tr. 11,675-76 (Braumuller, Fernandez); Tr. 11,626 (Pickett); nor did any make one himself. Tr. 11626 (Pickett); Tr. 11675-76 (Fernadez, Braumuller); Tr. 11,589 (Coleman).

B.5.2. Mr. Coleman, Henry Stiner's welding foreman, testified that while he had on occasion instructed the welders on his crew to oscillate their weld rods, he had not ever directed Mr. Stiner or any other welder to weld in excess of four core diameters, Applicants' Ex. 177 at 10 (Coleman), or otherwise weld in violation of procedure. Tr. 11538.[1/]

B.5.3. Each welder at CPSES is monitored by a welding foreman. See Applicants' Ex. 177 at 12 (Baker); Tr. 11,533 (Coleman); Tr. 11,463 (Brown). Welding foremen monitor regularly the welders on their crew and know each welder's capability as well as the nature of the welding task

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1/ Mr. Coleman testified also that he was not ever a foremen in the fab shop, id., contradicting Mrs. Stiner's allegation (CASE Ex. 919 at 10) that he was the foreman in the fab shop who showed her how to fill in a bad fit-up by inserting the flux from one weld rod into the gap and weave welding another pass to cover it up. Tr. 11,538 (Coleman).

to which the welder is assigned. See Tr. 11,463 (Brown); Tr. 11,533-34 (Coleman). Mr. Coleman testified that his practice was to check up on his welders at least 2-4 times daily. Tr. 11,534. The practice of Mr. Brown, Mr. Stiner's supervisor during his second term of employment, was to monitor the welders on his crew 3-4 times a day. Tr. 11,465. Thus, if there were a practice of excessive weave welding on Mr. Stiner's welding crew, it would not have gone undetected. See Tr. 11,475 (Brown).

B.5.4. Welders are also subject to unannounced inspections every 14 days by the welding engineering department. Applicants' Ex. 177 at 12 (Baker). Henry Stiner, for example, was inspected on 15 different occasions during his tenure at CPSES and his wife, Darlene Stiner, was audited 28 times during her term of employment. Id. Among the items checked during these inspections are: (i) welder identification; (ii) weld filler material; (iii) weld progression (i.e., uphill or downhill); (iv) bead width; and (v) weld rod control. Id.; see Applicants' Ex. 184, ff. Tr. 10,939.

B.5.5. Although Mr. Stiner denied that he ever received a thorough inspection by welding engineering monitors, see 10,595-604, this assertion is not credible in view Applicants' Exhibit 184, which is a copy of a series of welder surveillance reports (checklists) relating to Mr. Stiner, the authenticity of which Mr. Stiner does not dispute. Tr. 11,810 (H. Stiner).

B.5.6. In addition to the monitoring by their foreman and the surveillance of welding engineering monitors, welders are observed by the quality control inspectors who frequent the areas where welding is taking place. Tr. 11,322 (Brandt). Quality Control inspectors look for deviations from procedure and are authorized to report any non-conforming condition that comes to their attention at any time. See Tr. 11,268 (Brandt). Welders are aware that quality control inspectors need not wait until called for a formal inspection to report a defect. See Id., Tr. 10,680 (H. Stiner). Thus, in view of the close and frequent monitoring of welders, had there been a practice of excessive weave welding at CPSES, Applicant would have discovered it. Therefore the Board can regard the absence of such discovery as evidence that a practice of excessive weave welding does not exist at CPSES.

B.6 Excessive Heat Input

B.6.1. The Board cannot accept Mr. and Mrs. Stiner's allegation that weave welding in excess of four core diameters results in excessive heat input which weakens the base metal. See CASE Ex. 919 at 5-14; Tr. 10,805-06. The Stiner's admit that they are not experts in metallurgy. CASE Ex. 919 at 8, and the Board agrees. Tr. 10,794 (Bloch). The Stiner's opinion regarding the dangers of excessive heat input are based solely on their reading of a welding handbook referenced by them in their testimony. See CASE Ex. 919, Attachment B.

B.6.2. If the amount of heat is excessive for the type of metal involved, the metallurgical strength of the weldment may be lessened and the metal's capcity to withstand stress reduced. Staff Testimony at 7 (Collins, Smith). Consequently, where the designer requires that a particular component or system have specified energy absorption capacity (Charpy impact property), it is important that that capability not be lessened by excessive heat input. Id. Heat input can be controlled by regulating the amount of transverse oscillation. Id. at 8.

B.6.3. Where a component is not required by the designer to be tested for Charpy impact properties, there is no need to regulate the amount of transverse oscillation. Staff Testimony at 7 (Collins, Smith). Similarly, where the base metal is not affected by the amount of heat generated by an oscillating welding pattern, it is is not necessary from a metallurgical standpoint to control transverse oscillation. Id.; Tr. 9998 (Muscente). This is the reason the ASME Code regards a change form a "stringer" bead pattern to a "weave" bead pattern (or vice versa) as a "non-essential variable" where materials requiring Charpy impact testing are not involved. Staff Testimony at 5 (Collins, Smith).

B.6.4. At CPSES, Charpy impact testing is required only for the main steam and feedwater systems. Tr. 11,764-65 (Baker). Company records reflect that neither Darlene nor Henry Stiner ever welded on any hanger attached to either of these systems. Id.[2/]

B.6.5. Brown & Root procedure 11032 is qualified for Charpy impact testing. Tr. 11,252 (Brandt). That is to say that a welder can utilize an oscillating pattern of up to four core diameters on Charpy material and still be in compliance with the procedure. Tr. 11,252-53. Procedure 11032, however, also is used for welding on non-Charpy materials as well. Tr. 12,166-67 (Taylor). Consequently, the four core diameter limitation is applicable even to non-Charpy materials. Id. In this

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2/ Mr. Stiner admitted that his statement that he worked "in various parts of the plant where I feel sure impact testing is required," CASE Ex. 919 at 7-8, was based on nothing more than his own opinion. Tr. 10,781, 11,094.

respect, Procedure 11032 is more stringent than the ASME Code which limits transverse oscillation only where materials requiring Charpy impact testing are involved.

B.6.6. The four core diameter limitation on non-Charpy materials is not essential safety requirement because the type of steels used at CPSES in the construction of pipe supports and cable tray supports (A-36 and A-515) are low carbon steels. Staff Testimony at 7 (Collins, Smith). (Baker). Low carbon steels are those having a carbon content less .30 percent. Staff Testimony at 7; Tr. 9982 (Baker); Tr. 9997 (Muscente). Low carbon steel is a "very ductile and forgiving metal." Tr. 9999 (Muscente). In other words, this type of steel is not susceptible to embrittlement or cracking, Tr. 9998 (Muscente), and can withstand exposure to extreme temperatures without experiencing a significant loss in strength. Tr. 9999 (Muscente). Indeed, low carbon steel "can be heated red hot or even white hot and quinched in cold water without appreciable embrittlement." Id. This is not to suggest, however, that low carbon steel is indestructible, see Tr. 10,000 (Muscente) ("If you took it [low carbon steel] in a blast furnace, it would probably melt it), only that it is unlikely that the low carbon steel will crack or become embrittled by the welding heat generated by the weld rods and welding equipment used at CPSES. Id. This is true even if welders do not observe the four core diameter limitation. Id.

B.6.7. Since the structural integrity of low carbon steel is not affected by weave welding in excess of four core diameters, it is not necessary from a safety standpoint that an excessive weave weld be ground down on a non-Charpy component. Staff Testimony at 10; Tr. 12,158 (Collins). Unless the engineering department determines that the weld is acceptable "as-is," Brown & Root generally require that welds that exceed the four core diameter limit be ground to impress upon welders the importance of complying with procedures. Tr. 10,001 (Baker). Grinding a weld so as to conform to the four core diameter limit is an acceptable but unnecessary repair procedure. Staff Testimony at 10; Tr. 12,158 (Collins, Smith).

