SYSTEMATIC SUPPORT INVESTIGATION

FOR

RANCHO SECO NUCLEAR GENERATING STATION

IN RESPONSE TO NRC AUDIT 85-01

TASK FORCE REPORT

SACRAMENTO MUNICIPAL UTILITY DISTRICT

SACRAMENTO, CALIFORNIA

JUNE 20, 1985

REPORT NO. ERPT-C0001

REVISION 0

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Note: Immediately after completion of this investigation, on June 23, 1985, an RCS leakage due to a crack in the 1 inch high point vent piping from the B-OTSG was identified. Consequently, this task force's assignment was extended to further investigate this issue, prepare an LER, and perform a root cause evaluation on this event. Upon completion of this task, a supplemental report will be issued.

EXECUTIVE SUMMARY

On January 7-11, 1985, the Nuclear Regulatory Commission (NRC) conducted a review of Sacramento Municipal Utility District's activities to evaluate the capability of the District's management to control the design and modification processes. As a result of this audit (NRC Inspection 85-01), the NRC issued a Notice of Violation due to nonconformances noted between the as-built conditions and the design documents for a few HVAC supports in the Nuclear Services Electrical Building (NSEB). In addition, the NRC issued a Notice of Deviation and identified two areas of concern with respect to the District's quality assurance program.

By letter, dated March 14, 1985, the District completely responded to the Notice of Deviation and the two areas of concern. Appropriate corrective actions were identified and implemented.

In response to the Notice of Violation, the District performed an immediate root cause evaluation and a visual inspection of supports of the same type as inspected by the NRC. The District's preliminary investigation identified areas of potential programmatic improvements and also concluded that the incident was an isolated case since only one temporary QC inspector was involved in all the nonconformant cases identified by the NRC. An engineering evaluation of the discrepancies indicated that no safety concerns existed. These results were provided to the NRC by the March 14, 1985 letter.

To assure that proper corrective action was being taken and that the full scope of the problem was identified, a multi-discipline Task Force was established. The charter of the Task Force was as follows:

- Research and evaluate other work performed by the identified inspector.
- Define the scope and accomplish the task of performing additional investigation which will include other systems within the NSEB and other buildings.
- Implement any appropriate corrective actions (such as improved training of new inspectors, or additional QA surveillances of QC inspection).
- Issue a final report of this investigation and any resulting corrective actions to the NRC prior to the Cycle 7 startup.

The Task Force developed a systematic support investigation program (program plan issued in March, 1985) to evaluate other work performed by the subject inspector and that of other inspectors on other systems and in different buildings. This investigation involved approximately 20 engineers and quality control inspectors in walkdowns of various supports selected at random including HVAC, cable tray, conduit and piping supports.

A total of 240 support structures, with approximately 2,880 individual components (i.e., welds, bolts, braces, member sizes, etc.), were inspected. Of the approximately 2,880 individual inspection items, 172, or approximately 6 percent, were found to be nonconforming. An engineering evaluation has been performed for the identified nonconforming items and no safety concerns were found. The following types of nonconformances were identified:

- Structural member undersized
- Connection detail not per design
- Weld undersized
- Member orientation/dimensions incorrect
- Bolted connection working point off
- Design/Design drawing discrepancy
- Structural member missing
- Bolt missing
- Violation of anchor bolt spec. EII CC-12
- Bolt spacing deviation from design
- Support gap deviation from design
- Base plate/anchors not installed per design
- Support location outside tolerance
- Support components not per design

The number and various types of nonconforming items indicate the need for programmatic improvements in several areas. The programmatic weaknesses identified by the Task Force include:

- Design personnel are not consistently indicating sufficient installation tolerances on design drawings.
- Craft personnel occasionally install supports with discrepancies.
- Field engineers are not consistently identifying configuration discrepancies during installation and prior to inspection.
- Some instances were noted concerning QC inspectors failing to document discrepancies.
- Insufficient number of permanent SMUD QC inspectors to adequately oversee the temporary/contract inspectors.
- QA was not completely implementing their construction surveillance program.
- Construction Inspection Data Reports (CIDRs) have lacked sufficient inspection requirements in some instances.

- Difficulty in determining if the noted discrepancies had previously been documented on an NCR.

- Bracing members romoved to facilitate maintenance and new work were not replaced in a few occasions.

