Handout (3)

SUSQUEHANNA STEAM ELECTRIC STATION

REPORT

INVESTIGATION OF UNIT ONE

SMALL PIPING SYSTEM DESIGN

INSTALLATION AND INSPECTION

PROGRAM ADEQUACY AND IMPLEMENTATION

W. H. Gulliver 8/20/82
W. H. Gulliver
Investigation Team Leader

B. M. Swoyer 8/20/82
B. M. Swoyer
Investigation Team Leader

R. J. Shovlin 8/23/82
R. J. Shovlin
Investigation Manager

SUSQUEHANNA STEAM ELECTRIC STATION - UNIT 1
REPORT - INVESTIGATION OF SMALL PIPING SYSTEM DESIGN
INSTALLATION AND INSPECTION - PROGRAM ADEQUACY
AND IMPLEMENTATION
AUGUST 3 - 12, 1982

I. INVESTIGATION OBJECTIVES

The ultimate objective is to ensure Pennsylvania Power & Light Company that recently encountered problems in the design, installation and inspection of small pipe systems do not pose a threat to the safe and reliable operation of Susquehanna Steam Electric Station.

In support of the ultimate objective, there are several principle objectives:

A. To assess the adequacy of small pipe design/installation/inspection programs and their implementation for a representative sample.

B. To document inadequacies (in the form of Findings and Observations).

C. To address the program implications of specific concerns raised by the NRC, and in the allegation letter dated May 3, 1982.

D. To transmit all Findings/Observations (defined in Section III of this report) to the independent Review Committee with an assessment of broader implications for other design/installation/inspection activities.

II. CONDUCT OF THE INVESTIGATION

The conduct of the Investigation was handled in accordance with Nuclear Quality Assurance Procedures 9.1 and 19.0 to the extent that Plans, Checklists and Findings/Observations were documented and a full Investigation Report was to be developed.

Two Investigation Teams were assembled. Their responsibilities were:

A. Investigation Team #1

The primary responsibility of Investigation Team #1 was the design/installation program. They reviewed all relevant documents, specifications, and procedures, and a representative piping system to determine:

1. How the original/revised design intent was developed and documented.

2. The format for conveying design intent, verifying its implementation and evaluating the functionality of as-built designs.

3. If the individual Design and Installation Program/Procedures were unique and exclusive to each function, or were they complementary?

4. The impact of a transfer of certain design responsibilities to various field organizations.

5. The strength and weaknesses of the Design/Installation Programs.

B. Investigation Team #2

The primary responsibility of Investigation Team #2 was the Inspection Program. They reviewed all relevant documents, specifications, procedures, a representative piping system, and the Bechtel and the PP&L Inspection functions to determine:

1. If the Bechtel Inspection program is complementary to the Design/Installation Program.

2. If the Bechtel Inspection Program provides adequate feedback to the Design/Installation organizations to assure hardware implementation in accordance with design intent.

3. If the Bechtel Inspection functions' responsibility to verify "as-built" documentation is adequate and provides a feedback loop in the design verification process.

4. To determine if there are appropriate interfaces established between the Bechtel and PP&L Inspection functions.

5. The extent to which the Bechtel and PP&L Inspection functions are responsible to verify the functionality of hardware as installed.

6. The strength and weaknesses of the Inspection Programs.

C. Piping System Walkdown

Coincident with the Investigations, two representative small pipe systems were selected for walkdown. The Investigation Teams jointly developed a walkdown plan to verify that the

design intent was implemented in the specific hardware of those systems.

D. Processing of Investigation Team Findings

When either of the Investigation Teams developed Findings during their investigation, those Findings were to be forwarded immediately to the Investigations Manager, who was in turn responsible to:

1. Immediately inform the Plant Superintendent of Findings which may impact the safe operation of Susquehanna, Unit 1.

2. Inform the independent Review Committee of the Findings so that they may be considered for applicability to other Design/Installation/Inspection programs.

III. Definitions

Items identified by the Investigation Teams were broken down into three categories with the following definitions:

A. Finding - A Finding is an item that impacts the adequacy of small pipe design, hardware, or the quality program, or has potential generic implications that may impact other aspects of design, installation or inspection. It may or may not impact the safety of the plant.

B. Potential Finding - A Potential Finding is an item that requires further investigation and may impact the adequacy of small pipe design, hardware, or the quality program, or may have potential generic implications and impact on other aspects of design, construction or inspection. It may or may not impact the safety of the plant.

C. Observation - An Observation is an item that does not impact the adequacy of small pipe design, hardware, or the quality program and does not impact the safety of the plant. An Observation implies the inconsistent application of practices in the small pipe program or the application of less conservative practices in the small pipe program that those normally used in other design/installation/inspection programs.

IV. SCOPE

The scope of the Investigation included the following:

A. <u>Sample</u>

The sample selected consisted of the following small pipe lines and included the investigations as listed under each sample item:

1. Diesel Fuel Oil Transfer Pipe as defined on Bechtel Project Engineering Stress Isometric drawing number SK-M-5418, Rev. C, and Bechtel Fabrication Isometric drawing number SP-HBC-78-8, Rev. 13, was investigated for:

   a. Program adequacy for the design, installation and inspection functions,

   b. Program implementation during the design, installation and inspection functions,

   c. Effectiveness of the design, installation and inspection process in achieving original design intent,

   d. Adequate final installation determined through a walkdown to assess:

      (i) The "as-built" system hardware configuration for compliance to the design drawings identified as "as-built,"

      (ii) The "as-built" system for functionality and compliance to design intent.

2. Suppression Pool Water Level Instrumentation - Field Fabrication Isometric drawing numbers SP-HCB-133-1, 2, and 3, Revisions 16, 8 and 8 respectively and SP-HBD-1538-1, Revision 8, was investigated for:

   a. Program implementation during the design and installation functions,

   b. Adequate final installation determined through a walkdown to assess:

      (i) The "as-built" system hardware configuration for compliance to the design drawings identified as "as-built,"

      (ii) The "as-built" system for functionality and compliance to design intent.

3. Drain from Core Spray Pumps as defined on "As-Built" Isometric #SP-GBB-102-2, Rev. 7, was assessed for the

effectiveness of the design of the vent and drain criteria, Bechtel Specification 8856-M-242.

4. Wetwell Atmospheric Sample Supply System as defined on "As-Built" Isometrics #'s SP-HCB-109-1, Rev. 14, and SP-HCB-109-2, Rev. 16, was investigated for various aspects of the:

   a. Program adequacy and implementation of the design functions.

   b. Effectiveness of the design process in achieving original design intent.

B. <u>Controlling Documents</u>

1. 10CFR50 App. B, Criteria III, V, VI, X, and XIV
2. Bechtel NQAM - Construction - I-8 (2), I-9 (1), II (2), (4), (5), IV-1 (2-C), 5 (3-A), 7 (1-A), 10 (0-B), 12 (1-A)
3. Bechtel QCNM - SF/PSP G-6.3, Rev. 1
4. FP-P-11, Rev. 6 (Bechtel Field Procedures Manual)
5. FP-P-16, Rev. 2 (Bechtel Field Procedures Manual)
6. FP-P-20, Rev. 2 (Bechtel Field Procedures Manual)
7. Bechtel Specification 8856-M-213, Rev. 11
8. Bechtel Specification 8856-M-241, Rev. 3
9. Bechtel Specification 8856-M-391, Rev. 3
10. Bechtel EPM Rev. 10 App. B. Int. Chg. 45

VI <u>ASSESSMENT OF SMALL PIPE PROGRAM</u>

A. <u>General</u>

The objective of Bechtel's small pipe program to insure safe and reliable design and installation of small pipe systems is based on the "as-built" reconciliation portion of their program. Initial "as-built" information was utilized to recalculate loads and stresses to the latest design criteria. The changes instituted into the <u>final</u> "as-built" configurations were to be reconciled against these revised calculations. This resulted in three (3) phases of this "as-built" program that were important

to meet the objective. The following constitutes an assessment resulting from the investigation of these areas.

1. Design - The purpose of the design portion of the "as-built" reconciliation was to assure that the stresses and loadings of the final piping system configuration met the original design intent. To do this, it was necessary to have controls in place to transmit the latest design criteria and the latest configuration to the engineers performing the evaluation of the adequacy of the piping system. The Investigation indicated that there were some aspects of these design controls that lacked the appropriate controls or definition. For the samples chosen, the Investigation indicated that there was no direct impact from these deficient controls, except for the indeterminate condition described in Investigation Item #1-2.

   The general areas that lacked the proper controls are:

   a. The design criteria as outlined in Bechtel Specification 8856-M-241, Rev. 3, was supplemented, clarified, and changed by numerous uncontrolled and informal memos. There is no assurance that all this information had been available to all design personnel, who were to utilize the latest design criteria.

   b. The interface between the Resident Engineering Group (a field arm of San Francisco Project Engineering), who performs the "as-built" reconciliation calculations and has the design responsibility, and the Field Engineering Group (a group within the field Construction organization), who performs the "as-built" configuration, is normally outlined and controlled procedurally. Cases were found where an undocumented, unofficial interface system was instituted and utilized, particularly during the first half of 1982 when efforts were accelerated to achieve schedule milestones. This would indicate that design/document control system in some instances is inadequate to assure that documents are processed correctly and were readily available to all personnel. There is no assurance that all the latest "as-built" configuration/reconciliation information was transmitted or received by the appropriate personnel, or, in some isolated instances, used to perform reconciliation calculations.

   c. Various conditions indicated that the Resident Engineering Group did not have the latest documentation by

which to perform their duties, including the small pipe standard hanger supports and details issued from San Francisco Project Engineering showing support load allowables.

d. The "as-built" design calculation relied on the individual Resident Engineer and the Resident Engineering Checkers to utilize their judgment in areas where definition or direction may have been appropriate.

2. Definition and Documentation of Hardware "As-Built" Configuration

The Investigation Team noted, based on a review of Bechtel Specification 8856-M-213, Rev. 11, that the definition and documentation of hardware "as-built" configuration actually consisted of three (3) distinct walkdown efforts.

a. Field Engineering performs a walkdown of the piping system as installed and documents the actual dimensions and physical condition of the lines and hangers via a mark-up of Field Fabrication Isometric and Unique Hanger Detail drawings.

b. A Stress Engineer (Resident Engineering Group) performs a thermal walkdown of the piping system using the Field Engineering prepared "as-built" Field Fabrication Isometric drawings. This walkdown is intended to ensure adequate clearance from adjacent objects for thermal expansion and identify any thermal interferences.

c. A Stress Engineer (Resident Engineering Group) performs a stress walkdown of the piping systems to assure that all supports are performing their intended designed function.

The Investigation Team's assessment is that this walkdown program was adequate. Specifics regarding the implementation of these walkdowns are:

a. The Field Engineering walkdown was determined to have been implemented satisfactorily. During the Investigation Team's walkdown activity, it was found that Field Engineering was able to reproduce the dimensional measurements as shown on the current "as-built" Fabrication Isometric and Hanger drawings with excellent correlation.

b. The thermal walkdowns were performed in accordance with requirements. During the Investigating Team's walkdown, two (2) areas were identified (Ref. Investigation Item #1-15) which were questionable in terms of thermal clearance. Although these two (2) clearance problems were assessed to have no impact on the sample piping system investigated, it was noted that these diminished clearances were related to work that was performed after the system was jurisdictionally transferred to PP&L. The assessment of the Team was that controls over the installation of adjacent components or structures must include criteria for maintaining the thermal clearances of piping systems intact. The Investigation Team did not pursue these installations (such as electrical conduits and supports) due to time constraints.

c. The Investigation Team walkdown results led to an assessment that the Bechtel Resident Engineering Stress Walkdown (which had been determined to have been performed in accordance with program requirements) was effective in ensuring that the piping system supports were performing their intended function.

As a result of the Investigation Team's own walkdown, they observed that any "fixes" identified during the stress and thermal walkdowns were implemented.

3. Quality Control - The overall assessment of the Investigation was that, with the exception of Investigation item numbers 2-2 and 2-4 (see Attachment A and Section IV-B of this report), the Bechtel QC Program and its implementation for small pipe and small pipe hanger installation is effective in providing the desired independent verification of the quality of small pipe line installations at SSES. The basis and justification for this assessment is provided in Section VI.

Based on the Investigation Items 2-2 and 2-4, the Team noted that there are weaknesses in the engineering definition of attributes to be inspected by Bechtel QC. However, the Team's general assessment is that most of the small pipe system attributes and acceptance criteria have been provided in Bechtel Specifications, Drawings and Procedures and referenced in Bechtel Inspection Records.

The Investigation Team also assessed that the documentation and records reviews were adequately performed by Bechtel QC

including all required inspections of piping systems and hangers. The documentation of these inspections and their results, to provide assurance that the "as-built" piping lines and hangers have been installed in accordance with the design definition of the "as-built" configuration, was also adequate.

In addition, Bechtel QC had adequately completed documentation to provide assurance that in-process activities were adequately assessed involving piping and hanger installations, including welding.

B. Summary of Investigation Items (See Attachment A for detailed descriptions)

1. Item #1-1: For the small piping system "as-built" design performed by simplified analysis, Bechtel Specification M-241, Revision 3, was used. In addition, numerous informal and uncontrolled memos and notes have been written with the intent that the information they contain be used in conjunction with or in lieu of the criteria established in M-241. From the investigation sample, no impact could be determined on the "as-built" calculations reviewed.

2. Item #1-2: Various discrepancies were found on the Fab Iso #SP-HBD-1538-1 and associated Hanger Detail #SP-HBD-1538-H-1. See Attachment A for specific details of this finding. These discrepancies indicate that the design/document control system was not adequate to assure proper processing of the documents in question and availability of these documents to the appropriate personnel. It also appears that the interface between the Resident and Field Engineering groups are not clearly defined and controlled. The impact of not using the latest revision of the Hanger Detail during the "as-built" reconciliation could not be determined during the time of the Investigation.

3. Item #1-3: Identification of major and minor changes and how these changes are reconciled are based on Resident Engineering's conception/judgment. The sample investigated showed that some calculations contained major changes that were reconciled using engineering judgment, while others contained specific calculations (including computer calculations) for both major and minor changes.

4. Item #1-4: The Stress Engineer's (Resident Engineering Group) Thermal Interference Walkdown requirements do not contain the controls to assure that the latest revision of

the "as-built" iso is being utilized. See Attachment A for specifics. Further investigation revealed that there was no impact for the discrepancy identified.

5. Item #1-5: Combining several Findings and Observations identified during the Investigation lead to this Finding. Some areas in the small pipe Program itself and in the Program's implementation are deficient. As a result, Bechtel cannot assure design and installations in every instance were carried out in accordance with Program commitments. Reference Attachment A - Items #1-5 for more detail. (Note that Investigation Items #1-6 through 1-14 pertain to this Finding.)

