

U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION IV

Report No. 50-445/78-17; 50-446/78-17

Docket No. 50-445; 50-446

Category A2

Licensee: Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

Facility Name: Comanche Peak, Units 1 & 2

Investigation at: Comanche Peak Station and Off-Site

Investigation conducted: October 4-12, 1978

Inspectors: W. A. Crossman
for R. G. Taylor, Resident Inspector, Projects Section
(Paragraphs 1, 2, 3, 4 & 5)

10/25/78
Date

John J. Ward
W. J. Ward, Investigation Specialist
(Paragraph 4)

10/25/78
Date

Approved: W. A. Crossman
W. A. Crossman, Chief, Projects Section

10/25/78
Date

Inspection Summary:

Investigation on October 4-12, 1978 (Report No. 50-445/78-17; 50-446/78-17)

Areas Inspected: Special investigative inspection of generic aspects due to failure of a Cadweld splice during fabrication operations in Unit 1 Containment Building wall. The investigation involved sixteen inspector-hours by the CPSES Resident Inspector and the RIV Investigator.

Results: No generic aspects of the Cadweld splice failure were identified.

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INTRODUCTION

The Region IV Investigator and the IE Resident Inspector assigned to Comanche Peak Steam Electric Station (CPSES) conducted an investigation related to generic aspects of poor workmanship in Cadweld splicing of the Unit 1 Containment wall reinforcing steel.

REASON FOR INVESTIGATION

The licensee, on October 4, 1978, reported to the Resident Inspector an event that had occurred on October 2 and had the potential of being reportable under the requirements of 10 CFR 50.55(e). The licensee reported that a Cadweld splice in the Unit 1 Containment wall reinforcing steel had pulled apart upon application of a light force while preparing the spliced bar for additional splicing. The mode of failure was such that grossly poor workmanship had to be the cause, either by intent or by negligence. The Cadweld splicer, according to licensee quality assurance records, had performed over six hundred (600) other splices throughout the various Category I buildings and involved both Units 1 and 2. The Cadweld splicer had been terminated in March 1978 for disciplinary reasons not related to his actual work.

SUMMARY OF FACTS

1. The following facts were established from licensee quality assurance records made available to the IE Resident Inspector:
 - a. The failed Cadweld splice was made on the second shift during the evening hours of December 16, 1977, and was one of four (4) splices made that evening by the splicer.
 - b. The splicer had made a total of six hundred eighty-seven (687) splices over a period beginning January 21, 1977, and terminating March 27, 1978.
 - c. The splicer had been qualified initially and his work inspected and tested commensurate with the requirements of NRC Regulatory Guide 1.10 throughout his working period.

- d. The licensee/contractor quality control organization had rejected a total of eight (8) splices made by the splicer for visual defects during the above working period.
 - e. None of twenty-five (25) tensile tests conducted on the splicer's work evidenced failure.
 - f. All but twelve (12) splices made by the splicer were embedded in concrete and thus were not readily available for examination. Of the four made on the evening of December 16, only one splice in addition to the failed splice was available for examination.
2. The following facts were established by the licensee during the period from October 2 through October 11, 1978. The IE Resident Inspector maintained an overview surveillance of these activities during the period:
- a. Each of twelve accessible Cadweld splices made by the person in question was radiographed to ascertain position of the bars within the splice sleeve and visually reinspected for correct filler metal fill. All splices were deemed acceptable by the licensee.
 - b. The licensee's Product Assurance Group, a component of the licensee's QA organization charged with special investigations, sureveillances, etc., reinspected 3106 Cadwelds in Unit 1 Containment not already embedded with following results:
 - (1) Nine (9) had visually detectable defects not meeting acceptance criteria. All were tension tested after being removed from the structure and met acceptance criteria.
 - (2) Fifty-one (51) had witness mark problems making uncertain the sleeve centering over the bar ends. Twenty-six (26) of these were radiographed where the highest degree of uncertainty existed. All were found acceptable.
 - (3) Eight (8) vertical Cadwelds displayed some amount of end packing of asbestos remaining on the bottom end of the splice. Upon removal, all splices were visually acceptable.

