



So your children can tell
their children.

June 22, 1977

Mr. J. P. O'Reilly
Director-Region I
U. S. Nuclear Regulatory Commission
931 Park Avenue
King of Prussia, Pennsylvania 19406



SUSQUEHANNA STEAM ELECTRIC STATION (SSES)
INTERIM REPORT OF A REPORTABLE DEFICIENCY REGARDING
UNSATISFACTORY FIELD WELDING AND INSPECTION OF
SHEAR STUDS
DOCKET NOS: 50-387 & 50-388
LICENSE NOS: CPPR-101 & CPPR-102
ERs 100450/100508
PLA-182

FILE 840-4

Dear Mr. O'Reilly:

This relates to an occurrence which was reported to Regulatory Inspector, Mr. S. Folsom during the course of an unannounced inspection visit May 24-27, 1977. The inspector was informed that PP&L was evaluating the reportability of deficiencies in construction involving the installation of shear connectors.

It was determined that for concrete placements 183-S-02, 201-S-02 and 714-S-03 there were several instances of the unsatisfactory resistance welding of shear studs and that the construction activities for the three (3) placements had progressed through final concrete preplacement inspection and acceptance by Bechtel QC personnel.

This is considered to be a significant deficiency in construction which is described in 10 CFR 50.55, (e), (iii).

An interim report, detailing the information available at this time, is attached for your information and review.

Although the attached report identifies early 1978 as the tentative time frame for a final definitive report, PP&L is making a deliberate effort

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60

to identify a specific and an earlier time for resolving this situation. You will be kept informed of progress or changes in status regarding our submittal of the final definitive report of this deficiency.

Very truly yours,



N. W. Curtis
Vice President-Engineering and Construction

Attachment

ARS:mcb

cc: Mr. Ernst Volgenau (15)
Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Mr. G. McDonald, Director
Office of Management Information
and Program Control
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

INTERIM REPORT
ON
SHEAR STUDS
FOR
SUSQUERANNA STEAM ELECTRIC STATION
UNITS 1 AND 2.

Prepared By: *[Signature]*

Checked By: *[Signature]*

Approved By: *[Signature]*

Project QC Engineer: *[Signature]*
Project QA Engineer: *[Signature]*

BECHTEL POWER CORPORATION
San Francisco, California

June 17, 1977

INTERIM REPORT
ON
SHEAR STUDS

TABLE OF CONTENTS

A. Purpose

B. Background

C. Discussion

- o Description of the Deficiency
- o Analysis of Safety Implications
- o Corrective Action

SHEAR STUDS

INTERIM REPORT

SUSQUEHANNA STEAM ELECTRIC STATION

UNITS 1 AND 2

PURPOSE

The purpose of this interim report is to provide available information, pursuant to 10 CFR 50.55 (e) (3), concerning errors made in inspection and a significant deficiency in construction involving field welding and inspection of shear studs. These shear studs are used in reinforcing concrete construction to provide a shear anchor between concrete slabs and structural steel floor framing.

BACKGROUND

Prior to placement of concrete for building floors in certain locations, shear studs are attached to structural steel members, primarily by resistance welding (i.e. a large electric current is passed between the stud and the structural steel member causing local melting and fusion at the point of contact). The studs then become embedded in subsequently placed concrete and provide a shear connection between the steel and the concrete.

The integrity of the weld between the stud and structural steel is inspected visually and tested by selectively bending the studs after the welding process is completed. Such bending does not prevent the functioning of the stud as a shear anchor. The bend tests are performed on the first two studs welded to each structural steel member.

The materials, welding, inspection and testing of such studs is in accordance with American Welding Society Code AWS D1.1-72, Section 4, Part IV.

DISCUSSION

Description of the Deficiency

Subsequent to Bechtel Quality Control (QC) final pre-concrete placement inspection and acceptance on May 21, 1977 for concrete placements 183-S-02 and 201-S-02 in the reactor building and 714-S-03 in the control building, Pennsylvania Power and Light Company (PL) Quality Assurance (QA) personnel found studs which did not meet the requirements of project specification 8856-C-19, "Installation of Shear Connectors" in at least one of the above placements. This



1234

deficiency, was noted on May 24, 1977. Bechtel personnel performed another inspection of these three placements and rework was performed as required. Bechtel QC completed the second inspection and acceptance of these placements on May 26, 1977. On this same date PL QA personnel again found studs in the above placements which did not meet specified requirements.