6. Item #1-15: During the Investigation Team's walkdown of the Diesel Generator Over-Flow Line, three (3) areas were identified as resulting from work performed after final Bechtel inspection and the system was transferred to PP&L jurisdiction. These items were determined to have no impact, but this observation was noted to make all organizations (PP&L and Bechtel) aware of the requirement to maintain the design intent of the systems.

7. Item #2-1: Small Pipe Hanger Standard Support and Detail (SP and SPA) drawings issued from San Francisco were not processed and distributed in accordance with Field Procedures. Two hundred seventy-four (274) drawings were received in the field and not processed for distribution because the Lead Field Small Pipe Hanger Engineer (Field Engineering Group) determined that these were not useful for installation or hanger design by Field personnel. The hanger installations were completed and were designed using unique hanger detail drawings. It was not recognized that some information contained on these SP and SPA drawings impacted Resident Engineering's final "as-built" reconciliation. This information was the support load allowables which had been revised to include the increased Phase III loads.

   This finding was verified to have had no adverse impact on the design of the selected sample because it was verified that any SP and SPA drawings referenced in the reconciliation or original calculations did contain Phase III load information.

   The safety impact was classified as indeterminate because of the potential that incorrect (pre-Phase III) load allowables might have been used for other small pipe

systems. (Note Phase III reconciliation was performed in late 1981.)

8. Item #2-2: Bechtel Specification 8856-M-213, Appendix F, was issued by Project Engineering to provide Bechtel QC with definition of the inspection attributes and acceptance criteria required to be verified to assure that hangers are installed correctly. These are the critical attributes defined by Project Engineering. A review of Appendix F revealed that it contained no criteria for clamp ear gap measurements for friction type anchor clamps to assure positive contact of the pipe by the clamp. The Investigation Team noted that this deficiency resulted in PL-NCR-728 which identifies that there are anchor clamps installed without adequate pipe gripping. The team determined this to be a Potential Finding with no safety impact because the clamps in question have been identified for correction and the only question remaining regards any other critical attributes that may be omitted in Appendix F.

9. Item #2-4: Identified that the criteria for inspection of attributes associated with vendor fabricated components was not contained in Bechtel Specification 8856-M-213. Specific examples were the criteria for inspection "Detail 600" anchor clamp gaps and the criteria for inspecting sway strut installation and jam nut tightening.

   This was identified as a Finding with safety impact because of the generic implication of this finding on small pipe installations and the installation of other systems and components. There was no safety impact identified on the sample included in the Investigation.

IV INVESTIGATION ITEMS IN COMPLIANCE

For the sample investigated, the following Investigation aspects were found to be in compliance. (Reference Attachment B for documents sampled.)

A. Bechtel Design Control

1. The design criteria listed in Bechtel Specification M-241, such as support load tables, maximum pipe spans, response spectra curves, piping flexibility, proper "SIF" and other original design definitions and intents, were checked. Based on a limited sample reviewed, they were found to be properly utilized so as to have a technically adequate "as-built" calculation.

2. "As-Built" calculations for the sample considered reconciled all the changes reflected in the final "as-built" drawings with the initial "as-built" calculations.

3. The vent and drain criteria, Bechtel Specification 8856-M-242, was properly implemented.

4. Based on discussions with R.E. Group Supervisors, the personnel involved in the "as-built" program appears to be qualified in the appropriate engineering activities. No qualification records were reviewed.

5. The Stress Engineer's (R.E. Group) Stress walkdown used to ensure that all supports are performing their intended function was found to be implemented properly.

6. All "as-built" calculations checked contained the appropriate level of signatures and checks.

7. Field Engineering's "as-built" walkdown was performed to the criteria outlined procedurally.

8. The transposition of redline information into final "as-built" drawings were investigated and found to be in compliance with procedural requirements.

B. <u>As-Built Walkdown Performed by Investigation Teams</u>

1. The Team verified Field Engineering's walkdown to have been performed effectively in that all "as-built" dimensions were reverified to be consistent with the current revision of as-built fabrication isometrics and hanger details.

2. The team generally (with the exception of Investigation Item #1-13) verified the effectiveness of Quality Control Inspections as defined in applicable Quality Control Instructions.

3. The Teams generally verified the adequacy of the Resident Engineering Stress and Thermal Walkdowns to establish compliance with the requirements of Bechtel Specification 8856-M-213.

C. <u>Bechtel Quality Control</u>

The following aspects of Quality Control were investigated and found to be in compliance with the controlling documents.

1. QC Instructions (QCIs)

a. QCIs were found to exist to cover all aspects of piping system installation including anchor plate installation, grouting, piping subassembly, piping installation and rework, piping system completion verification, pipe support installation, pipe system leak testing inspection and pipe support final review.

b. QCIs were found to contain adequate description of the various inspection tasks associated with the inspection subject, reference to governing procedures and specifications, identification of references containing inspection criteria, identification of the method to be used in completing inspection tasks, identification of any supplementary records pertaining to each inspection task.

c. QCIs were verified to be controlled documents and showed evidence of required approvals.

2. Inspection Records (IRs)

a. Inspection Records were found to exist for each QCI showing that all aspects of the piping system selected were inspected. This included, as applicable, in-process and final inspections of all hangers and piping installation.

b. IRs were found to establish that QC final inspections were done to the drawings identified as "as-built."

c. IRs established that inspections performed during the design and installation process were completed in accordance with the applicable revision of design documents.

d. IRs show the acceptability of the inspection tasks verified.

e. IRs are approved for close-out.

f. IRs reference the item inspected.

g. IRs reference the documents which provide the acceptance criteria.

h. IRs reference the applicable QCIs.

i. IRs document and reference nonconformances identified during inspections.

j. Hold Points are established where required; e.g., welding, completion of weld records, hydrotesting application of pressure.

3. Engineering/QC Interface

   a. QC was found to be receiving all necessary drawing revisions as evidenced by correct references to revisions on IRs.

   b. QC was found to be receiving Project/Resident engineering dispositions for nonconformance when required.

   c. QC hold points were found to be completed in a timely manner.

4. Drawing Control Logs, Inspection Record Logs, Installation Review Form Logs and the Hanger Punchlist (MAPPER) were reviewed and found to be maintained according to procedural requirements.

V. CONCLUSIONS

Within the time constraints of the two-week review, the Investigation Teams conducted numerous interviews, assessed the adequacy of Bechtel small pipe program and its implementation, and completed a walkdown of two small piping systems. Based on their joint effort, the conclusions regarding the small pipe Program and the potential generic implication for other design/installation/inspection programs follows:

A. Small Pipe Program

1. Due to the loosely implemented program controls for design criteria, specifications, "as-built" drawings, and reconciliation calculations, the Investigating Teams conclude that additional investigation of other small pipe systems is required.

2. The problems encountered in managing and administering the small pipe design program indicate that program controls were not sufficient for the size of effort and time frame required for performance. The Investigating Teams conclude that the small pipe design program for Unit #2 needs to be evaluated for implementation practicability and should be redefined on the basis of such an evaluation. The Investigating Teams also conclude that increased attention is required in defining the organizational interface responsibilities in design particularly between Project

Engineering in San Francisco, Project Engineering in its role as Resident Engineering, and the Field Engineering organization within the construction group.

3. While the scope of the Investigation Teams' activities did not include an assessment of training, the Investigating Teams, based on the complexity of the small pipe program and the number of contract personnel, particularly in Resident Engineering, conclude that a review of programmatic training is required.

4. While the scope of the Investigating Teams' activities did not include an assessment of the Quality Assurance coverage of this effort by Bechtel and PP&L, a concern exists regarding Quality Assurance coverage, particularly during the final hectic period. The Investigating Teams conclude that Quality Assurance coverage for the small pipe program needs to be evaluated.

5. As a result of the Investigation Teams' walkdowns, they concluded that the Bechtel walkdown program was adequate. Thermal interferences and dimensional problems were consistently picked up and resolved. The Teams' walkdown also showed that Bechtel Field Engineering's "as-built" program is adequate from a field dimension/hardware standpoint.

6. As a result of the Investigation Teams' review of Bechtel's inspection efforts, they concluded that Bechtel's Quality Control program was adequate, effective, and fully met all commitments.

B. Generic Implications

1. Based on the problems encountered in the small pipe program at the interface between Resident Engineering and Field Engineering, the Investigating Teams conclude that all such safety related design/installation areas need to be investigated as a separate effort. The Investigating Teams also conclude that similar programs with "split" design responsibilities should be investigated.

2. As a result of the difficulties encountered in controlling, distributing and utilizing all types of documentation relative to the small pipe program, the Investigating Teams conclude that a review of the documentation control program is required.

3. The character of the discussions with Bechtel field personnel point out that some Bechtel and PP&L managers

involved in the day-to-day activities were not sufficiently sensitive to the schedule pressures and their impact on a highly complicated quality effort. The Investigating Teams conclude that increased management attention to these aspects of the Susquehanna project is required.

VI. GENERAL INFORMATION

A. Investigation Makeup

1. Team #1

B. M. Swoyer	-	NQA (Team Leader)
C. L. Dvorscak	-	NPE
W. R. Kline	-	NPE
J. Saranga	-	NQA
D. B. Ritter	-	Project Construction

2. Team #2

W. H. Gulliver	-	NQA (Team Leader)
D. M. Sattar	-	NPE
F. X. McCreesh	-	NPE
J. D. Murray	-	Project Construction

3. Investigation Manager

R. J. Shovlin	-	Asst. Project Director

B. Persons Contacted

Rajan Parekh	Plant Design Gp. Sup. (SFHO)
Basudeb Mukherjee	Resident Engineering Gp. Sup.
A. T. Morrow	Resident Engineering, Hanger Gp. Ldr.
Mohammed Kazoun	Resident Engineering - Stress Gp. Ldr.
Wayne Huynh	Stress Engineer (RE)
Ruthann Zeitler	Plant Admin. (RE)
Jules Colker	Piping Field Engineering
Ken Buchanan	Field Engineering (Hangers)
Tim Minor	Field Engineering
Dan Good	Field Engineering
Dan Montreuil	Document Control
Dan Hollingshead	Admin. (Piping Hangers)
Dave Yenson	Field Engineering (Piping)
Terry McHenry	Bechtel QC
Greg Gelinas	Bechtel QC
James A. Dahnert	Bechtel QC
Jitendra Khandhar	Bechtel QA
George Bell	Project QA Engineer

Gene Glorvigen	Bechtel QA
Robert Slaughter	Lead QCE - Hangers
Dave Cronomiz	Field Engineer Unit I Completion Team
Charles Kircher	QCE - Piping
Bruce Wells	Asst. Lead QCE - Piping and Mechanical
Mike Scarcella	Small Pipe Engineer
Sal Di Pippa	Small Pipe Engineer
Bruce Bailey	Small Pipe Hanger Engineer
George Drummer	Small Pipe Hanger Engineer

ATTACHMENT A

INVESTIGATION ITEMS: Nos. 1-1 through 1-15
and 2-1 through 2-4

Item #1-1

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8-12-82

OBSERVATION [ ] #:

POTENTIAL FINDING [ ] #:

FINDING [X] #: 1-1

SAFETY IMPACT [ ] YES

[ ] NO

[x] INDETERMINATE

DESCRIPTION:

Small piping system design which was not accomplished by detail analysis (i.e. ME-101) was performed in accordance with the requirements of Revision 3 of Specification M-241, Design Criteria for Simplified Analysis of Small Pipe. Revision 3 of M-241 was issued on 5/21/81. Since that time numerous informal and uncontrolled memos and notes have been written with the intent that the information they contain be used in conjunction with or in lieu of the criteria established in M-241.

An initial cursory review of the information contained in these informal documents

SIGNATURES:

INVESTIGATION TEAM MEMBER: Jason Saranga, C.L. Dvorscak, W.R. Kline, D.B. Ritter (signed: Jason Saranga 8/13/82, C.L. Dvorscak 8-13-82, W.R. Kline 8/13/82, D.B. Ritter 8/13/82)

INVESTIGATION TEAM LEADER: B.M. Swoyer (signed: B.M. Swoyer 8-13-82)

INVESTIGATION MANAGER: (signed: R.J. Shovlin 8/13/82)

I concur that this item is a Finding

Item #1-1

indicates that Spec. M-241, Rev. 3 did not provide the Resident Engineering Group with pertinent technical direction in certain areas of small pipe design.

Note: Revision 4 of Spec. M-241 was also reviewed. As of 8/11/82 the spec was in a final state, but lacked final sign-off (per Bechtel).

Item #1-2

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [ ] #:

POTENTIAL FINDING [ ] #:

FINDING [X] #: 1-2

SAFETY IMPACT [ ] YES

[ ] NO

[X] INDETERMINATE

DESCRIPTION:

As a result of the walkdown of the piping shown on SP-HBD-1538-1 (Rev. 8, 5/7/82) and review of the associated documents the following discrepancies were noted:

A.. Fab ISO SP-HBD-1538-1

(1) "Final As-built Drawing" stamp, required by FP-P-11, Paragraph 8.0, was signed-off on 6/7/82 approving rev. 7. (One month after issuance of rev. 8, which does not contain the "as-built revision/reconcilliation" stamp)

(2) Hanger #1 had been removed on revision 9 (dated 8/3/82) on final.

SIGNATURES:

INVESTIGATION TEAM MEMBER: [signature] 8/13/82

INVESTIGATION TEAM LEADER: B. M[signature] 8-13-82

INVESTIGATION MANAGER: [signature] 8/13/82

I concur that this item is a Finding

Item #1:1-2

(3) Subsequent to the walkdown the team was advised that rev. 9 (8/3/82) had been issued to show deletion of H1. Rev. 9 contained a 2nd "Final As-built Drawing" sticker approving rev. 9 which was signed off on 8/4/82. This violated paragraph 8.5.2 of FP-P-11 which requires a revision stamp and not an as-built stamp.

Comment: Rev. 8 was given to the team by the RE group who apparently thought it was the latest revision even though they had signed-off rev. 9. The FE group, who had revised the drawing, produced a copy of rev. 9 only after questioning.

B. Hanger Detail, SP-HBD-1538-H1

(1) Rev. 1F3 given to team for walkdown.

(2) "Final As-built Drawing" sticker for rev. 1F3 did not have RE approval sign-off.

(3) RE Calcs (final as-built reconcilliation) were done to rev. 1F3.

(4) Rev. 1F2 was issued for cancellation.

Note: The document control system has no mechanism for assuring a cancelled drawing does not re-appear.

(5) During the program for removing the "Q" from the first support after the end of a Seismic I line, this hanger detail was up-rev'd to 1F3 and identified as "insp. As-Built".