B.7 Interpass Temperature

B.7.1. Henry and Darlene Stiner also allege that welders do not check interpass temperatures or preheat material before welding. CASE Ex. 919 at 11. According to Mr. Stiner, failure to observe the correct interpass temperature will cause the weld to crack, id., and the effects of welding not preheated is also a factor in setting up bad welds." Id. at 9 (H. Stiner). Mr. Stiner also alleged that welders do not use "temperature indicating crayons" to check interpass temperature. CASE Ex. 919 at 11.

B.7.2. The Board refused to admit evidence relating to the use of temperature indicating crayons, ruling that Mr. Stiner's allegation had not been raised in a timely fashion. Tr. 10,734. Consequently, the question whether welders at CPSES use temperature indicating crayons to measure interpass temperature is not an issue in this proceeding. The Staff, however, will require Applicants to determine whether welders comply with the requirement set forth in Procedure 11032 that interpass temperature be verified and to provide satisfactory assurance that any non-compliance with this requirement does not raise a significant safety concern.[3/]

B.7.3. "Interpass temperature" is the temperature of the weld joint immediately prior to the next pass on a multiple pass weld. Tr. 10,008 (Baker). Procedure 10046 (non-ASME) contains no restriction on interpass temperature; however, Procedure 11032 (ASME) provides that maximum interpass temperature not exceed of 500°F. Id. The reason Procedure 11032 is qualified 500°F is because Procedure 11032 is also utilized for welding on Charpy impact materials and the ASME Code limits the maximum interpass temperature for Charpy materials to 500°F. Tr. 10,008, 10,012 (Baker). Thus, had separate procedures been promulgated for Charpy and non-Charpy materials, it would not have been necessary to specify any interpass temperature for materials not requiring Charpy impact testing. Id.

B.7.4. It is unlikely that a welder could exceed the 500°F interpass temperature when welding within the parameters of procedure 11032. Tr. 10,008-09 (Baker). Applicants proved this in 1980, almost four years before the control of interpass temperature became an issue in this proceeding. Tr. 10,008-09 (Baker). Applicants conducted a test to determine the rate at which a weld joint cools. The interpass temperature was measured by a thermocouple inserted into the weld joint. A weld pass was made directly over the termocouple. After reaching a high of approximately

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3/ The Staff has received a response from the Applicants addressing this matter. The Applicants' response is being evaluated by the Staff, and the Staff will take appropriate action to resolve this concern. In accordance with the Board's direction, the Staff will submit an affidavit indicating its resolution of this concern.

3000°F, the temperature of the weld joint declined dramatically, falling below 500°F in less than 55 seconds. Tr. 10,009 (Baker). From there the cooling rate dropped gradually to 200°F and stayed in that range for several minutes. Id.

B.7.5. According to Applicants, the reason a welder is unlikely to exceed the 500°F interpass temperature under normal welding conditions is because before he could make a succeeding weld pass, he would have to stop to clean the previous weld, grind out its starting and stopping points, and insert a new electrode into his holder. Tr. 10,010. By the time he had completed all of these tasks, the interpass temperature would have dropped well below 500°F. Id.

B.7.6 Applicants also conducted a test to determine whether the effect of excessive interpass temperature on low carbon steel. See Tr. 10,015 (Baker). The test was conducted to determine whether there was any basis to Mr. Stiner's contention that excessive interpass temperature causes the weld joint to crack when bent. CASE Ex. 919 at 11.

B.7.7 The test was conducted by welding on a standard qualification joint and exceeding all of the parameters of procedure 11032 (i.e., very slow travel speed, bead widths in excess of four core diameters, high amperages and voltages). Tr. 10,015-016. (Baker). By disregarding all of the parameters of procedure 11032, Applicants reached an interpass temperature of 750°F (which drops below 500°F in about 10 seconds (Tr. 10,010 (Baker)). The plate containing the weld joint was then cut into strips, placed in press and then bent in a U-shape. Tr. 10,0016 (Baker). The weld joint did not crack. Tr. 10,018 (Baker); Applicant 178, ff. Tr. 10,566.

B.7.8. In addition to refuting Mr. Stiner's contention that excessive interpass temperature causes the weld joint to crack, the test results described above corroborate Applicants' position that the ductility of the low carbon used at CPSES is not affected by exposure to heat input in excess of that generated under normal conditions. Compare Applicants' Ex. 178, with Tr. 9999 (Muscente).

B.7.9. Mr. Stiner also testified that weave welding in excess of four core diameters necessarily entraps slag in the weld causing porosity. Tr. 10,822-23. Slag is entrapped, according to Mr. Stiner, because "it is impossible to control the [molten] puddle from rolling back over the slag." Id. Mr. Stiner testified that he had personally observed this phenomenon but he did not detail any instances where this occurred. Tr. 10,823. The Board cannot credit Mr. Stiner's testimony on this point. Mr. Stiner was not even aware that any weave welding, (i.e., oscillation) was permitted by procedures 11032 and 10046 until after he was terminated from his employment at CPSES. Additionally, although Mr. Stiner testified that he was instructed by his supervisors to weave weld, he has never (despite numerous opportunities to do so) identified a single instance in which he made a weave weld in excess of four core diameters. Compare Tr. 4209 with Tr. 10,591. Yet Mr. Stiner would have the Board believe that he engaged in the practice of weave welding over four core diameters. The Board declines to do so.

B.7.10. Moreover, Mr. Stiner does not indicate the amount of slag that is entrapped in an excessive weave weld. This is crucial because the ASME Code provides that a weld containing slag is acceptable so long as the diameter of each pore does not exceed 1/16". Tr. 11,215 (Brandt);

see Tr. 12,279 (Collins, Smith). In addition, it should be noted that Mr. Stiner's position conflicts with the ASME Code and the AWS Code. Neither of those codes prohibit weave welding in excess of four core diameters on non-Charpy materials. See, e.g., Staff Testimony at 5. The absence of such a prohibition necessarily suggests that there is no correlation between the degree of oscillation and the risk of entrapping slag. This very point is confirmed by the experts testimony in this case. See, Tr. 12,167, 12,276 (Collins).

B.8 Preheating

B.8.1. Mr. Stiner alleged that he welded on Class 3 hangers that were not preheated on days when the temperature was below 32°F. CASE Ex. 919 at 9 (H. Stiner). The Board struck this portion of Mr. Stiner's testimony, but requested that the Staff report to the Board regarding the results of its investigation into this area. Tr. 9950. During Mr. Stiner's first term of employment at CPSES the temperature dropped below 32°F only on March 3, 1980, when the recorded temperature at CPSES was 28°F at 6:00 a.m. Tr. 10,035 (Baker). The temperature rose steadily on that date and reached a high of 60°F. Id. The Board took official notice that during Mr. Stiner's second term of employment, from June 1981-July 1981, the temperature at CPSES (which is located in central Texas) did not drop below 32°F. Tr. 10,035.

B.8.2. Welding when the temperature is below 32°F is not necessarily a violation of applicable procedure. Paragraph 4.2 of Section IV of the ASME Code prohibits welding only "where the ambient temperature is below 0° Fahrenheit." Tr. 10,031 (Baker). "Ambient temperature" does not refer to the atmospheric or environmental temperature, but rather the temperature in the immediate vicinity of the weld joint. Id. Thus, even if it were 0°F degrees outside, welding operations could continue so long as the area adjacent to the weld joint was maintained at 0°F or higher. Id.