3. The following facts were established during an interview of the Cadweld splicer in question at his home on October 7, 1978. The interview was conducted by the IE Region IV Investigator with the Resident Inspector present.
 - a. The individual denied any recollection of the specific splice involved although he was shown pictures of the failed element.
 - b. The individual recollected having made a group of splices on the evening of December 16, 1977.
 - c. The individual stated that, in his opinion, he had been a good Cadweld splicer and has never knowingly made a poor splice.
 - d. The individual offered the possibility that he may not have actually made the failed splice, but rather that another splicer may have used his identifier marking on the splice sleeve. The individual could not recall what other splicers may have been in the vicinity that evening.
 - e. The splicer also offered the possibility that, during his absence, a helper may have improperly set up the Cadweld for him to fire on his return. The individual could not recall the name of the helper.

4. The following facts were obtained by the IE Resident Inspector during an on-site interview with the Brown & Root quality control inspector of record for the splices made on the evening of December 16, 1977:
 - a. There were several other splicers in the general vicinity of the location of the failed splice on the evening of December 16. (The inspection record indicates three other splicers on the same work segment.)
 - b. The B&R inspector stated that he recalled the particular work that evening because of the difficulties and hazards involved. He stated that much of the splicer setup work was done under poor lighting conditions and that he had had to use a penlight to make his inspections.
 - c. The B&R inspector stated that he had inspected some of the preparatory setup work of each of the splices made that evening by each of the four splice crews involved, but had no recollection of what stage of work he had inspected on any given splice.

CONCLUSIONS

1. The defective splice reported to the IE Resident Inspector as having pulled apart was not representative of the splicer's work and is therefore considered to be an isolated case.
2. There is no reason to question the integrity of the Cadweld splices in the Containment based upon the licensee's reinspection and test effort.
3. The Cadweld splicers are occasionally careless in proper marking of the spliced bars. The licensee has committed to certain procedural revisions to make clearer the requirements and to retraining the splicers and their immediate supervision in this area.
4. The quality control personnel have been remiss in their inspections of Cadweld splices on occasion. The licensee has retrained these personnel during the course of their special inspection.

DETAILS

1. Persons Contacted

Principal Licensee Personnel

R. G. Tolson, TUGCO Site QA Supervisor
J. V. Hawkins, TUGCO/G&H Product Assurance Supervisor
R. V. Fleck, TUGCO/G&H Civil Inspection Supervisor
E. Holland, TUGCO Product Assurance Technician

Other Personnel

Cadweld Splicer "CD," Brown & Root Ironworker (No longer employed)
Brown & Root QC Inspector

2. Unit 1 Containment Wall Reinforcing Steel Cadweld Splice CDD-56

a. Identification of Incident

The licensee on October 4, 1978, reported a possible significant construction deficiency to the IE Resident Inspector. The licensee representatives indicated that a Cadweld splice, identified as CDD-56 in the Containment wall diagonal reinforcing steel at approximately the 955 foot level, had pulled apart during preliminary work of preparing the bar for additional splicing to continue the steel to the Containment springline.

b. Examination of Cadweld Splice CDD-56

The IE Resident Inspector examined the splice and found that one bar, the lower one already embedded in concrete, extended into the splice sleeve only about 1/2 inch rather than the normal of 4-1/2 inches, while the other bar extended through the sleeve to meet the lower bar.

The upper bar also had two witness file marks on the bar rib for locating the bar ends after splicing, one positioned such as to indicate the actual bar end point and one 4-1/2 inches away indicating where the bar end point should have been, i.e., in the center of the sleeve. The concrete was subsequently removed from the necessary area of the lower bar on which two witness file marks were also revealed.

Further examination of the splice revealed that the bars had been properly located so as to be substantially concentric with the inside diameter of the splice sleeve and been properly filled with splice filler metal. The finished inplace splice would have met the visual quality control inspection criteria except for the presence of four witness marks instead of two, a point which apparently escaped the notice of the Brown & Root inspector who inspected the splice both before and after it was completed as indicated by applicable inspection records.

The IE Resident Inspector reviewed the background of the B&R inspector of record and determined that he had an educational level commensurate with current industry standards for the job and had received training (with attendant examination) in Cadweld splice inspection.

3. Interview with B&R QC Inspector

On October 12, 1978, the IE Resident Inspector interviewed the B&R inspector for the purpose of ascertaining any peculiar conditions which might have prevailed when the splice was made on December 16, 1977, during the second shift. He was asked if he could give his understanding of the meaning of a check mark and initials on the inspection records.