(6) After considerable investigation the original drawing, which had been up-rev'd to 1F4 to "Reissue For Cancellation", was located on the desk of a field engineer who had neglected for several weeks to put it back into the system.

(7) Rev. 1F4 had both a "Final As-built Drawing" and a revision reconciliation stamp. Both stamps had RE sign-off.

(8) The revision reconciliation stamp indicated that there was no affect on calcs.

(9) RE failed to enter the signed-off as-built in the log required by EPM rev. 10 Section XII Paragraph 5.

(10) On 4/22/82 and on 5/21/82 the RE stress group walkdown revealed that hanger H1 did not exist.

(11) As of Thursday 8/12/82, the RE group was revising loads on hanger H1 and the engineer was not aware that the hanger had been deleted.

Conclusion: The discrepancies noted above indicate that the design/document control system was not adequate to assure the proper processing of the documents in question. It appears that the interface between the FE group and RE group was not clearly defined and that communications within the RE group was not uniformly established.

Item #1-3

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: August 13, 1982

OBSERVATION [ ] #:

POTENTIAL FINDING [ ] #:

FINDING [X] #: 1-3

SAFETY IMPACT [ ] YES

[X] NO

[X] INDETERMINATE on a generic basis.

DESCRIPTION:

The use of engineering judgement to reconcile as-built conditions in the small piping program is not defined in either M-241 or M-213. Discussions with R. E. Group (Bechtel) indicated that distinction between major and minor changes defined in M-213 Sections 4.15 and 4.16 were applied to large piping (>2") only. Identification of major and minor changes on small piping is based solely on Resident engineer's conception/judgement. On the calculation sheet, there is a notation a minor change is reconcilled by engineering judgement and that for major changes - reference attached calculations. (Refer to attached description)

SIGNATURES:

INVESTIGATION TEAM MEMBER: W.R. Kline, C.L. Dworscak, D.B. Ritter — W.R. Kline 8/13/82, C.L. Dworscak 8/13/82, D.B. Ritter 8/13/82

INVESTIGATION TEAM LEADER: B.M. Swover — B.M. Swover 8/13/82

INVESTIGATION MANAGER: [signature] 8/13/82

I concur that this item is a Finding.

The investigation team reviewed and walked down two small piping systems. These two lines are summarized below as an example of how two different engineers perceived major and minor changes to the design intent of small piping systems.

Line #1: SP-HBC-78-8 Rev. 13
Day Tank Overflow to Main Oil Storage Tank in
Diesel Generator Bay

Length of Line - approx. 81'-8"
#Hangers: Spring = 0
Rigid = 3
Anchor = 3 (1anchor not numbered - Civil Anchor)
Guide = 9

15 Total Supports

Reconciliation - Covered 14 Total Supports *
Conclusion of comparison between engineering intent and as-built condition:

No difference -	9
Minor Difference	2
Major Difference	3
	14 Total

In only one (1) case was a hanger (H49) reconciled using calculations to show that the as-built hanger was acceptable. All others were dispositioned by engineering judgement. A copy of the ABH (As-Built Hanger) calculation is attached for reference.

* The anchor identified as a civil anchor was not reviewed in ABH calculation since it did not have a unique hanger detail associated with it. The reason for this was due to the fact that the anchor was actually the concrete used to seal the hole in a vertical wall made by the pipe.

Line #2 SP-HCB-133-1
SP-HCB-133-2
SP-HCB-133-3
SP-HBD-1538-1
Suppression Pool Water Level Instrumentation

Length of Line - Approx. 80'6 3/4"

#Hangers =	Spring	-	4
	Rigid	-	1
	Anchor	-	0
	Guide	-	18
			23 Total Supports

Reconciliation - Covered 23 Total Supports
Conclusion of comparison between engineering intent and as-built condition:

No Difference	-	5
Minor Difference	-	8
Major Difference	-	10
		23 Total

This engineer did detail design calculations for <u>each</u> of the changes categorized as Major (including the use of engineering judgement within parts of the overall calculation). <u>No</u> discussion was provided for any of the minor differences so the reviewer was unaware of what the changes were by looking at the calculation. A copy of ABH calculation is attached for reference.

It is evident by looking at the two calculations that a clear definition or direction on how to handle major and minor changes was not made available to Resident Engineering. Further investigation indicated that the engineers working in the Resident group all possessed approximately the same level of expertise.

CALCULATION SHEET

BECHTEL

CALC. NO. ABH-5418 REV. NO. 1

ORIGINATOR [illegible] DATE 4-3-82 CHECKED KP DATE 4/15/82

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8856

SUBJECT SP-HBC-78-7 & SP-HBC-78-8 SHEET NO. 1

1. SK-M 5418 REV. C 2. FAB ISO

FAB ISO	AS BUILT REV.	ENG. REV.
SP-HBC-78-7	18	14 E1
SP-HBC-78-8	13	10 E1

3. COMMENTS

4. SUPPORTS	AS BUILT REV.	ENG. REV.	NO DIFFERENCE	*MINOR DIFFERENCE	**MAJOR DIFFERENCE
			CONCLUSION OF COMPARISON BETWEEN ENGR. & AS BUILTS		
SP-HBC-78-H49	2/F2	3			✓
SP-HBC-78-H50	1/F5	2	✓		
SP-HBC-78-H51	1/F3	2	✓		
SP-HBC-78-H52	1/F2	2	✓		
SP-HBC-78-H53	1/F3	2	✓		
SP-HBC-78-H54	1/F3	2	✓		
SP-HBC-78-H95	1/F3	2	✓		
SP-HBC-78-H57	2/F2A	3	✓		
SP-HBC-78-H58	1/F3A	2			✓
SP-HBC-78-H59	2/F4A	3			✓
SP-HBC-78-H61	2/F2	3			✓
SP-HBC-78-H62	1/F3	2		✓	
SP-HBC-78-H63	1/F2	2	✓		
SP-HBC-78-H64	1/F1	2		✓	
SP-HBC-78-H65	1/F2	2	✓		
SP-HBC-78-H66	1/F1	2		✓	
SP-HBC-78-H96	1/F3	2	✓		
SP-HBC-78-H69	2/F1	3		✓	
SP-HBC-78-H70	1/F4A	2		✓	
SP-HBC-78-H71	2/F3	3	✓		
SP-HBC-78-H2033	0/F2	0		✓	
SP-HBC-78-H2034	0/F2	0		✓	
SP-HBC-78-H2035	0/F2	0	✓		
SP-HBC-78-H2036	0/F3	0			✓
SP-HBC-78-H2040	0/F1A	0		✓	

* BY ENGINEERING JUDGMENT NO REANALYSIS IS REQUIRED. △ [illegible] 6/25/82 NPS 6/25/82

** SEE INSIDE FOR NEW COMMENTS AND CALCULATION.

*** LATEST HANGER REVISION FROM SUMMARY SHEET.

BECHTEL

CALCULATION SHEET

CALC. NO. ABH-5418 REV. NO. 0

ORIGINATOR [illegible] DATE 4-3-82 CHECKED KP DATE 4/15/82

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8856

SUBJECT SP-HBC-78-7 & SP-HBC-78-8 SHEET NO. 2

1. SK-M 5418 REV. C

2. FAB ISO

FAB ISO	AS BUILT REV.	ENG. REV.
SP-HBC-78-7	18	14E1
SP-HBC-78-8	13	10E1

3. COMMENTS

4. SUPPORTS	AS BUILT REV.	ENG. REV.***	CONCLUSION OF COMPARISON BETWEEN ENGR. & AS BUILTS: NO DIFFERENCE	*MINOR DIFFERENCE	**MAJOR DIFFERENCE
✓ SP-HBC-78-H2042	0/F1	0		✓	
✓ SP-HBC-78-H2043	0	0	✓		
✓ SP-HBC-78-H2047	0/F1	0	✓		
✓ SP-HBC-78-H2041	0/F2	0		✓	
SP-HBC-78-H2056	0/F1	0		✓	
SP-HBC-78-H2057	0/F1	0	✓		

* BY ENGINEERING JUDGMENT NO REANALYSIS IS REQUIRED.

** SEE INSIDE FOR NEW COMMENTS AND CALCULATION.

*** LATEST HANGER REVISION FROM SUMMARY SHEET.

CALCULATION SHEET

BECHTEL

Q

CALC. NO. ABH-5418 REV. NO. 0

ORIGINATOR [illegible] DATE 4-15-82 CHECKED KP DATE 4/15/82

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8856

SUBJECT SP-HBC-78-7 & SP-HBC-78-8 SHEET NO. 3

H49 & H61

THE MAJOR DIFFERENCE BETWEEN THE AS-BUILT HANGER & SPA 720 IS THAT THE AS-BUILT USES A SMALLER & THINNER PL THAN THE SPA. PRELIMINARY CALCS. USING THE ORIGINAL LOADS SHOW THAT THE SUPPORT WOULD FAIL, THUS THE FOLLOWING LESS CONSERVATIVE LOADS WERE GIVEN BY STRESS.

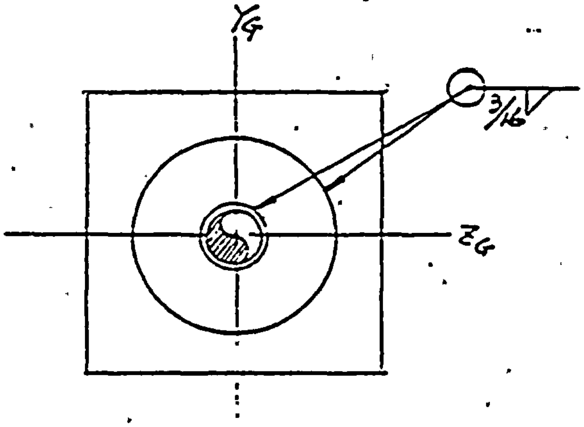
$$F_x = F_Y = F_Z = 200^{\#}$$

$$M_x = M_Y = M_Z = 200^{FT-\#} = 2400^{IN-\#}$$

COMBINED BENDING & COMPRESSION:

$$S = 2\left(\frac{b h^2}{6}\right) = \tfrac{1}{3}\,(2.0625\ IN)(0.625\ IN)^2 = 0.2696\ IN^3$$

$$AREA = 2(bh) = 2(2.0625)(0.625) = 2.5791\ IN^2$$



$$\frac{f_a}{F_a} = \frac{(0.2^K/2.5791\ IN^2)}{19.11} = 0.004 < 0.15$$

$$\therefore \frac{f_a}{F_a} + \frac{f_{by}}{F_{by}} + \frac{f_{bz}}{F_{bz}} \leq 1.0$$

$$\Rightarrow 0.04 + \frac{(2.400^{IN-K} + 2.400^{IN-K})}{(0.2696\ IN^3)(19.1\ KSI)}$$

$$= 0.94 \leq 1.0$$

∴ COMBINED STRESSES ARE O.K. IN THE PL.

SHEAR STRESSES IN THE PL ARE O.K. BY ENGINEERING JUDGEMENT.

WELDS; CONSIDERING THE SMALLER WELD. (THAT ON THE PROCESS PIPE)

$$f_x = \frac{0.2}{7.46} + \frac{(2.400 + 2.400)}{4.43} = 1.11\ ^K/_{IN}$$

$$f_y = \frac{0.2}{3.73} + \frac{(2.400)(1.19)}{10.52} = 0.33\ ^K/_{IN}$$

$$f_z = \frac{0.2}{3.73} + \frac{(2.400)(1.19)}{10.52} = 0.33\ ^K/_{IN}$$

$$f_r = \sqrt{f_x^2 + f_y^2 + f_z^2} = 1.20\ ^K/_{IN}$$

[illegible] 1.2 K/IN [illegible] = .40 IN < 3/16" [illegible]

CALCULATION SHEET

Q

BECHTEL

CALC. NO. ABH-5418 REV. NO. 0

ORIGINATOR [signature] DATE 4-15-82 CHECKED KP DATE 4/15/82

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8856

SUBJECT SP-HBC-78-7 & SP-HBC-78-8 SHEET NO. 4

∴ ALL REMAINING WELDS ON SUPPORT ARE O.K.

∴ AS-BUILT HANGERS H49 & H61 ARE O.K. FOR THE LATEST LOADS GIVEN ABOVE.

H58 IS A MAJOR DIFFERENCE. BECAUSE AS BUILT HANGER HAS ITEM 7 INSTALLED WHILE ENGINEERING DIDN'T CALL FOR IT. ALSO THE WELDS ON THE ENDS OF ITEM 2 ARE 3/16" ALL-AROUND WHILE ENGINEERING ONLY CALCULATED FOR 1/4" FILLET ON TWO SIDES. ALSO ADDED ITEMS 3 & 4 ⟶ MAJOR GEOMETRY DIFFERENCE. HOWEVER SUPPORT IS O.K. BY ENGINEERING JUDGEMENT.

H59 IS A MAJOR DIFFERENCE BETWEEN THE AS-BUILT HANGER & THE EVALUATED ONE, IN THAT THE LATTER ONLY CONSIDERED LOADS DUE TO 4 ATTACHMENTS, WHILE ACTUAL AS-BUILT HANGER HAS 5 ATTACHMENTS. LISTED BELOW ARE THE AS-BUILT & EVALUATED CONDITIONS.

HANGER	LOADS USED IN EVALUATION	AS-BUILT LOADS
H59	Fx = 520# Fz = 370#	Fx = 423# Fz = 367#
H71	Fx = Fz = 274#	Fx = 239# Fz = 261#
H2033	Fx = 616# Fz = 240#	Fx = 616# Fz = 240#
H2034	NOT CONSIDERED	Fx = Fy = 274#
H2057	Fz = 250#	Fz = 239#

MEMBER STRESSES;

SINCE IN MOST CASES ABOVE, THE LATEST LOADS ARE LOWER THAN OR EQUAL THOSE USED IN THE EVALUATION, AND THE MEMBER STRESSES FROM THE STRUDL OUTPUT ARE LOW, THE ADDITIONAL EFFECTS DUE TO THE UNCONSIDERED HANGER WILL NOT OVER STRESS TO THE EXISTING MEMBERS BEYOND THE ALLOWABLES.

BECHTEL

CALCULATION SHEET

Q

CALC. NO. ABH-5418 REV. NO. 0

ORIGINATOR [signature] DATE 4-15-82 CHECKED KP DATE 4/15/82

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8856

SUBJECT SP-HBC-78-7 & SP-HBC-78-8 SHEET NO. 5

DEFLECTIONS;

THE DEFLECTIONS IN ALL THERE DIRECTIONS ARE CONSIDERABLY LOWER THAN THE ALLOWABLE 1/8" FOR THE EVALUATED GANG HANGER. BY ENGINEERING JUDGEMENT THE ADDED EFFECT DUE TO THE ADDITIONAL HANGER WILL NOT BE OVER TOTAL DEFLECTIONS TO EXCEED THIS ALLOWANCE.