To resolve the identified programmatic weaknesses, the Task Force proposes the following corrective actions to be completed by October 1, 1985, as committed to the NRC by letter dated June 3, 1985. The responsible department is identified in parenthesis.

- Implement Design Guides (new nuclear engineering procedures) and improve the training for the dising personnel to emphasize need to indicate tolerances on desing drawings. (Nucler Engineering).

- Improve training of craft supervision with respect to installation in accordance with design drawings and properly receive instructions. (Nuclear Engineering/Nuclear Operations).

- Assure that the training for field engineers addresses verification of the installation prior to QC inspection. (Nuclear Engineering/Nuclear Operations).

- Ensure that training is provided for QC inspection personnel emphasizing that inspection and acceptance of work must be performed to approved deisgn documents. (Initial training for QC inspectors was accomplished during initial phase of Inspection 85-01 Investigation.) (Nuclear Engineering/Nuclear Operations).

- The District will reorganize to combine two separate plant QC groups into a single department. (AGM, Nuclear).

- The QA surveillance program was reemphasized in the first quarter of 1985 with the issuance of scheduled QA surveillances and will continue to be implemented. (QA).

- Implement new construction Engineering Procedures/Inspection Standards (NEPs) and provide training to appropriate personnel. (Nuclear Engineering).

- Investigate methods to enhance the tracking of NCRs. (QA).

  (a) Data Base
  (b) Notation on Dwgs.
  (c) Notation on CIDRs

- Provide procedural controls for removed bracing members. (Nuclear Engineering/Nuclear Operations).

The Task Force has completed its investigation and identified programmatic weaknesses and recommended corrective actions. Although minor nonconformances were observed, no safety concerns were discovered. The Task Force has therefore concluded that further investigation is not warranted to close NRC Audit 85-01.

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ABSTRACT

On January 7-11, 1985 the Nuclear Regulatory Commission (NRC) conducted a review of Sacramento Municipal Utility District's activities to evaluate the capability of the District's management to control the design and modification processes. As a result of this audit (NRC Inspection 85-01) the NRC issued a Notice of Violation due to nonconformances noted between the as-built conditions and the design documents for a few HVAC supports in the Nuclear Services Electrical Building (NSEB). In addition, the NRC issued a Notice of Deviation and identified two areas of concern with respect to the District's Quality Assurance Program.

In response to the Notice of Violation, the District performed an immediate root cause evaluation and a visual inspection of supports of the same type as inspected by the NRC. The District's preliminary investigation identified areas of potential programmatic improvements and also concluded that the incident was an isolated case since only one temporary QC inspector was involved in all the nonconformant cases identified by the NRC. However, to assure that this was the case and to prevent recurrence of such incidents, the District planned a systematic support investigation for the HVAC and other systems within the NSEB and other buildings.

Random samples of HVAC, Cable Trays, Conduits, and Piping Supports were selected for this investigation. In addition, a sample of the inspections performed by the identified temporary inspector was also selected. The result of this investigation revealed discrepancies between as-built and design drawings which were indicative of the need for procedural and programmatic improvements. However, due to the minor nature of the discrepancies and sufficient safety margins in the original designs, no safety problems were identified during the dispositioning of the issued NCRs.

In this report, programmatic problems are identified and corrective actions are proposed. The suggested corrective actions are in the form of enhancements in the QA and QC inspection programs, additional training, new and more detailed procedures, and increased communication between various disciplines.

1.0 PURPOSE

The purpose of this report is to summarize the findings of the investigation conducted by the Task Force For Response to NRC Inspection 85-01 in response to this NRC audit. The Task Force was chartered to determine whether programmatic problems or safety concerns exist, and if so, to propose corrective actions for resolution of any problem. Doing so, the District is assured that the recurrence of such problems is minimized.

2.0 APPROACH

Random samples of supports for HVAC, Cable Trays, Conduits, and Piping were selected. In addition, a sample of the inspections performed by the identified temporary QC inspector involved with the NRC audit findings was selected. Selected samples were field inspected by a team of engineers and QC inspectors and the results were documented. The walkdown effort focused on the support configurations, locations, and component details.

An evaluation was performed to determine the programatic cause of each nonconforming item. Parallel to these evaluations, all the nonconforming supports were reviewed for safety concerns by engineering and the issued NCRs were dispositioned in accordance with SMUD QA and Engineering procedures.