The B&R inspector appeared to very well recollect the particular evening, since it was somewhat unusual. The inspector related that he and several Cadwelders (the record indicates four) with their helpers were dispatched to Unit 1 Containment wall to add short bars to already installed diagonal bars in order to achieve the needed elevation for subsequent concrete placements. These personnel rode a construction elevator up the inside of Containment, crawled over the top of the liner, down Nelson studs on the outside and into place in the reinforcing steel. The work was to take place about 150' above the ground with no scaffolding and only site area lighting available.

The inspector indicated the splice setups were done with the aid of flashlights and that he used a penlight to perform his inspections, a condition which might explain why the extra witness marks were missed.

The B&R inspector also explained his understanding of the meaning of the check marks on the inspection record. He understood that he was to check the record form if he saw any part of the splice setup of any given splice whereas the related quality control procedure in effect at the time (now superceded and obsolete) would imply that he observed the entire setup and found it acceptable. The B&R inspector could not recall what setup aspect he observed on any given one of the twelve (12) splices made that night although he saw some part of every one and so indicated on the record.

4. Interview with Identified Cadwelder

The IE Region IV Investigator and the Resident Inspector jointly interviewed the identified Cadwelder of record involved in making the defective splice to ascertain if he could recall the particular splice or any others made by him or others that might be comparable. The interview took place at the home of the individual on October 7, 1978, rather than on the job site since he had been terminated for disciplinary reasons not related to his work in March 1978. The following is a summary of the results of the interview:

- a. The individual denied having any recollection of setting up a splice in the manner described to him and as illustrated with pictures.
- b. The individual could recall splicing the stub extension bars in December 1977 and that the lighting was bad, but did not relate other circumstances.
- c. The individual indicated that he thought he had made sixty or seventy diagonal splices for the two units. He further indicated that while the diagonal splices were sometimes more difficult than vertical or horizontal, they were not so difficult as to make him do his job improperly. (Note: The site records reflect a total of sixty-one such splices, all but two of which have been embedded in concrete for a substantial period.)
- d. When asked to guess as to how this could have happened, the individual suggested the possibility that a helper could have done the entire splice setup and that the Cadwelder could have ignited it without first checking the alignment. He did not recall any time when a helper would have done this for him.
- e. He could not recall any of his helpers' names.

- f. The individual also stated that he might not have made the splice at all. Sometimes a Cadwelder will place another Cadwelder's identifier on a sleeve to avoid the work involved in being tested. This might occur particularly when the splice has to be tested under adverse conditions.
- g. The individual claimed that he had been a good Cadwelder; had always tried to do a good job and never knowingly done improper work.
- h. The individual denied any knowledge relative to the double witness marks on the splice.

5. Surveillance of Licensee Evaluation

The IE Resident Inspector maintained general surveillance over the licensee's effort to resubstantiate the quality of Cadweld splicing in the Unit 1 Containment as well as in other buildings. The licensee assigned a quality assurance component referred to as "Product Assurance" to the task. The group had no routine responsibility for making or inspecting Cadwelds but had the necessary expertise to accomplish a re-evaluation. The findings of the group were:

- a. The splicer identified as CD had worked in Unit 1 and 2 Containments, the Unit 1 Safeguard Building and the Common Auxiliary Building. Only one of his splices in Unit 1 Containment, other than the failed item, and eleven splices in the Auxiliary Building were not yet embedded in concrete. These twelve splices were radiographed with a technique sufficiently sensitive to reveal the bar positions within the splice sleeve. All were found to be satisfactory. The IE Resident Inspector reviewed selected radiographs including the one splice available in Containment and had no questions concerning this finding.
- b. The group conducted a preliminary reinspection of other Cadweld splices in the 955' concrete placement area of the Unit 1 Containment and found problems which caused them to ultimately reinspect all Cadwelds in the structure not yet embedded in concrete. The licensee's records indicate that 3106 such Cadwelds were reinspected by the group of five people over a period of four working days.

Nine (9) of the splices contained splicing defects which should have been initially rejected by either the craft or by quality control. Each of the nine were cut out and tension tested. Each splice developed full bar strength.

Eight (8) vertical splices had some packing still remaining on the bottom area.

The balance of visually detectable Cadweld problems were either no witness marks, one witness mark or several marks; i.e., more than two. There were fifty-one splices in this category. The Product Assurance group had twenty-six (26) of these splices radiographed where there was uncertainty as to correct bar positioning in the sleeve. All were acceptable.