∴ DEFLECTIONS ARE O. K.

FREQUENCY;

FREQUENCY IS O.K. BY INSPECTION OF EXISTING STRUDL OUTPUT & ENGINEERING JUDGEMENT.

BOLTS & BASE ℞'s;

AS-BUILT HANGER USES 4 BOLT BASE ℞'s WITH 5/8 φ HILTI-KWIK BOLTS. BASED ON PREVIOUS CALCS. (SK-M 5418 REV 3) & ENGINEERING JUDGEMENT EXISTING BOLTS & BASE ℞'s ARE O. K. FOR TRUE GANG CONDITIONS.

WELDS;

ALL EXISTING WELDS ARE O. K. FOR TRUE GANG CONDITIONS BY ENGINEERING JUDGEMENT.

∴ BASED ON THE PREVIOUS CALCULATIONS & THE ABOVE ARGUMENTS, EXIST SUPPORT IS O.K. AS IS.

CALCULATION SHEET

BECHTEL

CALC. NO. ALLY 5418 REV. NO. 0

ORIGINATOR [illegible] DATE 4-13-82 CHECKED [illegible] DATE 4/15/82

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8?56

SUBJECT SP-HBC-78-7 & SP-HBC-78-8 SHEET NO. 6

H62 IS A MINOR DIFFERENCE. BECAUSE AS BUILT DRAWING ...LY HAS A REGULAR FORMED PL WHILE ENGINEERING CALLED ... FOR A RE...ORCED ONE. HOWEVER AS BUILT CONDITION IS O. K. PER SPA 591.

H64 IS A MINOR DIFFERENCE. BECAUSE AS-BUILT WELD IS ONLY 3/16" FILLET WHILE SPA CALCULATED FOR 1/4" FILLET. HOWEVER THIS DIFFERE... IS O. K. BY ENGINEERING JUDGEMENT.

H66 IS A MINOR DIFFERENCE. BECAUSE AS-BUILT WELD IS ONLY 3/16" FILLET WHILE SPA CALCULATED FOR 1/4" FILLET. HOWEVER THIS DIFFERE... IS O. K. BY ENGINEERING JUDGEMENT.

H69 IS A MINOR DIFFERENCE. BECAUSE AS-BUILT WELD IS ... 1/16" SMALLER THAN THAT CALCULATED FOR. HOWEVER THIS DIFFERENCE IS O. K. BY ENG. JUDGEMENT.

H70 IS A MINOR DIFFERENCE. BECAUSE ENGINEERING CALLE... FOR REINFORCEMENT OF THE FORMED PL. WHILE AS-BUILT HANGER HAS UNREINF...ED PL. HOWEVER AS BUILT CONDITION IS O. K. PER SPA 641.

H2033 IS A MINOR DIFFERENCE. BECAUSE ENGINEERING CALL... FOR A 1/4" FILLET WELD ON THE FORMED PL. WHILE AS-BUILT WELD IS ONL... 3/16". HOWEVER THIS DIFFERENCE IS O. K. BY ENGINEERING JUDGEMENT

H2034 IS A MINOR DIFFERENCE BECAUSE OF THE SAME REASON AS FOR H2033.

H2036 IS A MAJOR DIFFERENCE. BECAUSE EVALUATED HANGER & AS-BUILT HANGER DIFFER IN GEOMETRY. HOWEVER INSTALLED HANGER IS O. K. BY ENGINEERING JUDGEMENT.

CALCULATION SHEET

CALC. NO. ABB 5499 REV. NO. 0

ORIGINATOR S. N. Reddy DATE 4-30-87 CHECKED NT DATE 5/4/87

PROJECT SUSQUEHANNA STEAM ELECTRIC STATION UNIT-1 JOB NO. 8856

SUBJECT SP-HCB-133-1, 2 & 3 SHEET NO. 1

1. SK-M 5499 Rev D 2. FAB ISO

ISO	AS BUILT REV.	ENG. REV.
SP-HCB-133-1	15	9E1
SP-HCB-133-2	7	4E1
SP-HCB-133-3	8	3E1

3. COMMENTS

G = GANG SUPPORT

4. SUPPORTS	AS BUILT REV.	ENG. REV.	NO DIFFERENCE	*MINOR DIFFERENCE	**MAJOR DIFFERENCE
SP-HCB-133-H1	1/F5	2	✓		
SP-HCB-133-H2	0/F3	1	✓		
SP-HCB-133-H4	0/F4	1	✓		
SP-HCB-133-H6	0/F3	1	✓		
G SP-HCB-133-H8	2/F1	2			✓
G SP-HCB-133-H10	3/F1	2			✓
SP-HCB-133-H11	1/F1	1		✓	
SP-HCB-133-H12	1/F6	3	✓		
G SP-HCB-133-H2001	0/F1	0			✓
SP-HCB-133-H2002	0/F1	0		✓	
G SP-HCB-133-H2003	0/F1	0			✓
SP-HCB-133-H2004	0/F1	0			✓
G SP-HCB-133-H2005	0/F4	0			✓
G SP-HCB-133-H2006	0/F2	0		✓	
G SP-HCB-133-H2007	0/F3	0		✓	
G SP-HCB-133-H2008	0/F2	0			✓
G SP-HCB-133-H2009	0/F1	0			✓
G SP-HCB-133-H2010	0/F2	1		✓	
G SP-HCB-133-H2011	0/F2	1		✓	
G SP-HCB-133-H2012	0/F2	1		✓	
G SP-HCB-133-H2013	0/F3	0			✓
G SP-HCB-133-H2014	0/F4	0			✓
G SP-HCB-133-H2015	0/F3	1		✓	

* BY ENGINEERING JUDGMENT NO REANALYSIS IS REQUIRED.

** SEE INSIDE FOR NEW COMMENTS AND CALCULATIONS.

*** LATEST HANGER REVISION FROM SUMMARY SHEET.

0 0 0 0 0 3 0 5 7

BECHTEL

CALCULATION SHEET

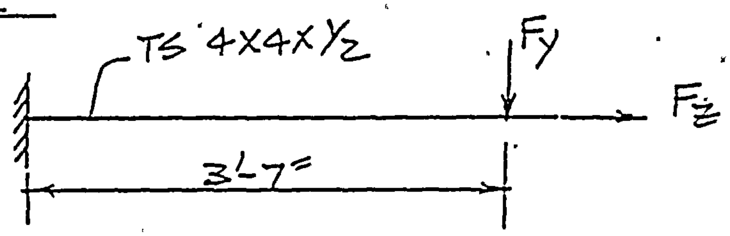
CALC. NO. 8U-5499 REV. NO. 0

ORIGINATOR S.N. Reddy DATE 5-1-82 CHECKED N DATE 5/a/82

PROJECT SSES JOB NO. 8856

SUBJECT SP-HCB-133-H2004 SHEET NO. 2

H2004



	Fy	Fz
EFF. LOADS	36	64
DESIGN LOADS	280	511

CHECK FREQUENCY

Y-DIR $= PL^3/3EI$

$$= \frac{36 \times 43^3}{3 \times 27.4 \times 10^6 \times 11.4} = 0.0031'' < 0.009$$

Z-DIR

$$\frac{PL}{AE} = \frac{64 \times 43}{6.14 \times 27.4 \times 10^6} = 0.000016'' < 0.009$$

CHECK MEM. TS 4x4x1/2

$$M_x = 280 \times 43 + 511 \times 2.75 = 13{,}445 \; ''\#$$

$$\text{MAX NORMAL STRESS} = \frac{13445}{5.70} + \frac{511}{6.14}$$

$$= 2440 \text{ PSI} < 19100 \text{ PSI}$$

O.K.

CALCULATION SHEET

CALC. NO. BH-5499 REV. NO. 0

ORIGINATOR S.N. REDDY DATE 5-1-82 CHECKED N DATE 5/4/82

PROJECT SSES JOB NO. 8856

SUBJECT SP-HCB-133-H2004 SHEET NO. 3.

WELDS O.K BY ENG. JUDGMENT

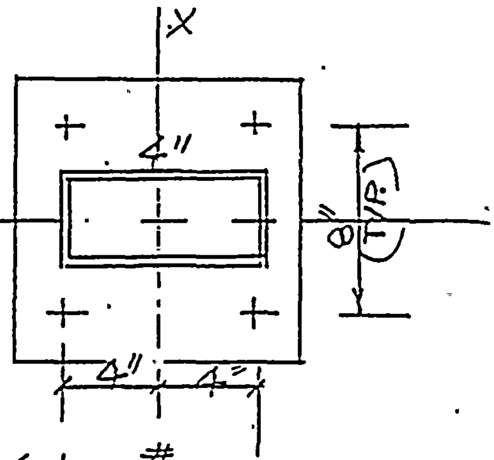
BASE PL

APPROX. PULLOUT

$\frac{13445}{2 \times 8} = 840^{\#}/\text{BOLT}$

$\text{SHEAR} = \frac{511}{4} = 128^{\#}$

$968^{\#}/\text{BOLT} < 1600^{\#}$



PL THICKNESS

$\sqrt{\frac{6 \times 840 \times 2 \times 2}{11 \times 23900}} = 0.28'' < 3/4''$ O.K

AS-BUILT HANGER O.K

BECHTEL

CALCULATION SHEET

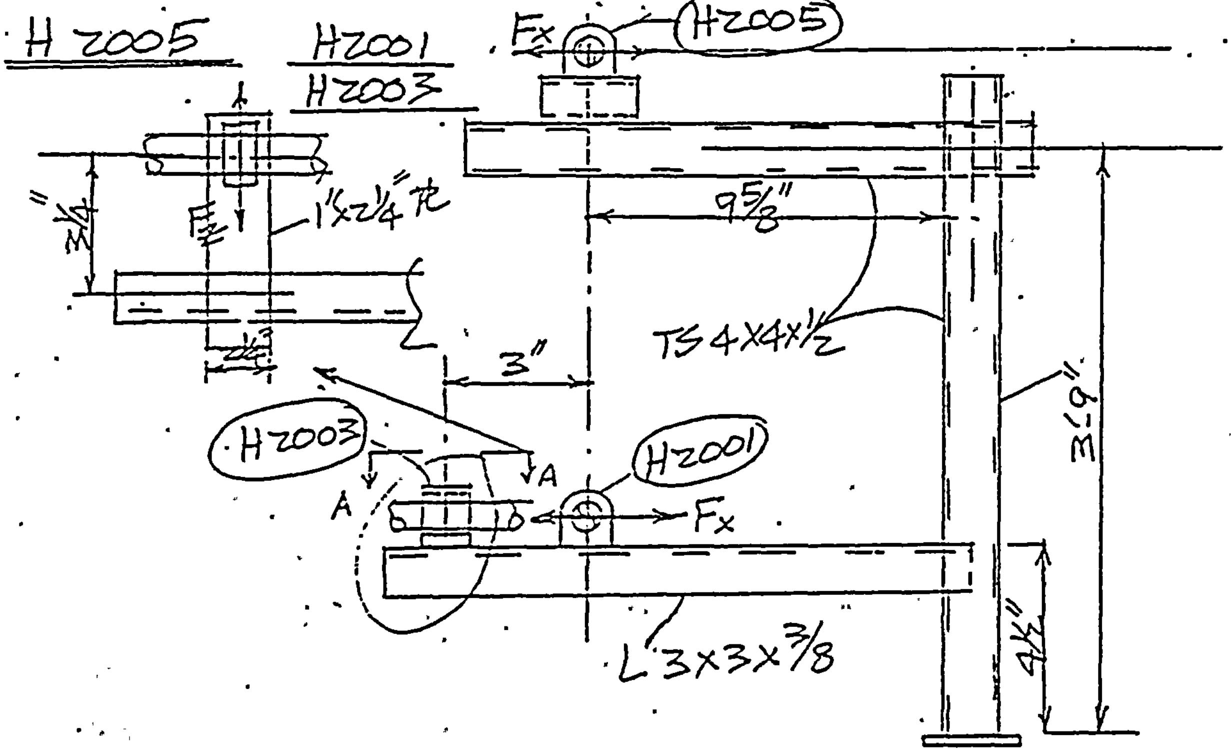
CALC. NO. 15499 REV. NO. 0

ORIGINATOR S. N. Reddy DATE 5-1-82 CHECKED N DATE 5/4/82

PROJECT SSES UNIT 1 JOB NO. 8856

SUBJECT SP-HCB-133-H2005 SHEET NO. 4

HGRS, SP-HCB-133-H2001 & H2003 ARE ATTACHED TO HGR SP-HCB-133-H2005 SUPPORT FRAME



LOADS

H 2001 — EFF. F_x 39#; DESIGN 328#

H 2003 — EFF. F_y 17, F_z 72; DESIGN 176, 649

H 2005 — EFF. F_x 36; DESIGN 373#

CALCULATION SHEET

CALC. NO. BH-5499 REV. NO. 0

ORIGINATOR S.N. Reddy DATE 5-1-82 CHECKED NJ DATE 5/4/82

PROJECT SSES UNIT 1 JOB NO. 8856

SUBJECT SP-HCB-133-H2005 SHEET NO. 5

FREQUENCY CHECK

H 2003   **Y-DIR.** $\frac{PL^3}{3EI_1} + \frac{PL_2^3}{3EI_2}$

$$\Delta_y \; \frac{17\times3.25^3}{3\times27.4\times10^6\times0.21} + \frac{17\times12.63^3}{3\times27.4\times10^6\times1.76}$$

$$= 0.00027'' < 0.009''$$

PL 1×2.5

$A = 1\times2.5 = 2.5$

$I = 2.5\times1^3/12 = 0.21\ IN^4$

Z-DIR $\frac{PL_1}{AE} + \frac{PL_2^3}{3EI_2}$

$$\Delta_Z = \frac{72\times3.25}{2.5\times27.4\times10^6} + \frac{72\times12.63^3}{3\times27.4\times10^6\times1.76}$$

$$= 0.0012'' < 0.009$$

H 2005

X-DIR $\Delta_x = \frac{PL_1}{AE} + \frac{PL_2^3}{3EI_2}$

$$\Delta_x = \frac{36\times9.63}{6.14\times27.4\times10^6} + \frac{36\times45^3}{3\times27.4\times10^6\times11.4}$$

$$= 0.0036'' < 0.009$$

CHECK MEM. TS 4×4×1/2

$M_Z = 373\times4.5 + 328\times4.5 + 176\times9.63$
$= 19,956$ #IN

$M_X = 649\times12.63 = 8197$ #IN

SFP-20758 Rev. (6/76)   ED-69 (5/76)

CALCULATION SHEET

		CALC. NO. 15499	REV. NO. 0
ORIGINATOR S.N. Reddy	DATE 5-1-82	CHECKED NJ	DATE 5/4/82
PROJECT SSES UNIT 1		JOB NO. 8856	
SUBJECT SP-HCB-133-H2005		SHEET NO. 6	

$M_y = 649 \times 4.5 + 176 \times 3.25 = 3493$ #IN.