B.8.3. "Preheat temperature" is the temperature of the material immediately prior to welding. Tr. 10,026 (Baker). Weld procedure 11032 specifies a minimum preheat temperature of 60°F for material less than 1 1/4" thick, and 200°F for materials more than 1 1/4" in thickness. Id. Joint Affidavit, p.9 (Gilbert, Taylor). Procedure 10046 (non-ASME) specifies a pre-heat temperature of 70° for steel up to 1½ inches thick. For steel from 1½-2 inches thick, preheat is specified as 150°, and for steel over 2 inches thick, the specified preheat is 225°. Joint Affidavit, pp. 9-10 (Gilbert, Taylor).

B.8.4. During colder months, the temperature in the areas where welding takes place is likely to be somewhat higher than the environmental temperature because welding usually takes place inside heated enclosed structures. Tr. 10,034 (Baker). Moreover, the ambient temperature (i.e., temperature in the vicinity of the weld joint), is even higher than room temperature due to supplemental heat sources such as space heaters, and lighting. Id.; Tr. 11,618 (Pickett). It is not necessary to preheat material when the room temperature is greater than the required preheat temperature. When it is necessary to preheat, however, a propane torch is used. See Tr. 11,537 (Coleman).

B.8.5. Mr. Stiner also stated that that welders at CPSES, himself included, did not preheat metal before welding. CASE Ex. 919

at 11. The weight of the evidence is to the contrary. Isiah Pickett, for example, testified that Mr. Stiner did preheat. Tr. 11,643 (Pickett). Mr. Pickett was certain of this because he remembered loaning his propane torch ("preheat bottle") to Mr. Stiner. Id. The other welders who worked on Mr. Stiner's crew or in the same general area as Mr. Stiner each testified that they complied with preheating requirement. E.g., Tr. 11,665 (Fernandez); Tr. 11,665 (Braumuller); Tr. 11,615 (Pickett).

B.8.c. Although Applicants' witnesses testified that welders preheated material prior to welding, this testimony does not address precisely the allegation made by Mr. and Mrs. Stiner: that welders do not check to make certain that the temperature prior to welding is at least 60°F for materials less that 1½" thick and 200°F for materials more that 1½" in thickness. Applicants' witnesses testified only that they used preheating bottles. There is no evidence, however, that suggests that welders utilized any kind of temperature measuring device to verify that the temperature of the metal after being preheated was at least 60°F or 200°F, whichever the case may be. In fact, Mr. Muscente implied that it is sufficient for a welder "to take his torch and play it over this material until he gets it up to what we refer to as hand warm." Tr. 10,028 (Muscente). Accordingly, the Staff will require Applicant to assess the significance of permitting welders to make subjective determinations as to whether the preheat requirement of Procedure 11032 is met.[4/]

4/ The Staff has received Applicants' response on this matter. The Staff is currently evaluating the Applicants' response, and will take appropriate action to resolve this concern. In accordance with the Board's direction (Tr. 9447-50), the Staff will submit an affidavit indicating its resolution of this concern.

C. DOWNHILL WELDING

C.1. Henry Stiner stated that he was ordered by Jimmie Green (his foreman during his second term of employment at CPSES) and Clifford Brown to make downhill welds even though that type of weld was prohibited by Brown & Root's procedures. E.g., CASE Ex. 666 at 45-46; Tr. 10,613; Tr. 10,622. In addition Mr. Stiner stated that he knew several welders who had made illegal downhill welds. Tr. 10,628-29. Under questioning by the Board, however, Mr. Stiner said he could remember only one welder who had done so (Tr. 11,629), but did not provide any further details. Tr. 10,629. Thus, the Board is unable to assess the merit, vel non, of this claim.

C.2. "Downhill welding" is an industry term referring to a technique in which the welder runs his weld bead downward from a higher elevation to a lower one. Staff Testimony at 18 (Collins, Smith); Applicants' Ex. 177 at 15 (Baker). Neither the 1974 ASME Code nor the 1975 AWS Code expressly defines the term "downhill" weld. Staff Testimony at 19 (Collins, Smith).

C.3. The 1974 ASME Code regards a change in the progression of travel from uphill to downhill (or vice-versa) as a "nonessential variable." Applicants Ex. 177 at 16 (Baker, Brandt); Staff Testimony at 19. Under the ASME Code, it is not necessary that a particular welding procedure be requalified in order to change the direction of travel if Charpy impact testing is not required. Id. If notch toughness (i.e., Charpy impact testing required) is a specific design requirement, however, the procedure must be qualified before a change can be made in the direction of travel. Id. In addition, the welder must be qualified to use the downhill welding method. Id.

C.4. Section 4.10.7 of the 1975 AWS Code provides that for prequalified welding procedures "the progression for all passes in vertical position welding shall be upward . . ." Staff Testimony at 19 (Collins, Smith). The AWS Code, however, allows the use of a downhill weld to repair undercut or to weld tubular products when using a prequalified welding procedure. If a prequalified welding procedure is not used, a new procedure must be established by qualification if a change in downhill welds on intermediate passes are not possible to detect by non-destructive (i.e., visual), examination. Id.

C.5. Mr. Stiner testified that downhill welding is useful to compensate for the "arc blow" caused by the magnetization of the welded metal. Tr. 4246-47, CASE Ex. 666 at 45. Metal, according to Mr. Stiner, becomes "magnetized" when cut with a welding torch. Tr. 4246. This assertion is further confirmation of Mr. Stiner's utter lack of metallurgical expertise. "Arc blow" is the phenomenon resulting in the deflection of the arc due to a deformation in the magnetic field. Applicants' Ex. 177 at 15 (Baker, Muscente). This deformation in the magnetic field is caused not by "cutting with a welding torch," but by welding close to ground or into obstructed areas such as corners. Id. Small amounts of arc blow are beneficial to the welder because it helps him form the bead shape, control molten slag, and achieve proper penetration. Id. Arc blow is a potential problem only when using amperage rates in excess of 250 amps, a rate more than double that used (90-120 amps) by welders at CPSES. Id. Accordingly, the Board finds that arc blow is not a problem at CPSES.

C.6. Mr. Stiner stated that he saw a welder named Roy Combs make a downhill weld. CASE Ex. 919 at 15. According to Mr. Stiner, Mr. Combs was ordered by "his foreman" (not further identified) to weld some stainless steel lugs to a pipe support by running a downhill weld. Id. The reason Mr. Combs' foreman is alleged to have given this order is because the placement of the weld was such that Mr. Combs was not in position to make an uphill weld. Id. Mr. Stiner did not provide any further details regarding this incident. For example, he could not remember the hanger number of the pipe support involved or the date of the incident, nor could he identify Mr. Combs' foreman or the specific area in which the incident occurred. Id.

C.7. Applicants conducted a computer search of its records which indicated that Mr. Combs had welded on stainless steel. Tr. 10,036 (Baker). A review of the welding packages for the items involved was conducted to determine whether the stainless steel welds "had had proper QC inspection." Id. Next followed a visual examination of each of these welds. Id. Because some welds had been ground smooth in preparation for non-destructive examination, it could not be determined with certitude whether they were downhill welds. Id.; Tr. 10,135. However, an examination of the welds that were still in the "as-welded condition" indicated that they were properly made uphill welds. Tr. 10,036.

C.8. Applicants made no attempt to ascertain whether the location of the welds may have prevented Mr. Combs from gaining the access necessary to perform a proper uphill weld. Tr. 10,136 (Baker). Mr. Baker, however, suggested that the degree of "access" has no bearing on the decision to make a downhill weld. Tr. 10,136. ("[L]imited access is limited access. If you are limited to making uphill welds, you'd also be limited to [making] a downhill weld."). According to Mr. Baker, this is because the angle at which the weld rod must be held to make a uphill weld is "primarily the same angle that is necessary for a downhill weld." Id.; Tr. 11,854. Mr. Baker acknowledged later that there may be a variance of up to 15° in the angles at which the weld rod is held for uphill and downhill welds. Tr. 11,856. Mr. Baker, however, stated that he knew of no situation at CPSES where this difference would make a downhill weld feasible. Tr. 11,857. This testimony was corroborated by Mr. Brown, one of Mr. Stiner's welding crewmates. Tr. 11,489 (Brown).