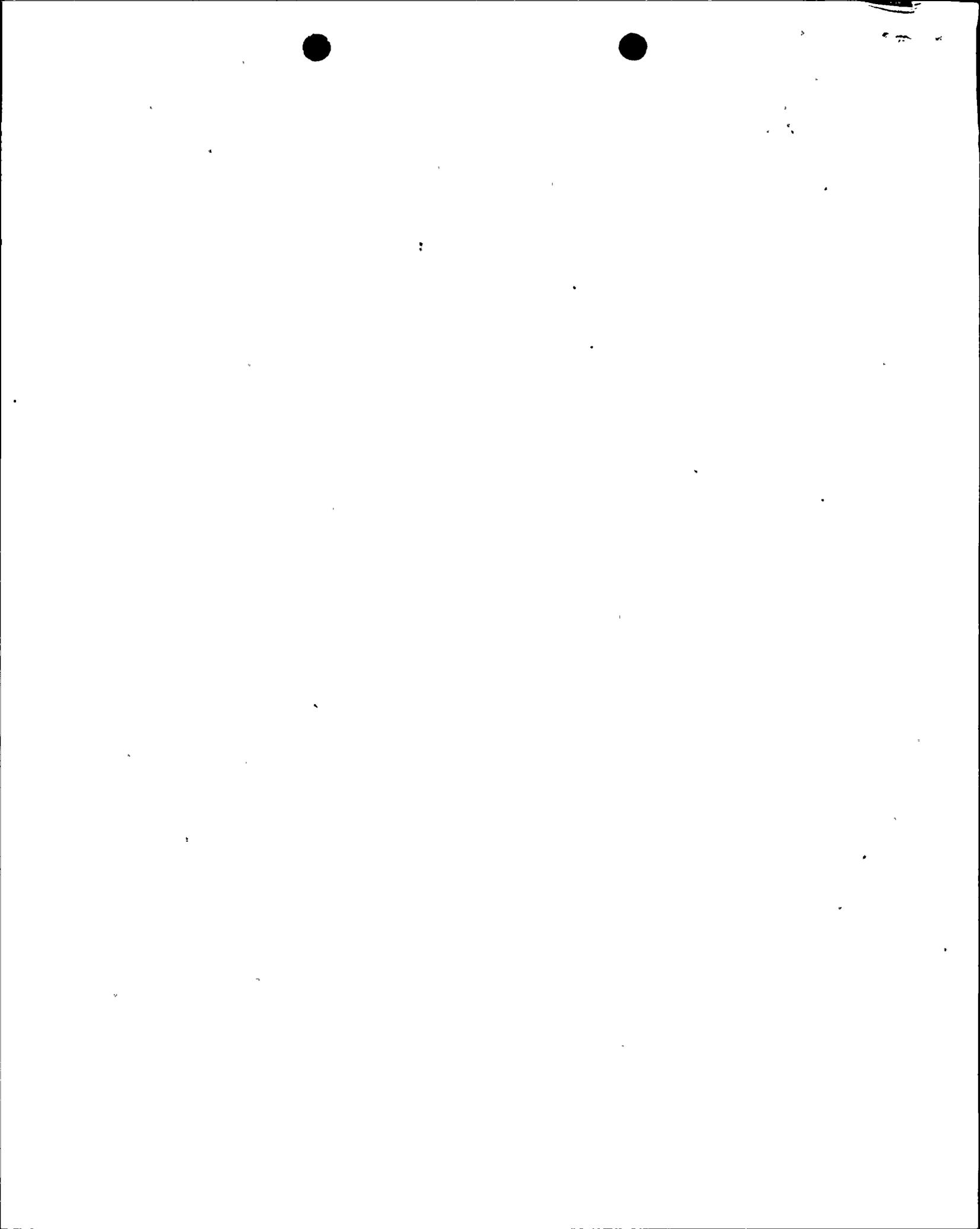
The basic cause of the inspection error was Bechtel QC personnel failure to carry out assigned responsibilities as defined in the quality control instructions for stud weld inspection. The following specifics are cited:

1. Responsible QC engineering personnel in the welding discipline signed inspection records signifying that 100% inspection had been performed. However, the inspections as defined by the program were not completely performed.
2. Responsible QC supervision personnel at the jobsite failed to provide adequate, definitive directions to the responsible QC engineering personnel in the welding discipline and failed to detect the lack of acceptable performance of the QC engineering personnel.

Major contributing elements to the unsatisfactory stud welding for concrete placements 183-S-02 and 201-S-02, is known to include to following:

1. The installation of studs was performed out of normal construction sequence, i.e. reinforcing steel and in some cases electrical conduit was installed prior to stud installation. This made it difficult for craft personnel to properly clean steel surfaces prior to welding operation.
2. Some of the studs were welded through the metal decking later used to support the fresh concrete placement. Such studs had a greater nonconforming rate than studs welded directly to the top flange of the beams as has been the practice for all other concrete placements.