$F_x = 176$ # $F_y = 328 + 373 = 701$ #

$F_z = 649$ #

$f_b = (3493 + 19956)/5.7$

$= 4114$ PSI < 19100

SHEAR & AXIAL LOADS ARE SMALL

TS 4x4x½ O.K

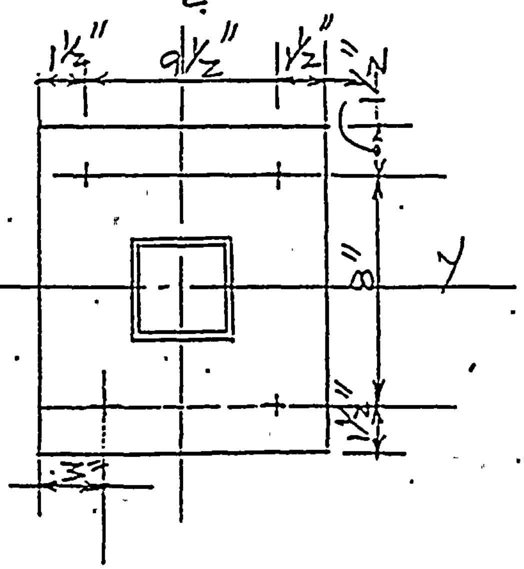
OTHER MEMBERS & CONNECTIONS ADEQUATE BY ENG. JUDGMENT

BASE PL & ANCHOR BOLTS

PER STAND PROGRAM (ATTACHMENT #2)

MAX. INTERACTION = 0.259 < 1.0

∴ ¾" PL & ¾"φ HILTI KWIK BOLTS O.K



SFP-20768 Rev. (6/76) ED-69 (5/76)

CALCULATION SHEET

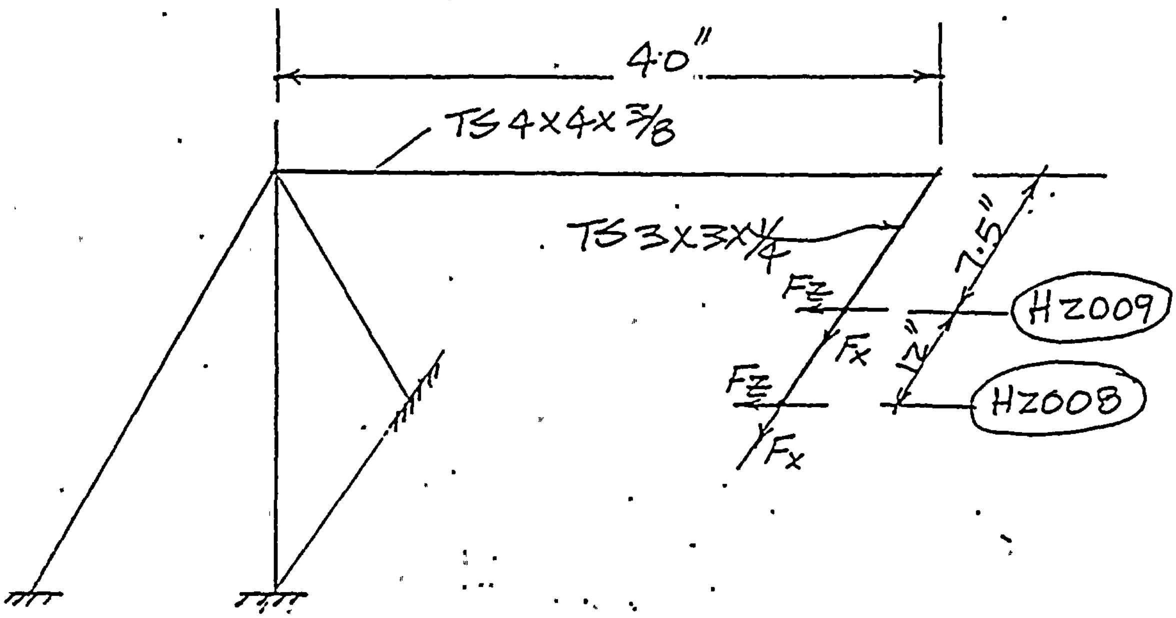
CALC. NO. BH-5499 REV. NO. 0

ORIGINATOR S.N. Reddy DATE 5-1-82 CHECKED NJ DATE 5/4/82

PROJECT SSES UNIT 1 JOB NO. 8856

SUBJECT SP-HCB-133-HZ009 SHEET NO. 7

H Z009 H Z008



ELEV. LKG. WEST

LOADS

H Z008		Fx	Fz
	EFF.	28	44
	DESIGN	154	395

H Z009		Fx	Fz
	EFF.	28	44
	DESIGN	271	220

- FROM STRUDL RUN
- ALL MEM. PASS CODE CHECK

STRUDL ATTACH. 1

CALCULATION SHEET

BECHTEL

CALC. NO. 134-5499 REV. NO. 0

ORIGINATOR S.N. Reddy DATE 5-1-82 CHECKED N DATE 5/4/82

PROJECT SSES JOB NO. 8856

SUBJECT SP-HCB-133-H2009 & H2008 SHEET NO. 8

REF

MAX. NORMAL STRESS = 5.29 KSI
(MEM. 5 L.C. 1) < 19.1 KSI

FREQUENCY CHECK WORST CASE @ JT. 7

X-DIR (JT. 7) —— 0.0093 SAY 0.009 STRUDL

Z-DIR (JT. 7) —— 0.0052 < 0.009"

O.K FOR FREQUENCY

DEFLECTION

X-DIR (JT. 7, 6) = 0.1346" ≈ 1/8"

Z-DIR (JT. 7) = 0.097" < 1/8"

O.K. FOR DEFLECTION

WELDS, BASE PL^S, ANCHOR BOLTS

O.K BY ENG. JUDGMENT

2010 & 2015

EXISTING SPRING SIZE IS FIG B-268 SIZE '00' NOT FIG 82. (DRAFTING ERROR) [FIELD INSPECTED.]

SFP-20768 Rev. (6/76) ED-69 (6/76)

CALCULATION SHEET

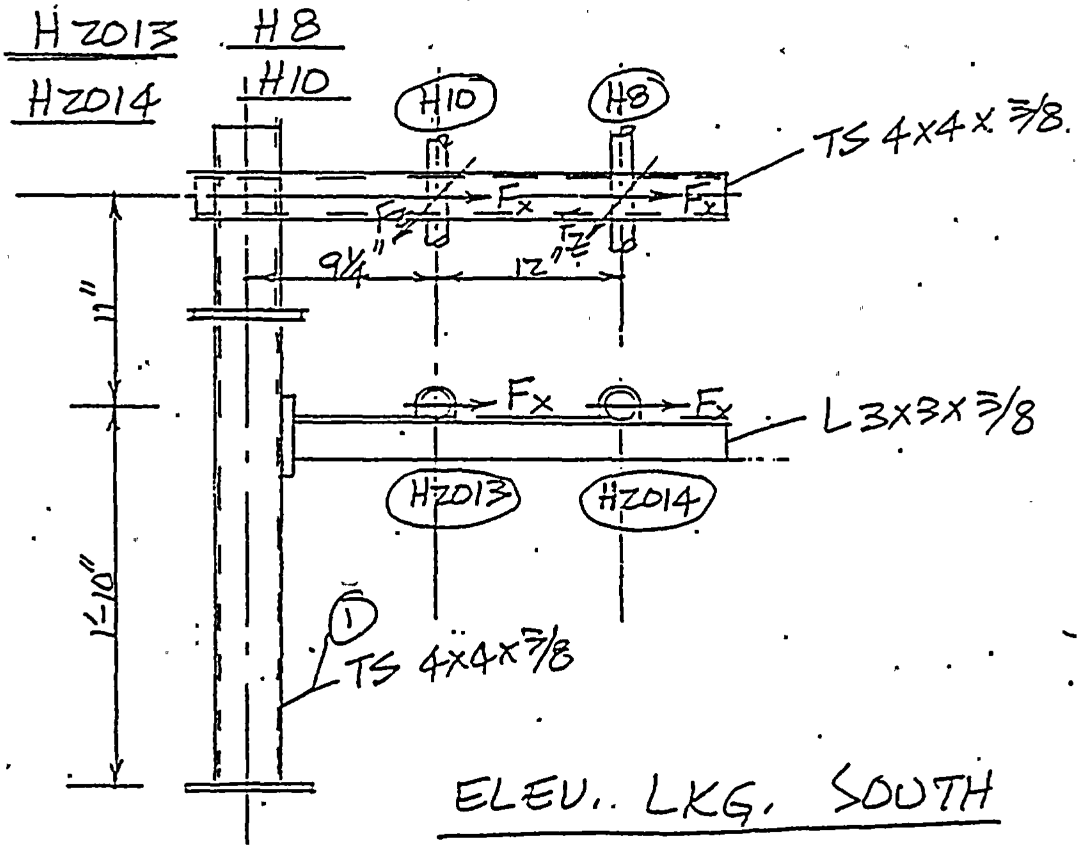
CALC. NO. -5499 REV. NO. 0

ORIGINATOR S.N. Roddy DATE 5-1-82 CHECKED [illegible] DATE 5/4/82

PROJECT SSES UNIT 1 JOB NO. 8856

SUBJECT SP-HCB-133-H2013 SHEET NO. 9

HGRS. SP-HCB-133-H8, H10 & H2014 ARE SUPPORTED FROM HGR. FRAME OF SP-HCB-133-H2013



ELEV. LKG. SOUTH

LOADS

H2013 & H2014 — EFF. Fx 26#; DESIGN. 141#

H8 & H10	Fx	Fz
EFF.	3	24
DESIGN	33	278

FREQUENCY

H2013 & H2014

$$\Delta_x = \frac{PL}{AE} + \frac{PL^3}{3EI}$$

$$= \frac{26\times19}{2.11\times27.4\times10^6} + \frac{26\times22^3}{3\times27.4\times10^6\times10.2}$$

SFP-20768 Rev. (6/76) ED-69 (5/76)

BECHTEL

CALCULATION SHEET

CALC. NO. BH-5499 REV. NO. 0

ORIGINATOR S.N. REDDY DATE 5-1-82 CHECKED NJ DATE 5/4/82

PROJECT SSES UNIT 1 JOB NO. 8856

SUBJECT SP-HCB-133-H2013 SHEET NO. 10

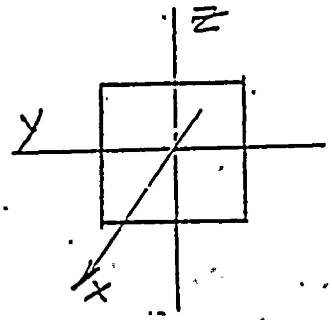
$$\Delta_x = 0.00034 < 0.009$$

<u>H8 & H10</u> CHECK IN Z-DIR. ONLY. X-DIR ALMOST INSIGNIFICANT

$$\Delta_z = \frac{PL^3}{3EI_1} + \frac{PL^3}{3EI_2} = \frac{24 \times 21^3}{3 \times 27.4 \times 10^6 \times 10.2} + \frac{24 \times 33^3}{3 \times 27.4 \times 10^6 \times 10.2}$$

$$= 0.0012'' < 0.009$$

<u>MEM. ① TS 4x4x3/8</u>



$$M_y = 2(278) \times 33$$
$$= 18348 \text{ ''\#}$$

$$M_z = 2(33 \times 33 + 141 \times 22)$$
$$= 8382 \text{ ''\#}$$

$$M_x \text{ (TORSION)} = 278(9.25 + 21.25)$$
$$= 8480 \text{ ''\#}$$

$$F_y = 2(141 + 33) = 348 \text{ \#}$$

$$F_z = 2 \times 278 = 556 \text{ \#}$$

} NEED NOT CHECK SHEAR

$$f_b = (18348 + 8382)/5.10 = 5241 \text{ Psi} < 19100 \text{ Psi}$$

TS 4x4x3/8 O.K

REMAINING MEMBERS & WELDED CONNECTIONS O.K BY ENG. JUDGMENT

CALCULATION SHEET

		CALC. NO. AB4-5499	REV. NO. 0
ORIGINATOR S. N. Roddy	DATE 5-1-82	CHECKED N	DATE 5/4/82
PROJECT SSES		JOB NO. 8856	
SUBJECT SP-HCB-133-H2013		SHEET NO. 11	

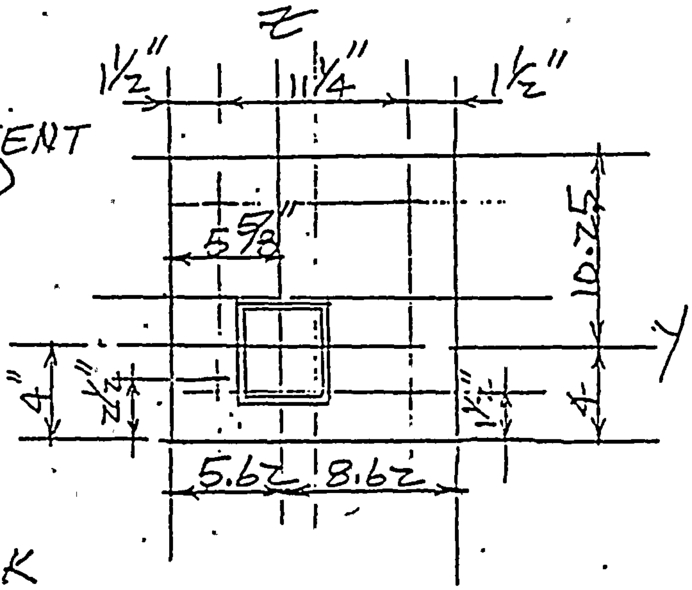
BASE PL. & ANCHOR BOLTS

PER STAND PROGRAM (ATTACHMENT #3)