C.9. That Mr. Combs may have made a downhill weld that went undetected by quality control in itself does not necessarily create a problem from a safety standpoint. As noted above, a properly made downhill weld is as strong and as acceptable as an uphill weld. Staff Testimony at 21 (Collins, Smith); Applicants' Ex. 177 at 19-20 (Baker). A defective downhill weld, on the other hand, would have unacceptable visual indications and would be detected by QC during inspection. Id. at 20. Since the downhill welds which Mr. Combs is alleged to have made passed QC inspection, there is little chance that they were not made properly. Id.

C.10. Mr. Stiner stated that on one occasion he made a downhill weld after being ordered to do so by his foreman Jimmie Green and that on another occasion he was told to do so by Clifford Brown (with the approval of Jimmie Green). Tr. 10,613; Tr. 10,622. According to Mr. Stiner, because of the location of the welds, he was unable to position himself to make an uphill weld. Tr. 10,611-12. He stated that because his crew was under pressure to complete the pipe support, Mr. Green ordered him "to make a downhill weld on it and grind the face of it off," which he did. Tr. 10,612. Mr. Green denied ever giving such an order to Mr.

Stiner. Tr. 11,716. Mr. Fernandez, who served on Mr. Stiner's welding crew during Mr. Stiner's second term of employment, testified that he had never been ordered to make a downhill weld and he had never seen any one else make one. Tr. 11,678 (Fernandez).

C.11. The Staff inspected the pipe support alleged by Mr. Stiner to contain the downhill weld. Staff Testimony at 22 (Taylor). Because the support had been painted with a thick coat of epoxy paint and is in a congested and inaccessible location, it was not possible for the Staff to determine whether the weld was made using a downhill weld. Id. Therefore, the Staff will require Applicants to provide satisfactory assurance that the hanger is acceptable.[5/] Id. at 23 (Taylor).

C.12. Mr. Stiner also stated that on another occasion, it was suggested to him by Clifton Brown that he make a downhill weld on a hanger located in the north yard tunnel. Tr. 10,622-23. Mr. Brown suggested that a downhill weld be made because due to "the thickness of [Mr. Stiner's] chest cavity," Mr. Stiner was unable to position himself properly make an uphill weld. Tr. 10,623 (H. Stiner). Mr. Stiner did not make a downhill weld on this occasion, however, because Mr. Brown, who was thinner than Mr. Stiner, was able to position himself to make an uphill weld. Id. Mr. Brown confirmed that he made the weld for Mr. Stiner but denied that he suggested that Mr. Stiner make a downhill weld. See Tr. 11,488-89 (Brown).

5/ The Staff has received a response from the Applicants on this matter, and is currently reviewing the acceptability of the Applicants' response. The Staff will submit an affidavit on this matter when it has completed its evaluation.

C.13. According to Mr. Brown, the weld he made for Mr. Stiner was not a "limited access" weld. Tr. 11,489. A "limited access" weld is one within 12" of an obstruction. Tr. 11,490. The weld which Mr. Stiner described was a limited access weld only in the sense that its location limited Mr. Stiner (as opposed to <u>any</u> welder) from positioning himself to make a proper uphill weld. Tr. 11,490.

C.14. Welders are well aware that downhill welding is prohibited by Brown & Root procedures 11032 and 10046. Tr. 11,667 (Fernandez, Braumuller); Tr. 11,628 (Pickett). An intentional violation of procedure is grounds for automatic termination. <u>See</u> Tr. 12,651 (Pickett); Tr. 11,682 (Fernandez, Braumuller); Tr. 11,481 (Brown); Tr. 11,734-35 (Green). Supervisors know that they are subject to immediate dismissal if they instruct a welder to violate procedures. Applicants' Ex. 177 at 11 (Green); Tr. 11,734 (Green).

C.15. In addition to the risk of disciplinary action, welders are deterred from making downhill welds by the fact that downhill welding is more time consuming than uphill welding. <u>See</u> Tr. 11,331 (Brandt); Tr. 11,489 (Brown); Tr. 11,841-44 (Baker); Tr. 11,489 (Brown). As noted earlier, because an inexperienced welder is not likely to control the molten puddle, visible surface indications would be left which would require him to grind out the weld and begin again. Tr. 12,231 (Collins). In the event, the downhill weld was made correctly, the welder must cover it up with an uphill weld pass or ground out the ridges and valleys in order to hide the direction of travel. <u>Id</u>. Either of these courses of action would be more time consuming than an uphill weld which, if made properly, need not be ground down. <u>See</u> Tr. 12,195-96 (Collins). Finally, even if a welder on Mr. Stiner's crew was capable of making a proper downhill weld, he would make one at his peril because he would risk detection by Mr. Coleman (who checked up on him usually between 2-4 times daily), Tr. 11,534 (Coleman), or Mr. Brown (who monitored the welders on his crew 3-4 times daily), Tr. 11,464, not to mention the welding monitors assigned to his area (Applicants Ex. 177 at 12 (Baker)) and QC inspectors. See e.g., Tr. 11,543 (Pickett); Tr. 11,322 (Brandt).

C.16. In view of the evidence adduced on this issue, the Board is persuaded that unauthorized downhill welding is not a widespread practice (if it is practiced at all) at CPSES.

D. WELD ROD CONTROL

D.1. Henry and Darlene Stiner allege that Applicants' weld rod control program is inadequate. CASE Ex. 667 at 40-42, Tr. 4164-66 (D. Stiner); CASE Ex. 666 at 18-19, Tr. 4220-21 (H. Stiner); CASE Ex. 919 at 18-22 ff. Tr. 10,333 (H. Stiner, D. Stiner). According to the Stiners, Applicants are unable to prevent welders from loaning or borrowing weld rods from one another or to account for all weld rods distributed from its weld rod distribution centers ("rod shacks"). E.g., CASE Ex. 919 at 19; Tr. 4164-66 (D. Stiner).

D.2. Article NF-4411, Section III of the ASME Code governs the identification, storage, and handling of welding materials. That provision states:

> Each Manufacturer or Installer is responsible for the control of the welding electrodes and other materials which are used in the fabrication and installation of component supports. (NF-4120). Suitable identification, storage, and handling of electrodes, flux, and other welding materials shall be maintained. Precautions shall be taken to minimize absorption of moisture by electrodes and flux.

D.3. Similarly, Section 4.9.2 of the 1975 AWS Code obligates the user to protect low-hydrogen electrodes from contamination:

> All electrodes having low hydrogen coverings conforming to AWS A5.1 shall be purchased in hermetically sealed containers or shall be dried for at least two hours between 450°F (230°C) and 500°F (260°C) before they are used. Electrodes having low hydrogen coverings conforming to AWS A5.5 shall be dried at least one hour at temperatures between 700°F (370°C) and 800°F (430°C) before being used. Electrodes shall be dried prior to use if the hermetically-sealed container shows evidence of damage. Immediately after the opening of the hermetically-sealed container or removal of the electrodes from drying ovens, electrodes shall be stored in ovens held at a temperature of at least 205°F (120°C). E70XX electrodes that are not used within four hours, E80XX within two hours, E90XX within one hour, and E10XX within one-half hour after the opening of the hermetically-sealed container or removal of the electrodes from a drying or storage oven shall be redried before use. Electrodes that have been wet shall not be used.