3.0 PROCEDURE

The walkdown effort for this task was performed per "Systematic Support Investigation Plan for Rancho Seco in response to NRC Audit 85-01," revisions March and May 1985.

3.1 SAMPLE SELECTION

The following populations were sampled for this investigation:

- Work performed by the identified temporary QC inspector involved with the NRC audit findings.
- HVAC Supports.
- Cable Tray Supports.
- Conduit Supports.
- Piping Supports.

Sampling was performed in accordance with SMUD's Quality Assurance Implementing Procedure QAIP Number 3 Revision 0, which is based on MIL-STD-105D, "Sampling Procedures and Tables for Inspection by Attribute".

The sampling was done in two phases. First, random samples were selected and walkdown was started. Next, those items within the samples which, during the walkdown, were found to be inaccessible (due to physical accessibility problem or ALARA considerations) were replaced with other randomly selected accessible items. In the second phase, a CIDR (which had been selected in phase 1 to represent the work of other temporary and permanent QC inspectors) was deleted. This sample was judged not to offer any additional information to help in identifying any programmatic problem. Furthermore, based on ALARA considerations, no sample was selected from the Reactor Building. The result of the above samples are indicative of the status of the supports within the reactor Building.

3.2 PERSONNEL TRAINING

Walkdown personnel were trained on their specific activities, responsibilities, and the overall purpose and goals of this project per the Investigation Plan. This training is documented in the back-up calculation files.

3.3 WALKDOWN PACKAGE PREPARATION

Before starting the walkdown process, the latest revisions of design drawings and the corresponding Drawing Change Notices (DCNs) were compiled. Walkdown packages, as a minimum, included the following information for the supports in the sample:

- o Location Plan Drawing
- o Support Detail Drawing
- o Design Tolerances (if available)

3.4 PERFORMING SYSTEM WALKDOWN

Selected items within the scope of this investigation were field verified. The walkdown team consisted, as a minimum, of one QC inspector and one discipline design engineer. A walkdown checklist was prepared to facilitate the process of verifying the necessary field data on each sample. This checklist was signed off by both team members. The walkdown team verified whether all the structural components of the supports conformed to the corresponding design drawings. For the purpose of this investigation, weld existence, configuration, visual cracks, and other gross deficiencies were inspected. Measurements were made, based on the as-built configuration, using a measuring device such as a tape, ruler, weld gage, etc. In the instances where the support was inaccessible, a visual dimensional check was performed if the confidence in accuracy was high. In such cases the documentation reflected the fact that visual check was performed in lieu of an actual measurement.

Where a deviation from, or nonconformance to, the design drawings was observed in the as-built configuration, the checklist was marked appropriately. An updated as-built sketch was prepared to assist the design engineer in evaluation of the impact and resolution of the nonconformance.

3.5 DEFINITIONS

The following definitions were established to assure consistent classification of the deviations by the walkdown personnel when filling the walkdown checklist:

3.5.1 SATISFACTORY (SAT): This term was used to indicate that the as-built configuration, with the consideration of design tolerances, matched the design documents.

3.4.2 MINOR DISCREPANCY (MD): Any discrepancy which, to the judgement of the discipline design engineer accompanying the walkdown team, did not alter the structural behavior of the support such as loose bolts, missing or damaged cotter pins, corrosion, brackets added for construction or maintenance purposes, etc.

3.5.3 NONCONFORMANCE (NC): Any configuration difference from design documents which was outside the design tolerances and was not classified as a minor discrepancy.

3.5.4 MAJOR DISCREPANCY (MJD): Any nonconformance (NC) the dispositioning of which required hardware changes to maintain system operability. In accordance with the SMUD, Rancho Seco Technical Specification, a system is operable if it is capable of performing its intended function within the required range. Any major discrepancy would be indicative of a safety concern.

3.6 ACCEPTANCE CRITERIA

The walkdown team performed their inspection based on the design documents, the design tolerances given on the design drawings, and the above definitions.

The correctable Minor Discrepancies (MDs) were addressed to Nuclear Operations and Maintenance for corrective action, through a Work Request, on a weekly basis. Engineering did not take any further action on such items. The Nonconformances (NCs) were documented in a Non Conformance Report (NCR) and assigned to the responsible design discipline for their dispositioning on a sample basis.