MAX. INTERACTION = 0.437 < 1.0

3/4 BASE PL

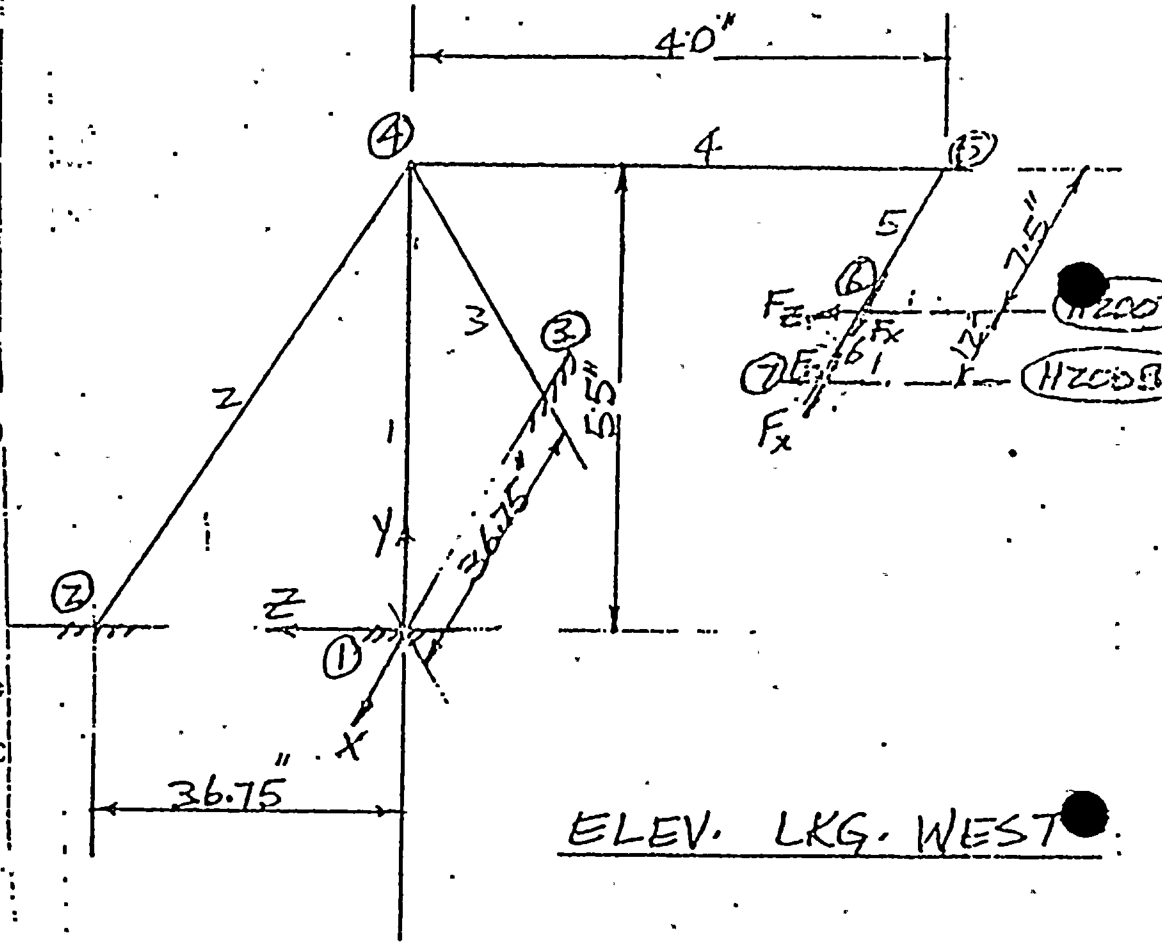
& 5/8" φ HILTI KWIK BOLTS O.K



0 0 0 ATTACHMENT #1

```
*********************************************
*                                           *
*         UNIVAC 1100 SERIES ICES           *
*    APR 29, 1982 :           10:52:14      *
*              VERSION  2.9                 *
*                                           *
*********************************************
>@ADD HCB133H2009.
   1. STRUDL 'S.S.E.S.' '0856'

                 ***********************************
                 *
                 *              ICES STRUDL-II
                 *        THE STRUCTURAL DESIGN LANGUAGE
                 *
                 *    CIVIL ENGINEERING SYSTEMS LABORAT
                 *    MASSACHUSETTS INSTITUTE OF TECHNO
                 *         CAMBRIDGE, MASSACHUSETTS
                 *
                 *         10.52.52          29 APR 82
                 *
                 *         UNIVAC 1100 SERIES  EXEC 8
                 *                VERSION 2.8
                 *
                 ***********************************
   2. TITLE 'SP-HCB-133-H2009    SEISMIC CLASS
   3. $ INPUT BY: SN. REDDY      DATE:      CHEC
   4. TYPE SPACE FRAME
   5. UNITS INCH KIP DEG
   6. JOINT COORDINATES
   7. 1 0 0 0 S
   8. 2 0 0 36.75 S
   9. 3 -36.75 0 0 S
  10. 4 0 55 0
  11. 5 0 55 -40
  12. 6 7.5 55 -40
  13. 7 19.5 55 -40
  14. MEMBER INCIDENCES
  15. 1 1 4
  16. 2 2 4
  17. 3 3 4
  18. 4 4 5
  19. 5 5 6
  20. 6 6 7
  21. REP 5 END JOI SIZE STA 2.0
```



ELEV. LKG. WEST

SP-HCB-133-H2009 & H2008

BY, S.N. Reddy 5-1-82

CHECKED BY: NJ 5/4/82

```
24. 2 3 TAB 'STUDES' 'T4X4X4'
25. 5 6 TAB 'STUDES' 'T3X3X4'
26. CONSTANT
27. E 27400.0 ALL
28. G 10540.0 ALL
29. DENSITY .000284 ALL
30. POI .3 ALL
31. BETA 0.0 ALL
32. LOADING 1
33. JOI 6 LOA FOR X .271 Z .220
34. JOI 7 LOA FOR X .154 Z .395
35. LOADING 2 'FREQ Z'
36. JOI 7 LOA FOR Z .044
37. DEADLOAD Z FAC 0.5
38. LOADING 3 'FREQ X'
39. JOI 7 LOA FOR X .028
40. DEADLOAD X FAC 0.5
41. STIFFNESS ANALYSIS
42. OUTPUT BY MEMBER
43. OUTPUT DEC 4
44. LIST FORCES REACTIONS DISPLACEMENTS ALL
```

0 0 0 0 0 0 0 0 6 9

```
****************************
*RESULTS OF LATEST ANALYSIS*
****************************
```

PROBLEM - S.S.E.S.   TITLE - 8856

ACTIVE UNITS INCH   KIPS   DEGREE DEGF   SECOND

ACTIVE STRUCTURE TYPE   SPACE FRAME

ACTIVE COORDINATE AXES   X Y Z

MEMBER FORCES

MEMBER LOADING	JOINT	/---FORCES--- AXIAL	SHEAR Y	SHEAR Z	/---MOMENTS--- TORSIONAL	BENDING Y	BENDING Z

		4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	2	1	-.1710	[illegible]0038	[illegible].0319	.2338	.4[illegible]	.0507
		4	.1710	-.0038	-.0068	-.2338	.2203	.1584
	3	1	.1479	.0367	-.0088	.5058	.1436	-.5511
		4	-.1479	.0019	.0088	-.5058	.3413	.4064
2								
	1	2	1.2269	-.0707	.2640	3.7814	-5.6025	-1.6817
		4	-1.2269	.0707	-.2640	-3.7814	-11.8602	-2.9935
	2	2	.2243	-.0199	.0092	.1317	-.2089	-.3193
		4	-.2059	-.0077	-.0092	-.1317	-.4021	-.0835
	3	2	.0123	-.0048	-.0008	.2822	-.1264	-.0957
		4	-.0123	.0048	-.0325	-.2822	-.9233	-.2246
3								
	1	3	-.8966	.0692	.2617	3.7615	-5.4786	1.5750
		4	.8966	-.0692	-.2617	-3.7615	-11.836[illegible]	3.0002
	2	3	-.0067	.0020	-.0114	.1315	.1072	.0327
		4	.0067	-.0020	-.0219	-.1315	-.4535	[illegible]1028
	3	3	-.2020	.0225	.0196	.2808	-.4315	.3725
		4	.1835	.0051	-.0196	-.2808	-.8603	.2045
4								
	1	4	.6150	-.0000	-.4250	-.0000	26.3525	-.0000
		5	-.6150	.0000	.4250	.0000	-9.3525	-.0000
	2	4	.0793	-.0000	.0000	-.0000	.9279	-.0000
		5	-.0512	.0000	-.0000	.0000	-.9279	-.0000
	3	4	-.0000	-.0000	-.0633	-.0000	1.9692	-.0000
		5	.0000	.0000	.0352	.0000	.0000	-.0000
5								
	1	5	-.4250	.0000	-.6150	-.0000	9.3525	.0000
		6	.4250	-.0000	.6150	.0000	-4.7400	.0000
	2	5	.0000	-.0000	-.0512	-.0000	.9279	-.0000
		6	-.0000	.0000	.0484	.0000	-.5545	-.0000
	3	5	-.0352	-.0000	.0000	-.0000	-.0000	-.0000
		6	.0324	.0000	-.0000	.0000	.0000	[illegible]0000
6								
	1	6	-.1540	.0000	-.3950	-.0000	4.74[illegible]	.0000
		7	.1540	-.0000	.3950	.0000	.00[illegible]	.0000
	2	[illegible]						
		7	-.0000	-.0000	.0440	-.0000	.0000	.0000
	3	6	-.0324	-.0000	-.0000	-.0000	-.0000	-.0000
		7	.0280	.0000	.0000	.0000	.0000	.0000

JOINT

SUPPORTS

LOADS -

JOINT LOADING	X FORCE	Y FORCE	Z FORCE	X MOMENT	Y MOMENT	Z MOMENT
	/----FORCES----		/	----MOMENTS----		

1	-.1334	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	-.0038	[illegible]	.0319	-.4689	.2338	.0509
3	-.0367	.1479	-.0088	-.1436	.5058	.5511
2 GLO						
1	.2640	.9609	-.7404	-1.6817	.0314	-6.7595
2	.0092	.1755	-.1412	-.3193	-.0066	-.2468
3	-.0008	.0075	-.0108	-.0957	.1644	-.2619
3 GLO						
1	-.5556	-.7071	.2617	6.6451	.0838	1.5750
2	-.0054	-.0044	-.0114	-.0161	.1689	.0327
3	-.1310	-.1554	.0196	.5147	-.0062	.3725

JOINT

SUPPORTS

DISPLACEMENTS -

JOINT LOADING	X DISPL	Y DISPL	Z DISPL	X ROT	Y ROT	Z ROT
	/------DISPLACEMENTS------		/	------ROTATIONS------		/
1 GLO						
1	.0000	.0000	.0000	.0000	.0000	.0000
2	.0000	.0000	.0000	.0000	.0000	.0000
3	.0000	.0000	.0000	.0000	.0000	.0000
2 GLO						
1	.0000	.0000	.0000	.0000	.0000	.0000
2	.0000	.0000	.0000	.0000	.0000	.0000
3	.0000	.0000	.0000	.0000	.0000	.0000
3 GLO						
1	.0000	.0000	.0000	.0000	.0000	.0000
2	.0000	.0000	.0000	.0000	.0000	.0000
3	.0000	.0000	.0000	.0000	.0000	.0000

JOINT

FREE JOINTS

DISPLACEMENTS -

JOINT LOADING	X DISPL	Y DISPL	Z DISPL	X ROT	Y ROT	Z ROT
	/------DISPLACEMENTS------		/	------ROTATIONS------		/
4 GLO						
1	.0009	.0001	.0017	-.0113	-.1159	.0123
2	-.0001	.0001	.0004	-.0006	-.0037	.0006
3	.0003	-.0001	-.0001	-.0011	-.0085	.0012
5 GLO						
1	.1345	-.0078	.0018	-.0113	-.2516	.0123
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NO	FX	FY	FZ	MX	MY	MZ	K-FACT
1	.00	.35	.56	8.48	[illegible].35	8.38	1.70
2	.00	-.35	-.56	-8.48	-18.35	-8.38	1.70
3	.00	.35	.56	8.48	18.35	-8.38	1.70
4	.00	.35	.56	8.48	-18.38	8.38	1.70

SP-HCB-133-H2013

ALL INPUT AND OUTPUT IS IN KIP-INCH UNITS

ANCHOR IS CHECKED FOR 4 LOAD CONDITIONS AS TABULATED BELOW

LOAD COND	FORCE X	FORCE Y	FORCE Z	MOMENT XX	MOMENT YY	MOMENT ZZ	K-FACTOR
1	.00	.35	.56	8.48	18.35	8.38	1.700
2	.00	-.35	-.56	-8.48	-18.35	-8.38	1.700
3	.00	.35	.56	8.48	18.35	-8.38	1.700
4	.00	.35	.56	8.48	-18.38	8.38	1.700

SP-HCB-133-H2013

ALL INPUT AND OUTPUT IS IN KIP-INCH UNITS

O U T P U T F O R L O A D C O N D I T I O N 1

BOLT SHEAR FORCES AND TENSILE CAPACITIES . . .

BOLT NO	/----SHEAR FORCE----/ Y	Z	/--TENSILE CAPACITY--/ BOLT	PLATE
1	-.107	-.055	1.595	3.143
2	-.107	.333	1.561	3.143
3	.281	.333	1.539	5.658

TENSILE CAPACITY FROM BOLT INCLUDES SHEAR REDUCTIONS

0 0 0 0 0 0 0 0 8 1

STRESS BLOCK INFORMATION . . .

/----------MOMENT YY----------/			/----------MOMENT ZZ----------/		
WIDTH(B)	LENGTH(L)	DEPTH(A)	WIDTH(B)	LENGTH(L)	DEPTH(A)
7.057	2.000	.175	7.057	6.620	.176

FINAL RESULTS . . .

/----------MOMENT INTERACTION CHECK----------/						
FOX	MOY	MOZ	MY/MOY*R	MZ/MOZ*R	SUM	CHECK
6.27	39.97	40.13	.4591	.2089	.366	OK

S T A N D -- STRENGTH DESIGN OF ANCHORS -- VERSION 01 PAGE 5
DATE 050482

SP-HCB-133-H2013

ALL INPUT AND OUTPUT IS IN KIP-INCH UNITS

O U T P U T   F O R   L O A D   C O N D I T I O N   .   2

BOLT SHEAR FORCES AND TENSILE CAPACITIES . . .

BOLT	/----SHEAR FORCE----/		/--TENSILE CAPACITY--/	
NO	Y	Z	BOLT	PLATE
1	.107	.055	1.595	3.143
2	.107	-.333	1.561	3.143
3	-.281	-.333	1.539	5.658
4	-.281	.055	1.574	10.718

TENSILE CAPACITY FROM BOLT INCLUDES SHEAR REDUCTIONS

STRESS BLOCK INFORMATION . . .