Evaluation of other factors which may have led to the unsatisfactory stud welding for placements 183-S-02 and 201-S-02 is continuing. Evaluation of factors which may have led to the unsatisfactory stud welding for placement 714-S-03 is similarly continuing.



Welding of shear studs at the jobsite is limited to floors where it is desired to develop composite action of the concrete slab/structural steel system. At the time the deficiency described above was discovered, studs had been embedded in concrete in the following safety related buildings:

1. Containment - Unit 1 and 2
2. Reactor Building - Unit 1 and 2
3. Control Building
4. Diesel Generator Building

Some areas containing studs which were welded prior to May 26, 1977 and which are to be part of other placements are available for inspection and testing as concrete has not yet been placed. Additional data will be gathered from these areas.

Analysis of Safety Implications

As noted above, the studs provide a shear anchor to permit composite concrete/steel action by the floors. A reduction in the ultimate integrity of the shear anchor has no effect where the margin in shear strength remains adequate for the design loading for previous concrete placements. Where it is determined that additional shear anchors should be included to ensure adequate margin is maintained, several alternative approaches will be developed as required.

Corrective Action

Nonconformance reports (NCR's) were issued against the studs found to be in noncompliance with specified requirements for concrete placements 183-S-02, 201-S-02 and 714-S-03. These NCR's were evaluated and disposition provided to either "rework" or "use as is" depending upon engineering evaluation. In addition, Bechtel QA issued a Management Corrective Action Report (MCAR-1-18) on May 26, 1977 and a Stop Work Report on May 27, 1977. These reports precluded further embedment of shear studs pending complete reinspection of studs in these placements to assure conformance to specification and design drawing requirements.

1. Immediate Corrective Action:

A complete reinspection of the three concrete placements within the scope of the MCAR has been carried out. The reinspection was accomplished in accordance with a specially prepared program, containing several provisions to maximize the effectiveness of the inspection and to virtually eliminate any inspection error. The special provisions included the following:

- a. A detailed training program specifically addressing the unique aspects of the special inspection program and the fundamental requirements for stud inspection was conducted.

Special emphasis was placed on the recent problems related to the studs.

- b. Each stud to be inspected was uniquely identified by number, providing traceability to the inspection record for the particular stud.
- c. As-built drawings were made which identify the location of every stud by providing the direction sequence of the stud numbers.
- d. A separate check list was completed and signed for each particular stud.
- e. Each individual stud received a "general soundness test," consisting of striking the stud using a heavy hammer.
- f. Each inspection for each individual stud was documented, and the resulting inspection records were independently reviewed for completeness and acceptability.
- g. NCR's were written identifying the general conditions described within the MCAR. These NCR's were dispositioned providing alternates of repair, retest or replacement - thereby allowing the field engineer participating in the reinspection to provide direction for immediate rework, replacement or repair as necessary. Each occurrence was documented.

All of the inspections are complete, and all required rework and repair has been accomplished with acceptable results.

2. Action to Prevent Recurrence

- a. The QC welding discipline has been relieved of the responsibility for inspection of the studs, except those installed during prefabrication of embeds. The QC civil discipline has been directed to assume this responsibility. This action results in the following upgrading of the inspection program:
 - i. The inspection of studs is now more closely integrated with other related preplacement inspections, such as embeds, reinforcing steel, conduit, etc.
 - ii. The amount of QC engineering manpower which may be focused upon stud inspection is now increased.
 - iii. Inspection may now more often be carried out while stud installation is being performed, and while craft personnel are present to perform immediate rework or repair if necessary.

- iv. Stud inspection may now normally be completed before the studs are visually obscured by other installed items, such as curtains of reinforcing steel.
- b. The inspection plan for stud inspection has been reviewed and strengthened in the following specific areas:
 - i. Marking to physically identify both acceptable and unacceptable studs has been clearly defined in the inspection plan.
 - ii. Verification of proper stud welding cable length (i.e., less than 100 feet) has been added.

In addition, as further corrective action, a special jobsite training session on stud installation has been conducted for field engineering and craft supervision to guarantee improved quality of stud installation. The craftsmen were re-instructed on stud welding and requirements.

Based on the above, the stop work order was lifted during the week of June 6, 1977.

The disposition of embedded shear studs continues under review. The absence of adequate evidence of control over the welding of these studs requires that the data referred to above under "Description of the Deficiency" be utilized, along with other information such as design requirements for specific areas, to establish the adequacy of the various floors or to identify corrective work which may be warranted.

Such data, which is currently being gathered, shows variability in inspection and test failure rates among various areas. This variability will be accounted for and taken into consideration in the final disposition and report.

Until sufficient data is gathered and a preliminary assessment made based on this data, a firm date for submittal of a final report cannot be established. However, Bechtel expects that this report will be available in early 1978.

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