These requirements are recodified in Section 4.5.2 in the 1981 AWS Code. In addition, the final sentence of the 1975 version of Section 4.9.2 has been incorporated into a new Section 4.5.4 in 1981 AWS Code. Section 4.5.4, entitled, "Redrying Electrodes," states:

> Electrodes that conform to the provisions of 4.5.2 shall subsequently be redried no more than one time. Electrodes that have been wet shall not be used.

Staff Testimony at 17-18 (Gilbert, Taylor).

D.4. A weld rod control program is intended to accomplish two objectives: (i) to ensure that the proper weld rod is used the welding job, and (ii) to ensure that weld rods are not exposed to excessive amounts of moisture. See Staff Testimony at 32 (Taylor); 1974 ASME Code, Section III, Article NF-4411. It is important that wet or moist weld rods not be used because moisture releases hydrogen during welding. See Tr. 12,266

(Collins). Too much hydrogen can embrittle the weld joint and cause it to crack. Tr. 11,822-24 (Muscente).

D.5. The Brown & Root weld rod control program is based on a daily system of accountability under which each welder is accountable for all weld material he uses on each shift. Applicants' Ex. 177 at 21 (Baker, Brandt); Tr. 11,421 (Brandt); Staff Testimony at 34 (Taylor). At the beginning of each shift, the foreman issues to the welder a Weld Filler Material Log (WFML) identifies the specific item or joint to be welded, the weld rod material type and quantity requested, the welding procedure to be used, and the welding symbol of the welder to whom the weld rods are issued. Applcants' Ex. 177 at 21 (Baker, Brandt).[6/] The WFML is then taken by the welder to any one of four rod shacks operated by Brown & Root where he draws the weld rod material for each specific work item. The rod shack attendant enters on the WFML the amount of material issued and the heat number of the material. The rod shack attendant also checks the welder's symbols against the welder qualification matrix to determine whether the welder is qualified to use the procedures listed in the WFML and whether the proper material has been requested for the assigned job. Applicant Ex. 177 at 21-22 (Baker, Brandt). In a separate accountability log, the rod shack attendant records the welder's symbols and the rod container numbers issued to him. Id..

D.6. Welders are trained to check welds rods for damage before using them. Applicants' Ex. 177 at 22 (Baker). If any weld rods are damaged,

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6/ Unlike CPSES, most nuclear facilities do not issue weld filler material on an item-specific basis; in this respect, Applicants' capability to trace its weld rods to specific work items exceeds the industry norm. Tr. 11,421-22 (Brandt).

the welder is required to return them unused to the rod shack at the end of his shift. Applicants' Ex. 177 at 22 (Baker, Brandt). As noted above, Applicants' procedures prohibit a welder from using a rod on any item to which it is not assigned. See Tr. 11,419 (Brandt). Consequently, if a welder is directed by his supervisor to work on a new project, a new WFML must be completed and weld rod material must be issued for that job even though the welder has already in his possession a sufficient number of rods to complete the task. Tr. 10,122 (Baker). Alternatively, if a welder does not have a sufficient amount of material to complete his assigned task, he must obtain authorization from his supervisor to receive additional welds rods from the rod shack. See Tr. 11,507 (Brown). Since the foreman estimates the amount of rods needed to perform the task assigned and adds to that a few additional rods, Tr. 11,599 (Coleman); Tr. 11,505-07 (Brown), a request for additional rods would prompt a foreman to inquire of the welder why his original allotment was insufficient. Tr. 11,507 (Brown).

D.7. At the conclusion of his shift, a welder must return to the rod shack to account for all of the material he was issued. The number of unused and damaged weld rods and used rod stubs must equal the number of weld rods issued to the welder. Any shortage is entered on a material shortage log. Applicants' Ex. 177 at 22 (Baker, Brandt). A welder who fails to turn in his filler material at the conclusion of his shift is subject to termination. Id. In addition, rod shack operations are reviewed periodically by the welding engineering and quality control departments. Id.

D.8. Mr. Stiner stated that welders at CPSES routinely keep extra weld rods so as to avoid having to return the rod shack. CASE Ex. 919 at 19 (H. Stiner). On cross-examination, Mr. Stiner acknowledged that he did not intend to imply that <u>all</u> welders keep extra rods, only those welders he observed. <u>See</u> Tr. 11,128. In further cross-examination, it turned out that Mr. Stiner had observed only two welders keep weld rods overnight. <u>Id</u>. Mr. Stiner stated that it was possible for welders to retain extra rods because rod shack attendants only count the number of unused rods returned by the welder and calculate the number of used rods by submitracting the number of unused rods from the total number of rods issued. CASE Ex. 919 at 19 (H. Stiner, D. Stiner).

D.9. Arrayed against the Stiner's allegation that the opportunity to retain used weld rods is made possible by the failure of rod control attendants to count used weld rod stubs is the testimony of the other welders involved in this proceeding. Mr. Pickett, for example, testified that he had witnessed rod shack attendants count his used rod stubs. Tr. 11,637 (Pickett). Mr. Coleman bore similar witness. Tr. 11,594 (Coleman). Messrs. Fernandez and Braumuller each stated that on occasion they had lost weld rods and that rod shack attendants noted the shortage. Tr. 11,696.

D.10. Rod shack attendants did not always count the weld filler material returned to them by welders immediately. On occasions when traffic at the rod shack was particularly heavy, the materials would be marked with the welder's symbols and counted at a more opportune time. <u>See</u> Tr. 11,595 (Coleman); Tr. 11,641 (Pickett).

D.11. In order for rod shack attendants to conceal their alleged abdication of responsibility, they would have to enter on the welder accountability log an amount equal to the difference between the number of rods issued and rods returned. To do this they would have to note on the shortage log maintained by them that there was no shortage. Mr. Baker, who heads the welding engineering department (which audits the rod control shack) testified that a review of shortage logs maintained by the rod shacks indicates that from August 1978 through the present reveals that there was no extended period when the number of unused or damaged rods and used rod stubs equalled the number of rods issued. Tr. 11,891-92 (Baker).

D.12. The other welders testifying in this proceeding stated that they had never retained extra weld rods for later use nor were they aware of other welders who may have done so. E.g., Tr. 11,686 (Fernandez, Braumuller). For example, Mr. Fernandez stated that it would be difficult for a welder to store extra rods in his tool bucket because the foreman would catch him. Tr. 11,698-99. Mr. Coleman testified that he knew Applicants place a high premium on weld rod control because he had been "really chewed out" for failing to return an empty rod can out overnight. Applicants' Ex. 177 at 32-33; see Tr. 11,501 (Brown) ("If you don't take rods back in the evening, they'd come looking for you.").

D.13. There is little to be gained by holding back extra rods since welders must report to the rod shack at the beginning of their shift the next day to draw their weld filler material. Applicants' Ex. 177 at 31-32 (Fernandez, Pickett, Braumuller). Also militating against retaining rods for later use is the knowledge that if a welder is caught using a weld rod on an item for which it has not been assigned, he is subject to the same punishment already meted out to one welder: termination. See Applicants' Ex. 177 at 28-29 (Baker), 31-32 (Fernandez, Braumuller, Pickett). In that case, the welder was caught by QC welding on a hanger with weld rods assigned for another task. The violation was recorded on NCR #M82-0034. Id. at 28. To remedy this violation, Applicants had the weld ground out and replaced. Id. at 29. This action, along with the welder's immediate discharge, in Applicants' view, "reflects the seriousness with which violations of the weld rod control procedure are viewed." Id.