All the walkdown personnel were instructed to report, per AP.22, any component or support found in a condition that seriously jeopardized its operability, should they run across such cases. None was identified.

4.0 SUMMARY OF RESULTS

The general walkdown results for all the samples selected are summarized below. The nonconformances were dispositioned by engineering evaluation and/or drawing change. The following are the identified categories of general nonconformances:

	No. of Occurrences
4.1 STRUCTURAL MEMBER UNDERSIZED:	(1)
The bracing member required per design was 3 1/2 x 3 1/2 x 3/8 angle, as-built was 3 x 3 x 3/8 angle.	
4.2 CONNECTION DETAIL NOT PER DESIGN:	(21)
Gusset plate size per design is 3/8" x 6", as-built plate sizes ranged from 3/8" x 5" to 3/8" x 6 1/2".	
4.3 WELD UNDERSIZED:	(29)
As-built fillet weld leg was undersized by up to 1/8". Two (2) supports were found to be missing welds.	
4.4 INCORRECT MEMBER ORIENTATION/DIMENSION:	(16)
Angle of bracing deviates from design drawing by up to 5°. As-built support dimensions deviate from design drawing dimensions.	
4.5 WORKING POINT FOR BOLTED CONNECTIONS WERE OFF:	(9)
As-built bolt working point is eccentric up to 3 1/4" (i.e., bolt lines of action do not intersect at location specified on design drawing.)	
4.6 DESIGN/DESIGN DRAWING DISCREPANCY:	(5)
Support designed as type 1, design drawing calls for a type 11 support (field installed type 1.) Support weld designed to be along plate length, drawing weld symbol calls for weld along plate width.	
4.7 STRUCTURAL MEMBER MISSING:	(4)
Support bracing member was removed and not reinstalled.	
4.8 BOLT MISSING:	(1)
Design drawing required 3 bolt connection between longitudinal brace and duct stiffener, as-built connection has 2 bolts.	

4.9 ANCHOR BOLT VIOLATION FROM SPECIFICATION: (17)

Embedded unistrut located within anchor bolt shear cone specified in EII CC-12. Anchor bolt center line - center line violates min. spacing required per EII CC-12.

4.10 BOLT SPACING DEVIATION FROM DESIGN: (5)

Design spacing for duct flange bolts center line - center line is 4" max., as-built spacing is 6" max. Stitch bolt spacing on back-to-back 2x2x1/4 angle is 20" max. per design, as-built spacing is 25 1/2".

4.11 SUPPORT GAP DEVIATION FROM DESIGN: (15)

Gap between process pipe and support deviates from design.

4.12 BASE PLATES/ANCHORS NOT INSTALLED PER DESIGN: (11)

Anchor bolt spacing/edge distances deviate from dimensions on design drawing. Base plate size deviates from design drawing size.

4.13 SUPPORT LOCATION OUTSIDE TOLERANCE (11)

As-built support location exceeds support relocation tolerance.

4.14 SUPPORT COMPONENTS NOT PER DESIGN: (7)

Pipe strap stock size 3/8" x 1 1/2" per design, as-built stock size is 1/4" x 2".

5.0 CONCLUSION

Evaluation of the walkdown data indicates that nonconformances between the as-built configurations and the design drawings do exist. Based upon the statistical sample, the Task Force has determined that programmatic problems exist. As illustrated by Table 5.1, the percentage of nonconformity is approximately 6% for all inspected components.

All the identified nonconformances were dispositioned through engineering evaluation alone with no hardware changes required to maintain support operability. Although nonconformances were observed, no major discrepancies were identified and therefore the Task Force has concluded that no safety problem exists in the support systems at Rancho Seco.

The following programatic problems were identified by the Task Force based on the data collected during the walkdown process.

A. Design personnel are not consistently indicating sufficient installation tolerances on design drawings.

B. Craft personnel occasionally install supports with discrepancies.

C. Field engineers are not consistently identifying configuration discrepancies during installation and prior to inspection.