/----------MOMENT YY----------/			/----------MOMENT ZZ----------/		
WIDTH(B)	LENGTH(L)	DEPTH(A)	WIDTH(B)	LENGTH(L)	DEPTH(A)
7.057	6.836	.173	7.057	3.630	.172

FOX	MOY	MOZ	MY/MOY*R	MZ/MOZ*R	SUM	CHECK
6.27	35.03	39.27	.5241	.2134	.437	OK

S T A N D -- STRENGTH DESIGN OF ANCHORS -- VERSION 01 PAGE 6
DATE 050482

EP-MCB-133-M2013

ALL INPUT AND OUTPUT IS IN KIP-INCH UNITS

OUTPUT FOR LOAD CONDITION 3

BOLT SHEAR FORCES AND TENSILE CAPACITIES . . .

BOLT NO	SHEAR FORCE Y	SHEAR FORCE Z	TENSILE CAPACITY BOLT	TENSILE CAPACITY PLATE
1	-.107	-.055	1.595	3.143
2	-.107	.333	1.561	3.143
3	.281	.333	1.539	5.658
4	.281	-.055	1.574	10.718

TENSILE CAPACITY FROM BOLT INCLUDES SHEAR REDUCTIONS

STRESS BLOCK INFORMATION . . .

MOMENT YY			MOMENT ZZ		
WIDTH(B)	LENGTH(L)	DEPTH(A)	WIDTH(B)	LENGTH(L)	DEPTH(A)
7.057	2.000	.175	7.057	3.630	.172

FINAL RESULTS . . .

FOX	MOY	MOZ	MY/MOY*R	MZ/MOZ*R	SUM	CHECK
6.27	39.97	39.27	.4591	.2134	.369	OK

ALL INPUT AND OUTPUT IS IN KIP-INCH UNITS

OUTPUT FOR LOAD CONDITION 4

BOLT SHEAR FORCES AND TENSILE CAPACITIES . . .

BOLT NO	/----SHEAR FORCE----/ Y	Z	/--TENSILE CAPACITY--/ BOLT	PLATE
1	-.107	-.055	1.595	3.143
2	-.107	.333	1.561	3.143
3	.281	.333	1.539	5.658
4	.281	-.055	1.574	10.718

TENSILE CAPACITY FROM BOLT INCLUDES SHEAR REDUCTIONS

STRESS BLOCK INFORMATION . . .

/-----MOMENT YY-----/ WIDTH(B)	LENGTH(L)	DEPTH(A)	/-----MOMENT ZZ-----/ WIDTH(B)	LENGTH(L)	DEPTH(A)
7.057	6.836	.173	7.057	6.620	.176

FINAL RESULTS . . .

/----------MOMENT INTERACTION CHECK----------/

FOX	MOY	MOZ	MY/MOY+R	MZ/MOZ+R	SUM	CHECK
6.27	35.03	40.13	.5249	.2089	.435	OK

Item #1-4

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8-13-82

OBSERVATION ☐ #:

POTENTIAL FINDING ☐ #:

FINDING ☒ #: 1-4

SAFETY IMPACT ☐ YES

☒ NO

☐ INDETERMINATE

DESCRIPTION:

It was found during review of the thermal interference walkdown (required by M-213) performed by the Stress Engineer (R.E. Group) that the field ISO # SP-HCB-133-1 Rev. 9 was used for the walkdown (done on 10-27-81). The latest revision of this ISO was Revision 12 (issued 9/28/81). There is no procedural guidance criteria that requires the RE Group to assure that they are using the latest revision.

SIGNATURES:

INVESTIGATION TEAM MEMBER: [signature] 8-13-82

INVESTIGATION TEAM LEADER: [signature] 8-13-82

INVESTIGATION MANAGER: [signature] 8/13/82

I concur that this item is a Finding

Item #1-5

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8-13-82

OBSERVATION ☐ #:

POTENTIAL FINDING ☐ #:

FINDING ☒ #: 1-5

SAFETY IMPACT ☐ YES

☐ NO

☒ INDETERMINATE

DESCRIPTION:

10CFR50, App. B, Criteria #3 requires that design control measures be established in procedures. Investigation Items #'s 1-1, 1-2, 1-3, 1-4, 1-6, 1-7, 1-8 and 2-1 indicate areas that would require procedural definition. Investigation Items #1-9, 1-10, 1-11, 1-12 1-13 and 1-14 indicate areas that there were breakdowns in the implementation of the procedural controls.

SIGNATURES:

INVESTIGATION TEAM MEMBER: B.M. Snoyer 8-13-82

INVESTIGATION TEAM LEADER: B.M. Snoyer 8-13-82

INVESTIGATION MANAGER: RJ Shovlin 8/13/82

I concur that this item is a Finding

Item #1-6

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [X] #: 1-6

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[X] NO

[ ] INDETERMINATE

DESCRIPTION:

There was no documented evidence to show that as-built ISO #SP-HCB-133-2 Rev. 8 was formally transmitted to the RE Group for reconciliation. The program for As-Built approval required the FE group to assemble a document package containing all as-built drawings (Fab Isos and Hanger Details) related to an SKM, attach a transmittal form, and forward it to the RE group. The RE group would then reconcile the Package, sign-off the documents and advise FE. The team was told that this drawing and approximately 265 others were handled by handcarrying the revisions from Field Engineering to the RE Group and not by a

SIGNATURES:

INVESTIGATION TEAM MEMBER: [signature] 8/13/82

INVESTIGATION TEAM LEADER: BM [signature] 8/13/82

INVESTIGATION MANAGER: RJ [signature] 8/13/82

I concur that this item is an observation.

transmittal form. The direction for this was given in a meeting between the two groups.

As a result of not having a dated transmittal form there is no assurance that the RE group had sufficient time to perform a substantive review/reconciliation of the as-built packages.

I[illegible]n #1-7

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [X] #: 1-7

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[X] NO

[ ] INDETERMINATE

DESCRIPTION:

Calculation #5268 - Isometric SP-HCB-109-1, Rev. 14; SP-HCB-109-2, Rev. 16. Sheet #6 of the above calculation shows that the span length between support H2008 and H1 exceeds the maximum dynamic support span by 2". Auditor was told by A. T. Morrow of the RE Support Group that overspans of up to 6 or 7 inches are sometimes allowed by engineering judgement. Spec. M-241 does not indicate any tolerances are to be applied to the maximum support spans.

SIGNATURES:

INVESTIGATION TEAM MEMBER: C. L. Dvorscak (signed) C. L. Dvorscak 8-13-82

INVESTIGATION TEAM LEADER: B. M. Swoyer (signed) B M Swoyer 8/13/82

INVESTIGATION MANAGER: R. J. Shovlin (signed) R J Shovlin 8/13/82

I concur that this item is an Observation

Item #1-8

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION	[X]	#:	1-8
POTENTIAL FINDING	[ ]	#:	
FINDING	[ ]	#:	
SAFETY IMPACT	[ ]	YES	
	[X]	NO	
	[ ]	INDETERMINATE	

DESCRIPTION:

Specification 8856-M-241 (Rev. 3) paragraph 4.2.3.2 requires satisfaction of primary stress allowables "by providing dynamic supports on straight pipe at spacing less than or equal to the maximum allowable spans given in Appendix B tables B-1.1 to B-1.11." Table B-1.11 prescribes a maximum allowable span of 9.5' for 2" schedule 80 carbon steel pipe located in the diesel generator rooms.

Contrary to this requirement, calculation #5418, sheet 3, does not consider maximum allowable span for the following pipe runs: 10'-3" span between supports SP-HBC-78-7-H63 and H64; 10'-0"

SIGNATURES:

INVESTIGATION TEAM MEMBER: D. B. Ritter 8/13/82

INVESTIGATION TEAM LEADER: B. M. [signature] 8/13/82

INVESTIGATION MANAGER: R. J. [signature] 8/13/82

I concur that this item is an Observation

span between supports Sp-HBC-78-7-H64 and H65; 10'-0" span between supports SP-HBC-78-7-H65 and H66; 10'-4½" span between supports SP-HBC-78-8-H51 and H52; 9'-11 3/4" span between supports SP-HBC-78-8-H52 and H53; 10'-0" span between supports SP-HBC-78-8-H53 and H54. All six of these pipe runs have spans in excess of the 9.5' allowable, by slight amounts.

Investigation indicates that these spans were within the length allowable by an earlier, superseded revision of specification M-241.

As-built reconciliation calculation ABS-5418 does not address reconciliation of these six overlength spans in clear fashion. Only a brief general note, "Referenced computer output for calc. #ABS-5416" is supposed to imply performance of this reconciliation. The investigation team was unable to make that inference due to lack of sufficient detail in this note (shown above). Only after a lengthy investigation was the team satisfied that the above span lengths are adequate.

There appears to be no adverse safety impact resulting from this action.

TABLE B-1.11

MAXIMUM SPAN TABLE FOR STRAIGHT PIPE DIESEL GENERATOR ROOMS

AREA: UNIT-1 AND COMMON
(43 ; 45)

ELEVATION FROM 669 FT. TO 737 FT.

PIPE SIZE & SCH.	INSULATION THICK (IN)	MAX. SPAN (FT.)	FUNDAMENTAL FREQ (CPS.)	MAXIMUM SPAN FORCES (LBS)	MAXIMUM SPAN MOM'S (FT-LBS)	75% OF MAX. SPAN FORCES (LBS)	75% OF MAX. SPAN MOM'S (FT-LBS)
3/4 · 160	0.0	6.25	16.035	56	270	18	120
1.0 - 80	0.0	7.0	16.505	74	407	24	160
1.0 - 160	0.0	7.0	16.159	92	503	24	223
1½ · 80	0.0	8.5	16.192	160	1064	51	469
2.0 - 80	0.0	9.5	16.128	257	1903	83	847

NOTE: SEE PAGE B-11a FOR INSTRUCTIONS FOR USE OF THIS TABLE.

INSTRUCTIONS FOR USE OF TABLE B-1.11

1. CALCIUM SILICATE USED AS INSULATION.

2. PIPE WITH WATER.

3. MAXIMUM SPAN FOR STRAIGHT PIPE IS BASED ON DESIGN PRESSURE OF 2000 PSI FROM PIPING CLASS SUMMARY SHEETS WITH CONSIDERATION OF UPSET, EMERGENCY AND FAULTED LOAD COMBINATION FOR CARBON STEEL S_h = 15000 PSI.

4. FORCES SHOWN FOR MAXIMUM SPAN AND FOR 75% OF MAXIMUM SPAN ARE DESIGN FORCE LOADS FOR SUPPORTS AND ANCHORS AND REPRESENT COMBINED FORCES FROM PIPING ON BOTH SIDES OF ANCHOR OR SUPPORT. IF PIPE SPANS OR PIPE AND INSULATION PROPERTIES ARE NOT THE SAME ON BOTH SIDES OF SUPPORT OR ANCHOR, ONE HALF THE TABULATED VALUES APPLICABLE TO PIPING ON EACH SIDE SHOULD BE ADDED TO OBTAIN THE DESIGN LOADS.

5. THE TABULATED FORCES & MOMENTS ARE BASED ON THE CONTROLLING LOAD COMBINATION OF (DW + OBE). THERMAL LOADS ARE NOT INCLUDED. △3

6. SIF = 1.3 USED FOR STRESS EVALUATION.

7. MOMENTS SHOWN FOR MAXIMUM SPAN AND FOR 75% OF MAXIMUM SPAN ARE DESIGN MOMENTS LOADS FOR ANCHORS AND REPRESENT COMBINED MOMENTS FROM PIPING ON BOTH SIDES OF THE ANCHOR. IF PIPE SPANS OR PIPE AND INSULATION PROPERTIES ARE NOT THE SAME ON BOTH SIDES OF THE ANCHOR, ONE HALF THE TABULATED VALUES APPLICABLE TO PIPING ON EACH SIDE SHOULD BE ADDED TO OBTAIN THE ANCHOR DESIGN LOADS.

8. RESPONSE SPECTRA INFORMATION IS TAKEN FROM CIVIL SPEC. 8856-G-24, REV. 1.

Item # 1-9

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [x] #: 1-9

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[x] NO

[ ] INDETERMINATE

DESCRIPTION:

Specification 8856-M-241 (Rev. 3) Appendix A figure A-3.15 presents geometry adjustment factors for concentrated weights and dynamic loads for one piping geometry. As the figure is self explanatory, no additional instructions are provided for its use. The figure states, "For W/WL = 0.51 to 1.0 ... Multiply maximum span L by F= 0.33." Contrary to this, calculation #5268 (Rev. 2), sheet 4, span "H2000 to H2011" shows for W/WL = 0.78 ... multiplication of maximum span L by F = 0.42. Investigation indicates that this value of F was obtained by interpolation of the values for F given in figure A-3.15. Such

SIGNATURES:

INVESTIGATION TEAM MEMBER: D. B. Ritter 8/13/82

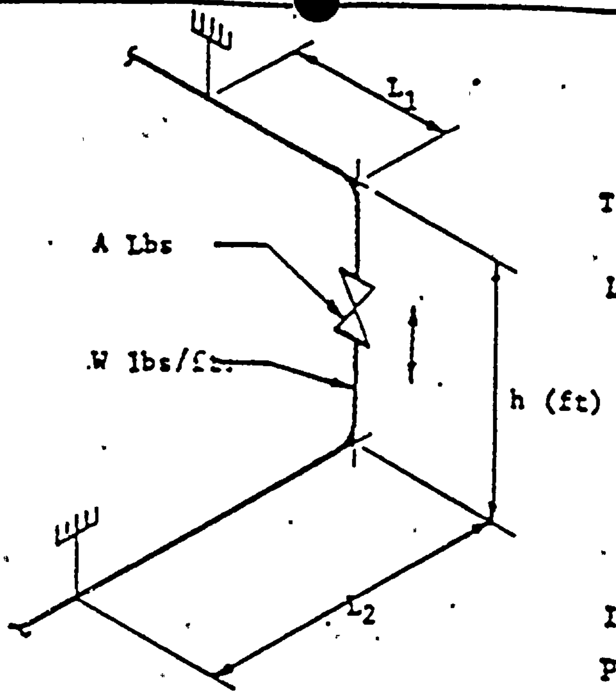
INVESTIGATION TEAM LEADER: B. M. Ewoy 8/13/82

INVESTIGATION MANAGER: R J Ikolin 8/13/82

I concur that this item is an Observation

interpolation of the values for F presented in Figure A-3.15 are not authorized within the specification. Application of this larger value for F, obtained by interpolation, resulted in acceptance of a 2'-5½" span, which should have been identified as being 4½" overlength, by spec M-241 criteria.

There appears to be no adverse safety impact resulting from this action.