D.14. Mr. Stiner also alleged that Applicants' weld rod control program does not prevent welders from loaning or borrowing rods. Tr. 11,644 (H. Stiner). Mr. Stiner's concern is not unfounded. Neither Applicants' program, nor any other for that matter, can ensure that no welder will ever borrow or loan a weld rod. Even Mr. Stiner is in agreement on this point. Tr. 11,651. The success of any rod control program depends in large part upon the integrity and professional pride of those involved in its implementation; CPSES is no different. Welders are expected to do their part to control their weld rods. Tr. 11,267 (Brandt). In view of the few documented weld rod control violations, Tr. 11,430 (Brandt), is not unfair to say that the record demonstrates that welders are doing their part.

D.15. QA/QC inspectors are alert to possible violations of weld rod control procedures. (Brandt, Tr. 11,267-71).[7/] Indeed, Mrs. Stiner's

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7/ Mrs. Stiner raised the concern that QC inspectors do not verify welder symbols "when doing an inspecting [of a hanger] that had partially been cut down and rewelded with no IRN (Interim Removal
(FOOTNOTE CONTINUED ON NEXT PAGE)

own experience illustrates that QC inspectors recognize and report such violations. See Tr. 4264-66; Tr. 10,205-07. On one occasion, Mrs. Stiner observed two bundles of unattended welds rods. Some of the weld rods had been "burned" partially but most of them had not been used. Mrs. Stiner's impression was that the rods either had been abandoned or were being saved for later use. Tr. 10,206. This apparent violation of weld rod procedures was reported immediately by Mrs. Stiner to her supervisor, Harry Williams. Id. According to Mrs. Stiner, Mr. Williams instructed her to take the rods to the foreman in the area and try to locate the person to whom the rods belonged. Tr. 10,207. The instruction which Mrs. Stiner allegedly received from Mr. Williams is not an unreasonable one since, according to Staff witness Taylor, frequently weld filler materials that appear to be abandoned are claimed by welders within a short period of time. Staff Testimony at 36-37 (Taylor).

D.16. Mrs. Stiner, however, considered Mr. Williams instruction "crazy" because she "felt sure that none of the craft foremen were going to. . . acknowledge the fact that the rods belonged to them." Tr. 10,207 (D. Stiner). That concern was unfounded, however, because if a welder violates weld rod control procedure it is he, not the foreman, that is subject to disciplinary action. See Applicant Ex. 177 at 31-32 (Pickett, Braumuller, Fernandez). Nevertheless, Mrs. Stiner disobeyed the instructions allegedly given her by Mr. Williams. Tr. 10,207. After keeping

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7/ (FOOTNOTE CONTINUED FROM PREVIOUS PAGE) Notice, which is required by procedures) in the traveler package..." CASE Ex. 919 at 20. Although the Board struck this portion of Mrs. Stiner's testimony Tr. 10,494 the Staff was asked to inquire into this concern. Tr. 10,504. When the Staff completes its inquiry an Affidavit will be filed with the Board addressing this concern.

the rods in her possession for several hours, she took them back to Mr. Williams, who is alleged to have thrown them in the trashcan. Id. According to Mrs. Stiner, Mr. Williams actions evidenced to her a lack of concern for proper weld rod control. See CASE Ex. 667 at 41-42, Tr. 4165-66 (D. Stiner).

D.17. Mr. Brandt, then Quality Assurance Manager (non-ASME) and Mr. Williams' supervisor, testified that Mr. Williams reported the incident to him and that he (Brandt) turned the weld rods over to the welding engineering department which was responsible for auditing rod shack operations. See Applicant Ex. 177 at 30. The welding engineering department conducted an investigation of the matter and traced the rods to Grinnell Fire Protection Company, one of Brown & Root's subcontractors. Id.; Tr. 10,132-34 (Baker); Tr. 11,454-55 (Brandt). Welders employed by Grinnell do not receive their weld filler material from rod shacks operated by Brown & Root; consequently, the failure of Grinnell's welders to follow rod control procedure in this instance cannot be attributed to any shortcoming on the part of Brown & Root's rod shack attendants. See Tr. 11,455.

D.18. To ensure that Grinnell welders observed weld rod control procedures, Applicant's quality control officials required that all of Grinnell's welders be "reindoctrinated" in "weld rod control requirements." Tr. 11,455 (Brandt). Thus, Grinnell welders are aware that they must be responsible for their weld rods, and that QC inspectors will report weld rod control violations.

D.19. Mrs. Stiner also alleged that an inordinate amount of rods were charged to hanger SI-0135032.S35R. CASE Ex. 667 at 40, Tr. 4164. Applicants conducted an investigation to see if there was any merit to

Mrs. Stiner's claim. Applicant Ex. 177 at 29 (Baker). That investigation revealed that only 50 weld rods (not 75 as reported by Mrs. Stiner) had been used on the hanger in question. Id. Moreover, a review of the weld rod accountability log "does not reflect that any rods were missing (i.e., the total number of unused rods, rod stubs, and damaged rods turned in was 50)." Id.

D.20. Even if it could be shown that welders routinely loaned or borrowed rods, or used weld filler material on items to which it was not assigned, or retained extra rods for later use, there is no danger that plant safety has been jeopardized. Low-hydrogen E7018 weld rods are used exclusively for structural welding at CPSES. Tr. 11,822 (Muscente); see Staff Testimony at 6, 31 (Taylor). Consequently, if welders borrowed rods, they would still be using the proper rod for the job. The E7018 weld rod also is readily distinguishable from the E6010 weld rod which was used at CPSES prior to the Stiners employment. Tr. 11,870 (Baker).

D.21. Finally, Applicant's tests show that the E7018 weld rod will produce acceptable welds even if left exposed for an extended period of time. See Applicants' Ex. 177 at 26-27 (Baker).

D.22. Finally, the Board notes that throughout the period of construction at CPSES, Staff inspectors have monitored Applicants' welding activities, including its weld rod control program. Staff Testimony at 36 (Taylor). Nothing in these inspections suggested that there was or is a weld rod control problem at CPSES. Id. at 36-37 (Taylor).

E. "PLUG WELDING"

E.1. Henry and Darlene Stiner testified that they had made "plug more properly are considered "repair welds." Staff Testimony at 24; see Applicants' Ex. 177 at 34-35 (Baker).

E.4. The 1974 ASME Code contains no express provision which governs the repair of misdrilled holes. Article NF-4131 of the 1974 ASME Code, however, permits the repair of defects discovered during the fabrication or installation process. In addition, Article NF-2510 of the 1974 ASME Code provides that defects in material may be repaired if permitted by the material's specifications. The material specifications for A-36 and A-500 low carbon steel provide that material defects may be repaired by welding. See ASME Code, Section II, Part A; Staff Testimony at 24 (Collins, Smith). In 1977, three years after publication of the code of record in this proceeding, ASME issued an Addendum which sanctions expressly the repair of misdrilled holes. ASME Code, Section III, Article NF-4131.

E.5. The 1975 AWS Code, like the 1974 ASME Code, does not address specifically the use of "plug welds" to correct defects in base materials. Section 3.7.4 of the AWS Code, however, permits "repair to base metals" if approval is obtained from the cognizant engineer, or other individual as permitted by Section 1.1.2 of the AWS Code. Staff Testimony at 24 (Collins, Smith).

E.6. The technique employed to repair a misdrilled hole is not a complicated one. The procedure entails welding one side of the hole and letting it cool. The plate then is turned on the opposite side, slag from the initial welding is removed with a chipping hammer or pencil grinder, and the second weld is made to close the hole. See e.g., Applicants' Ex. 177 at 35 (Baker); Tr. 11,623 (Pickett); CASE 919 at 22-23 (D. Stiner); Tr. 11,544; Applicants' Ex. 177 at 40 (Coleman).