D. Some instances were noted concerning QC inspectors failing to document discrepancies.

E. Insufficient number of permanent SMUD QC inspectors to adequately oversee the temporary/contract inspectors.

F. QA was not completely implementing their construction surveillance program.

G. Construction Inspection Data Reports (CIDRs) have lacked sufficient inspection requirements in some instances.

H. Difficulty in determining if the noted discrepancies had previously been documented on an NCR.

I. Bracing members removed to facilitate maintenance and new work was not replaced in a few occasions.

TABLE 5.1

SUMMARY OF RESULTS

240 support structures were inspected. Each support structure contained several inspectable components (i.e., welds, bolts, structural members, gaps, etc.). Therefore, based on an estimated number of inspected components, the following results can be concluded:

	SAMPLE	# OF SUPPORTS	(1) COMPONENTS PER SUPPORT	SIZE	SAT	MD	NC	MJD
1.	Inspections by the Identified Temp. Inspector	50	10	500	438	36	26	0
	(%)	-	-	(100%)	(88%)	(7%)	(5%)	(0%)
2.	HVAC Supports	50	10	500	413	51	36	0
	(%)	-	-	(100%)	(83%)	(10%)	(7%)	(0%)
3.	Cable Tray Supts	58	10	580	499	41	40	0
	(%)	-	-	(100%)	(86%)	(7%)	(7%)	(0%)
4.	Conduit Supports	50	10	500	471	20	9	0
	(%)	-	-	(100%)	(94%)	(4%)	(2%)	(0%)
5.	Pipe Supports	32	25	800	706	33	61	0
	(%)	-	-	(100%)	(88%)	(4%)	(8%)	(0%)
	TOTAL	240	-	2,880	2,527	181	172	0
	(%)	-	-	(100%)	(88%)	(6%)	(6%)	(0%)

NOTES: (1) APPROXIMATE NUMBER OF INSPECTABLE COMPONENTS PER SUPPORT STRUCTURE ASSUMED.

6.0 CORRECTIVE ACTIONS

To resolve to the identified programmatic weaknesses, the Task Force proposes the following corrective actions to be completed by October 1, 1985, as committed to the NRC in SMUD's letter dated June 3, 1985.

	CORRECTIVE ACTION	RESPONSIBLE DEPARTMENT
A.	Implement Design Guides (new nuclear engineering procedures) and improve the training for the design personnel to emphasize need to indicate tolerances on design drawings.	Nuc. Engineering
B.	Improve training of craft supervision with respect to installation in accordance with design drawings and properly receive instructions.	Nuc. Engineering/ Nuc. Operations
C.	Assure that the training for field engineers addresses verification of the installation prior to QC inspection.	Nuc. Engineering/ Nuc. Operations
D.	Ensure that training is provided for QC inspection personnel emphasizing that inspection and acceptance of work must be performed to approved design documents. (Initial training for QC inspectors was accomplished during initial phase of Inspection 85-01 Investigation.)	Nuc. Engineering/ Nuc. Operations
E.	The District will reorganize to combine two separate plant QC groups into a single department and improve the supervision for temporary/contract inspectors.	AGM, Nuclear
F.	The QA surveillance program was reemphasized in the first quarter of 1985 with the issuance of scheduled QA surveillances.	QA
G.	Implement new Construction Engineering Procedures/ Inspection Standards (NEPs) and provide training to appropriate personnel.	Nuc. Engineering

	CORRECTIVE ACTION	RESPONSIBLE DEPARTMENT
H.	The District will investigate methods to enhance the tracking of NCRs. (a) Data Base (b) Notation on Dwgs. (c) Notation on CIDR's	QA
I.	Provide procedural controls for removed bracing members.	Nuc. Engineering/ Nuc. Operations

Table 6.1

GENERAL CATEGORIES OF NONCONFORMANCES
AND CORRESPONDING CORRECTIVE ACTION

CAT.	GENERAL DESCRIPTION OF NONCONFORMANCE	ADDRESSING CORRECTIVE ACTION
1	Structural member undersized	B, C, D
2	Connection detail not per design	B, C, D
3	Weld undersized	B, C, D, F
4	Incorrect member orientation/dimensions	B, C, D
5	Working point for bolted connections were off	B, C, D
6	Design/Design drawing discrepancy	A, B, C, D
7	Structural member missing	B, C, D, E, F, I
8	Bolt missing	B, C, D, E, F, I
9	Anchor bolt violation from specification EII CC-12	B, C, D, F, G
10	Bolt spacing deviation from design	A, B, C, D, G
11	Support gap deviation from design	B, C, D, G
12	Base plate/anchors not installed per design	B, C, D, G
13	Support location outside tolerance	A, B, C, D, G
14	Support components (catalog items) not per design	G, E