E.7. Applicants have in place a procedure governing the repair of base metal defects, of which a misdrilled hole is one example. Tr. 11,766 (Baker); Staff Testimony at 24-25 (Gilbert, Taylor). Until January 1983, this procedure, WES-29, required that the welding engineering department issue a Repair Process Sheet (RPS) specifying the methods and techniques to be used for any base metal repairs, the qualified welding procedure to be used in making the repair (for Class 4 & 5 hangers the repair procedure is CDM 6.9 (Tr. 11,969) (Baker), and the type of nondestructive examination to be made of the repair. The RPS also provided for a final inspection by quality control. Tr. 11,766 (Baker). Beginning in January 1983, however, welders no longer are required to obtain authorization prior to repairing a base metal defect on a non-ASME item (i.e., cable tray supports). Staff Testimony at 25 (Gilbert, Taylor); Tr. 11,784-85 (Baker). Instead, welders are required only to notify QC before repairing the misdrilled hole. Tr. 11,785 (Baker). Quality control records the defect as "unsatisfactory" (i.e., misdrilled hole) on an Inspection Report (IR) and then reinspects the repair weld to determine whether it has been made properly. Id. The repair procedures comply with the ASME and the AWS Codes. Staff Testimony at 25 (Gilbert, Taylor).

E.8. If a misdrilled hole is repaired correctly, "there is little concern for the structural adequacy of the repaired material." Staff Testimony at 25 (Collins, Smith). A welder welding on the A-36 or A-500 low-carbon steel utilized at CPSES "need only weld in accordance with qualified welding procedures in order to produce a structurally sound weld." Id.

E.9. Mrs. Stiner expressed concern over the structural integrity of repair welds. According to Mrs. Stiner, repair welds contain entrapped slag which cannot be removed completely with a chipping hammer. CASE Ex. 919 at 22-23 (D. Stiner). The safety problem posed by this entrapped slag, according to Mrs. Stiner, is "the plug tempered with the base metal" creates a "weak spot" and could cause "the weld itself to break." Tr. 4154 (D. Stiner).

E.10. A properly made repair weld poses no greater risk of rupture or breaking than any other type of weld. Indeed, a properly made repair weld is stronger than the surrounding base metal. Staff Testimony at 26 (Collins, Smith). This is because the weld filler material used at CPSES (low-hydrogen E7018 electrodes) when blended with the low carbon steel used at CPSES results in a weld joint having a tensile strength of 70,000 pounds per square inch (psi), or about 10,000 psi more than the tensile strength of the base metal itself. Staff Testimony at 26; Tr. 12,236 (Collins).

E.11. Mrs. Stiner alleges that repair welds are unsafe because they contain entrapped slag deposit. Tr. 4154 (D. Stiner). Mrs. Stiner states that although she used a chipping hammer to remove slag deposits in repair welds, she was unable to remove <u>all</u> of the slag particles. Tr. 4154-55 (D. Stiner). However, it is not usual for small traces of slag to remain in a repair weld even after it has been cleaned. Moreover, in this respect a repair weld is indistinguishable from a stringer, weave, or any other kind of weld. <u>See</u> Tr. 12,185; Tr. 12,227 (Collins).

E.12. Slag deposits are an inevitable byproduct of the welding process itself. <u>Id</u>. This reality is recognized by the ASME and the AWS

Code, both of which regard slag inclusion as a rejectable defect only if the amount of slag (i.e., "porosity") exceeds specified allowables. Tr. 11,215 (Brandt); Tr. 12,279 (Collins, Smith). The ASME Code provides that porosity in a weld is a rejectable defect only if the diameter of any pore exceeds one-sixteenth of an inch (1/16"). Tr. 11,215 (Brandt). Porosity is not a rejectable defect under the AWS Code unless the sum of the diameters of the pores exceed three-eighths inches (3/8") in any linear inch, or three-fourths of an inch (3/4") in any linear foot. Id.

E.13. If there are no indications of slag on the surface of the weld, it is not unreasonable to assume that the weld is acceptable. Tr. 12,185 (Collins). This is because the slag particles remaining after the weld has been cleaned would be granulated by the force of the welding arc and would float to the surface of succeeding weld passes (Tr. 12,240 (Collins)), where they would be detected by QC if not removed by the welder.

E.14. Mr. Stiner stated that he dispensed with the cleaning of root and intermediate passes of multipass welds in order to save time. Tr. 10,684-85; CASE Ex. 919 at 22 (H. Stiner). According to Stiner, a welder had to make a "plug weld" quickly to avoid detection by QC. Id. Mr. Stiner stated that even though the "plug weld" contained unacceptable slag deposits, he could make it appear "visually acceptable" by grinding "the 'plug weld' down to the top of the parent metal and buff[ing] the surface so you could tell it was there." Tr. 4221; CASE Ex. 919 at 22. The weight of the evidence, however, indicates that a weld cannot be made properly or quickly if slag deposits are not cleared between passes. See Tr. 12,240 (Collins); Applicants' Ex. 177 at 37 (Baker).

E.15. The E7018 electrode used at CPSES produces a heavy layer of slag. Applicant Ex. 177 at 35 (Baker). This slag coating (which is a "non-insulator") is so heavy that unless it is removed, the welder will be unable to establish an arc. Id. at 35, 37; Tr. 12,240 (Collins). Because abnormal weldings techniques would be required to weld over significant amounts of slag, it would be counterproductive for a welder to use these techniques since they are "extremely time consuming." Applicants' Ex. 177 at 37 (Baker).

E.16. Porosity (i.e., slag inclusion) is indicated on the surface of the weld by "a series of little dimples," black in color. Tr. 12,162 (Collins). Grinding the surface to remove the dimples would not hide this condition because in grinding down the surface, the underlying slag would be uncovered which in turn would have to be removed. Id. Failure to clean inner or root passes will not leave excessive amounts of entrapped slag because, as noted above, the force of the welding arc will fracture the slag into granules which will rise to the surface in succeeding passes. Tr. 12,240 (Collins). In view of the foregoing, the Board is persuaded that any repair welds made by Mr. and Mrs. Stiner are unlikely to contain unacceptable amount of slag deposits.

E.17. The testimony of the other welders participating in this proceeding does not indicate that welders at CPSES dispensed with the cleaning of slag deposits. According to these welders (who are familiar with the practice of welders in the areas in which the Stiners worked) there were never any shortages of chipping hammers or pencil grinders. E.g., Tr. 11,621 (Pickett); Tr. 11,547 (Coleman); Tr. 11,469 (Brown). Indeed, several of these welders possessed two or more pieces of slag removal equipment. Tr. 11,621 (Pickett); Tr. 11,547 (Coleman). Further, none could corroborate Mr. Stiner's allegations that welders were pressured by supervisors to increase output. See e.g., Tr. 11,715 (Green); Tr. 11,598 (Coleman); Tr. 11,620 (Pickett).

E.18. Also of significance is the absence of any evidence corroborating Mr. Stiner's contention that a welder could not afford to spend the time required to clean away slag when "you're standing there trying to get these done without QC catching you. . ." Tr. 10,685 (H. Stiner). Messrs. Fernandez and Braumuller, two welders identified by Mr. Stiner as having made "plug welds" and having observed Mr. Stiner "plug weld" in the cable spread room, Tr. 10,675-76, each testified that although company procedures permitted the repair of misdrilled holes, he had never repaired one himself. Tr. 11,690 (Fernandez, Braumuller). Nor has either of them seen a welder make a repair weld. Id. Additionally, Mr. Fernandez testified that he had never worked in the cable spreading room as Mr. Stiner had stated. Tr. 11,691. Mr. Pickett stated that he had, and Mr. Stiner may have, repaired misdrilled holes in the cable spread room. Tr. 11,622, 11,629 (Pickett). Mr. Pickett testified, however, that because all of the repair welds made by him were authorized, there was no need to work fast to avoid detection by QC, see Tr. 11,622-25, 11,632, or to ask anyone to stand watch for QC. T. 11,655. Nor did any welder ever ask Mr. Pickett to stand watch for him. Id. Finally, Mr. Coleman, the only person identified by Mr. Stiner as having stood watch for QC while unauthorozed repair welds were made denied having done so. Tr. 11,602-03 (Coleman). According to Mr. Brown, who was Mr. Stiner's foreman during the latter's second term of employment at CPSES, a supervisor risks termination for "standing watch to make sure that [a welder] didn't get caught" while performing "illegal work." Tr. 11,481 (Brown).

E.19. Mrs. Stiner stated that she was ordered by her formen, James Stembridge and Clay Andrews, to make illegal plug welds on fabrication tables in the turbine building. Tr. 10,628 (D. Stiner). This allegation was investigated by both the Staff and the Applicant. In the course of its investigation, Mr. Stembridge confirmed to Applicant that he had directed Mrs. Stiner to weld a piece of angle iron onto a section of a small bore hanger in order to extend the dimension of the hanger. See Tr. 11,781 (Baker); see also Staff Testimony at 28-30 (Gilbert, Taylor). Mr. Hallford, a Brown & Root foreman, observed Mrs. Stiner execute Mr. Stembridge's order and notified a QC inspector named Larry Wilkerson and asked him to investigate. Tr. 11,783 (Baker). Mr. Wilkerson caught Mrs. Stiner in the act of making the improper repair. Id. According to Mr. Baker, Mr. Wilkerson determined that it was not necessary that a non-conformance report (NCR) be written because the hanger was discarded. Tr. 11,783-84. Mr. Stembridge had been appointed foreman shortly before the incident occurred. Tr. 11,781 (Baker). However, as a result of his violation of procedure, he has been stripped of his supervisory responsibilities and demoted back to a craftsman position with the understanding that he has no chance of ever becoming a supervisor again. Tr. 11,786-87 (Baker). The only reason Mr. Stembridge was not terminated was bcause his work record had been exemplary until that point. Id.

E.29. The Staff has not succeeded in contacting Mr. Andrews, who is no longer employed at CPSES, Staff Testimony at 29 (Taylor), and thus cannot confirm at this time Mrs. Stiner's charge against him. The Staff was able to confirm, however, that Mrs. Stiner had been directed by Mr. Stembridge to make a weld in violation of procedures, see Staff Testimony at 28-30 (Gilbert, Taylor), and that Mr. Stembridge has been penalized for his conduct by being demoted from his foreman position (Mr. Stembridge told Staff investigators, however, that his demotion was "voluntary"). Id. at 29. The Staff was not able to inspect the hangers in question because they have been scrapped. Id. at 30. Inasmuch as the hangers were not installed, there is no safety concern with respect to this incident, however.

E.21. In September 1981, the Staff investigated Mr. Stiner's allegation that misdrilled holes were not being repaired in accordance with Brown & Root's procedures. See Staff Ex. 178 at 5-6. The Staff interviewed five welders, three of whom stated that they had in the past repaired misdrilled holes; the other two stated that they had not because they believed "plug welding" was not allowed at CPSES. Id. at 6.

E.22. In April 1984, the Staff conducted another investigation into Mr. Stiner's allegation that unauthorized and uninpsected repairs of misdrilled holes had been performed at CPSES. Addendum to Page 27 of Staff Testimony at 1 (Gilbert). This investigation was prompted by Mr. Stiner's disclosure (subsequent to the Staff's September 1981 investigation) that he and Fred Coleman had made unauthorized and undocumented repairs of misdrilled holes in the north cable spreading room (Tr. 10,990-11,005; 11,008-11), and that Armand Braumuller had done the same in the south yard tunnel. Tr. 11,001 (H. Stiner).

E.23. The Staff inspected 56 of the approximately 200 supports in the north cable spreading room and 31 of the approximately 660 supports in the south yard tunnel. Tr. 12,274 (Gilbert). No indication of plug welds were present on any of the 31 supports examined in the south yard tunnel. Addendum to Page 27 of Staff Testimony at 1 (Gilbert). Had there been any plug welds on any of these supports, Mr. Gilbert would have noticed them because when ground down, a plug weld has a smoother surface than the surrounding base metal which can be seen with a flash light. Tr. 12, 275 (Gilbert).

E.24. The Staff's inspection of the 56 supports in the north cable spreading room, however, uncovered two plug welds in each of three supports. Addendum to Page 27 of Staff Testimony at 1 (Gilbert). The Staff then reviewed the hanger packages for these supports to ascertain whether these plug welds had been authorized, inspected, and approved. Id. The hanger packages contained no indication that that was the case. Id. Thus, to the extent that the documents do not confirm that the plug welds on these hangers were made according to procedure, there has been a violation of procedure. Tr. 12,261 (Gilbert). The Staff will require Applicants to explain the significance of these undocumented repairs. Specifically, the Staff will require Applicants to (i) determine whether these repair welds are structurally sound; (ii) explain why the identified repair welds escaped inspection by quality control; and (iii) provide satisfactory assurance that there are no remaining undocumented repair welds in the north cable spreading room.[8/]

8/ The Staff has received and is evaluating Applicants' response to this matter. An Affidavit will be filed with the Board when the Staff has completed its evaluation.

V. CONCLUSION

In view of the foregoing, the Staff submits that Applicants' weld fabrication and weld rod control procedures comply with applicable NRC regulations; are consistent with the 1974 ASME Code and the 1975 AWS Code; and comport with generally accepted welding practices. In addition, the Staff maintains, with the possible exception of the open items noted herein,[9/] that Applicants' weld fabrication and weld rod control program has been implemented in such a manner as to assure that the public safety is not threatened. Accordingly, with the exception of the open items listed in note 9 above, the Board finds that the Applicants have adhered to the quality assurance/quality control provisions required by the construction permits for Comanche Peak, Units 1 and 2, and the requirements of Appendix B of 10 C.F.R. Part 50 with regard to weld fabrication and weld rod control activities and the Board can make the requisite findings of 10 C.F.R. § 50.57(a) noted in paragraph III-6 above.

Respectfully submitted,

Gregory Alan Berry

Gregory Alan Berry
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 7th day of September, 1984

9/ These "open" items are the significance of (i) welders making subjective determinations as to whether the preheat requirement of Procedure 11032 has been satisfied, (ii) the significance of the alleged failure of welders at CPSES to use temperature indicating equipment to verify interpass temperatures; (iii) undocumented repair welds on two hangers in the north cable spread room discovered by the Staff; and (v) pipe support H-CC-1-SB-038-010-3, alleged by Mr. Stiner to contain a downhill weld; and (vi) the alleged failure of QC to verify welder symbols on Class 5 hangers.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NOTICE OF APPEARANCE

Notice is hereby given that the undersigned attorney herewith enters an appearance in the above-captioned matter. In accordance with 10 C.F.R. § 2.713(b) the following information is provided:

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Name of Party	-	NRC Staff U.S. Nuclear Regulatory Commission Washington, DC 20555

Gregory Alan Berry
Gregory Alan Berry
Counsel for NRC Staff

Dated at Bethesda, Maryland
this 7th day of September, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF PROPOSED FINDINGS OF FACT ON WELD FABRICATION" and "NOTICE OF APPEARANCE" in the above-proceeding have been served on the following by deposit in the United States mail, first class, or deposit in the Nuclear Regulatory Commission's internal mail system (*), or by express mail or overnight delivery (**), or by hand delivery (***), this 7th day of September, 1984:

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