Total Weight = W = wh + A (if any)

$L_1 + L_2 = FL$

If no concentrated weight is present:

For h/L	Multiply Maximum Span L by
0- .125	F = .72
.126 - .5	F = .55
.51- 1.0	F = .33
1.01- 2.0	F = .2
2.01- and up	F = .1

If a concentrated weight is present (such as a valve):

For W/wL	Multiply Maximum Span L by
0- .125	F = .72
.126 - .5	F = .55
.51- 1.0	F = .33
1.01- 2.0	F = .2
2.01 and up	F = .1

FIGURE A-3.15

Item # 1-10

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [x] #: 1-10

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[x] NO

[ ] INDETERMINATE

DESCRIPTION:

Support SP-HBC-78-8-H2041, as shown on the as-built support detail drawing, shows the pipe running along the north-south direction. The pipe actually runs along the east-west direction.

SIGNATURES:

INVESTIGATION TEAM MEMBER: C. L. Dvorscak *C. L. Dvorscak* 8-13-82

INVESTIGATION TEAM LEADER: B. M. Swoyer *B M Swoyer* 8/13/82

INVESTIGATION MANAGER: R. J. Shovlin *R J Shovlin* 8/13/82

I concur that this item is an *Observation*

I [illegible] = 1-11

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [X] #: 1-11

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[X] NO

[ ] INDETERMINATE

DESCRIPTION:

Calculation #5499 - Isometric SP-HCB-133-1, Rev. 16. Sheet #9 of the above calculation shows the minimum span required to accommodate piping thermal expansion and differential building movements. This calculation does not correctly account for differential building movements as per Spec. M-241.

SIGNATURES:

INVESTIGATION TEAM MEMBER: C. L. Dvorscak *C. L. Dvorscak* *8-13-82*

INVESTIGATION TEAM LEADER: B. M. Swoyer *B M Swoyer 8/13/82*

INVESTIGATION MANAGER: R. J. Shovlin *R J Shovlin 8/13/82*

I concur that this item is an *Observation*

Item # 1-12

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION	[X]	#:	1-12
POTENTIAL FINDING	[ ]	#:	
FINDING	[ ]	#:	
SAFETY IMPACT	[ ]	YES	
	[X]	NO	
	[ ]	INDETERMINATE	

DESCRIPTION:

Calculation #5268 - Isometric SP-HCB-109-1, Rev. 14; SP-HCB-109-2, Rev. 16. Sheet #5 of the above calculation shows the required span length between H2000 and H2002. Engineering judgement was used in the distribution of load between the two supports. (See attached for details). The same type of assumption was applied to the span calculation between penetration X-221A and H2011. Spec. M-241, Rev. 3 does not indicate any tolerances can be applied to the above condition.

SIGNATURES:

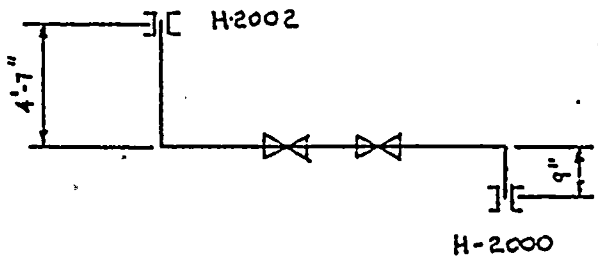
INVESTIGATION TEAM MEMBER: C. L. Dvorscak — C. L. Dvorscak 8-13-82

INVESTIGATION TEAM LEADER: B. M. Swoyer — B. M. Swoyer 8-13-82

INVESTIGATION MANAGER: R. J. Shovlin — R. J. Shovlin 8/13/82

I concur that this item is an Observation

The span between H2000 and H2002 can be represented as shown below.



The calculations indicate that all of the dynamic loads associated with the concentrated pipe and valve weights is taken by H2000. Strict interpretation of Spec. M-241, Rev. 3 would indicate that the load should be split up between the both supports and the span adjusted accordingly.

Spec. M-241, Rev. 4 provides direction for this type of condition, that is, when all the load can be lumped on one support and not split up. The calculations noted above appear to go beyond these guidelines also.

Pg 1 of 1

Item # 1-13

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [X] #: 1-13

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[X] NO

[ ] INDETERMINATE

DESCRIPTION:

During the walkdown of the Diesel gen. overflow line (SP-HBC-78-8), hanger #H2042, on SP-HBC-78-8-H2042 hanger detail, contained a 3" x 3" x 3/8" angle that was indicated to have a 4" long 1/4" fillet weld on each side in the vertical direction, (Total of 8 inches of weld). Instead there was a 3" long 1/4" fillet weld across the legs of this angle (horizontally) at two locations (Total of 6 inches of weld). Bechtel Q.C. failed to note this discrepancy. Discussions between NPE and Bechtel RE resulted in this item having no impact on the system.

SIGNATURES:

INVESTIGATION TEAM MEMBER: [signature] 8/13/82

INVESTIGATION TEAM LEADER: [signature] 8-13-82

INVESTIGATION MANAGER: [signature] 8/13/82

I concur that this item is an observation

Item # 1-14

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [x] #: 1-14

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[x] NO

[ ] INDETERMINATE

DESCRIPTION:

Calculation #5268 (Rev. 2) was completed on 6/22/81. It references fabrication isometric drawings SP-HCB-109-1 (Rev. 9) and SP-HCB-109-2 (Rev. 7) as its sources of data. Calculation #5268 utilizes supports SP-HCB-109-1-H2010 and H2011 (on pages 3, 4, 8, 9, 25, 2). These supports were not depicted on approved revision 9 of this iso. The following revision 10 to this iso drawing, which added these two supports, was not issued until 8/06/81. This use of other than an approved iso appears to be contrary to the requirement of specification 8856-M-241 paragraph 2.3.

SIGNATURES:

INVESTIGATION TEAM MEMBER: D. B. Ritter 8/13/82

INVESTIGATION TEAM LEADER: B. M. [signature] 8/13/82

INVESTIGATION MANAGER: RJ [signature] 8/13/82

I concur that this item is an observation

There appears to be no adverse safety impact resulting from this action.

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 1

DATE: 8/13/82

OBSERVATION [X] #: 1-15

POTENTIAL FINDING [ ] #:

FINDING [ ] #:

SAFETY IMPACT [ ] YES

[X] NO

[ ] INDETERMINATE

DESCRIPTION:

Three items were found during the walkdown of the Diesel Generator Overflow Line (SP-HBC-78) that would indicate there might be an oversite in the area of additional work performed (like repair) after the System has been turned over or after final inspection. It is PP&L's and Bechtel's responsibilities to make the appropriate people aware of any areas that require any additional design review or inspection. The three items are: (1) There was no clearance between the pipe and unistrut at a point approx. 2' west of hanger #H53 which was repaired (shimmed and bolts tightened) under the SP600 Hanger repair program.

SIGNATURES:

INVESTIGATION TEAM MEMBER: B M [signature] 8/13/82 J. [signature] 8/13/82 C. J. [signature] 8/17/82

INVESTIGATION TEAM LEADER: B M [signature] 8/13/82

INVESTIGATION MANAGER: R J [signature] 8/13/82

I concur that this item is a Observation

(2) A conduit was supported by being clamped to piece of unistrut. This unistrut was supported by being clamped to the Diesel Gen. Overflow line. This work is done after turnover.

(3) On Hanger H2047, one of the anchor bolts on the baseplate attached to the wall had the torque paint removed. The Bechtel QC documents had verified that the torque paint was intact prior to turnover. A second bolt, although extending slightly above the nut, allowed two threads in the nut to be visible. This condition was a result of the taper at the end of the bolt.

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 2

DATE: 8/13/82

OBSERVATION ☐ #:

POTENTIAL FINDING ☐ #:

FINDING ☒ #: 1

SAFETY IMPACT ☐ YES

☐ NO

☒ INDETERMINATE

DESCRIPTION:

Please refer to attached.

SIGNATURES:

INVESTIGATION TEAM MEMBER: Frank K. McCreesh 8/13/82

INVESTIGATION TEAM MEMBER: John D Murray 8/13/82

INVESTIGATION TEAM LEADER W. H. Gulliver 8/13/82

INVESTIGATION MANAGER: [signature] 8/13/82

I concur that this item is a Finding

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

DESCRIPTION:

Field Procedure P-11, Rev. 6, Section 6.2.7.1 outlines the requirements for the issuance of SP and SPA Details.

The procedure is as follows:

1. The SP and SPA Details are received by the site Print Room from SFHO.

2. The Print Room logs one copy into a suspense file and forwards one copy to the Lead Field Small Pipe Hanger Engineer for review and comment.

3. The LFSPHE then forwards the document to the Lead Field Welding Engineer for review and comment.

4. The LFWE then returns the document to the Print Room for appropriate distribution to the field, i.e. one copy to the Resident Engineer Group.

Contrary to the procedure, the LFSPHE did not forward 274 SPA drawing revisions which he received in January, 1982. Although the procedure does not specify a time limit for the above routing activity, a seven (7) month delay violates the intent of the procedure.

Bechtel QAR #8856-F-859 (copy attached) was issued on 7/30/82 to expedite corrective action.

The LFSPHE stated that he "sat on" the SPA's because the field design work was essentially complete at the time he received them, and that the SPA's are used for design guidance (Ref: FP-P-11, Rev. 6, Sect. 6.2.5).

In discussions with the LFSPHE, he stated that the SP and SPA Details were seldom incorporated as-is in the field, since as construction progressed and the plant became more comples, standard details became difficult to apply in the plant. Therefore, unique hanger drawings ere developed for each hanger in the plant. The small pipe hanger group generated the unique drawing, the field installed the hanger on a "risk" basis, and it wasn't until Project Engineering accepted the installed as-built hanger that the "risk" was removed. These steps are described in FP-P-11, Rev. 6 and M-213 Rev. 11.

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 2

DATE: 8/12/82

OBSERVATION	☐	#:	
POTENTIAL FINDING	☒	#:	
FINDING	☐	#:	
SAFETY IMPACT	☐	YES	
	☒	NO	Resolution of "potential fn[...] could change.
	☐	INDETERMINATE	

DESCRIPTION:

Bechtel specification 8856-M-213, Rev. 11, appendix F contains Project Engineering definition of the attributes of pipe hangers requiring QC inspection and provides the acceptance criteria. Appendix F fails to include friction hanger clamp ear gaps as an attribute to be inspected to assure adequate gripping of the pipe by the clamp. This attribute is not identified in any other documents used by QC for inspection. Consequently, numerous "detail 600" clamps (friction type) have been installed without QC inspection of the clamp ear gaps (Ref. Bechtel FCR-4066, PL-NCR 82-728). The Bechtel FCR does not request a change to Appendix F of M-213.

SIGNATURES:

INVESTIGATION TEAM MEMBER: W.A. Sullivan 8/13/82

INVESTIGATION TEAM LEADER: W.A. Sullivan 8/13/82

INVESTIGATION MANAGER: R J Shalin 8/13/82

I concur that this item is a Finding

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 2

DATE: 8/13/82

OBSERVATION	[X]	#:	
POTENTIAL FINDING	[ ]	#:	
FINDING	[ ]	#:	
SAFETY IMPACT	[ ]	YES	
	[X]	NO	
	[ ]	INDETERMINATE	

DESCRIPTION:

Hanger drawing SP-HBC-78-H53; Revision 1, Field Revision 3, indicates the location of Hanger, Number H65. (For reference only). But the drawing erroneously indicates the hanger number as H69. The proper hanger is installed in the field. Considering the number of revisions, reviews, and inspections, this error should have been corrected.

SIGNATURES:

INVESTIGATION TEAM MEMBER: [signature] Sattar

INVESTIGATION TEAM LEADER: W. H. Gulliver 8/13/82

INVESTIGATION MANAGER: [signature] 8/13/82

I concur that this item is an Observation

SUSQUEHANNA STEAM ELECTRIC STATION
SMALL PIPE - SYSTEM PROBLEMS
INVESTIGATION ITEM

TEAM #: 2

DATE: 8/13/82

OBSERVATION ☐ #:

POTENTIAL FINDING ☐ #:

FINDING ☒ #:

SAFETY IMPACT ☒ YES

☐ NO

☐ INDETERMINATE

DESCRIPTION:

Specification 8856-M-213, "Technical Specification for Installation, Inspection, and Documentation of pipe supports, hangers and restraints" does not provide criteria with regard to installation and inspection for all vendor fabricated components such as "Detail 600" and sway struts.

Examples:

1. There is no inspection criteria regarding the gap requirements on installed "Detail 600" Some of these were found to have no gap as documented in NCR No. 82-728 (PP&L's)

SIGNATURES:

INVESTIGATION TEAM MEMBER: ~~WA~~ J. Sattar

INVESTIGATION TEAM LEADER: W. H. Gulliver/with reservations regarding the generic conclusion drawn from the specific examples noted.

INVESTIGATION MANAGER: RJ Shorlin 8/13/82

I concur that this item is a Finding based on the generic implications of not utilizing vendor information for inspections (not spelled out as a requirement in a QCIR), not the two examples cited. RJS

2. There is no criteria for installation and inspection of sway struts. These struts are a complete vendor supplied assembly with jam nut(s). The vendor has specific requirements covering how to install the sway struts and how to tighten the jam nut(s). Yet many struts are found that have their nut(s) not tightened properly as is documented in PP&L NCR 82-794.

ATTACHMENT B

DOCUMENTS REVIEWED BY THE INVESTIGATION TEAMS

1. "As-built" Fabrication Isometric #SP-HBC-78-8 and associated "as-built" Hanger Detail Drawings - Diesel Generator Over-Flow Lines.

2. "As-built" Fabrication Isometrics #SP-HCB-109-1 and #SP-HCB-109-2 and their associated "as-built" Hanger Detail Drawings - Wetwell Atmosphere Sample Supply Lines.

3. "As-built" Fabrication Isometrics #SP-HCB-133-1, #SP-HCB-133-2, and #SP-HCB-133-3 and associated "as-built" Hanger Detail Drawings - Suppression Pool Water Level Instrumentation Lines.

4. "As-built" Fabrication Isometrics #SP-HBD-1538-1 and associated "as-built" Hanger Detail Drawings - Instrumentation Drain from 1" HCB-133-1 to Floor Drain.

5. "As-built" Fabrication Isometric #SP-GBB-102-2 (no hanger) - Drain Line from Core Spray Pumps Suppression Pool Instrumentation Line Stress Isometric, SK-M-5499.

6. Diesel Generator Over-Flow Line Stress Isometric, SK-M-5418.

7. Wetwell Atmosphere Sample Supply Line Stress Isometric, SK-M-5268.

9. Drain Line from Core Spray Pumps Stress Isometric, SK-M-5158.

10. Calculation #5418, Diesel Generator Over-Flow Lines and associated "as-built" reconciliation calculations (ABS #5418 and ABH #5418).

11. Calculation #5268, Wetwell Atmosphere Sample Supply and associated "as-built" reconciliation calculations (ABS #5268 and ASH #5268).

12. Calculation #5499, Suppression Pool Water Level, and associated "as-built" reconciliation calculations (ABS #5499 and ABH #5499).

13. The SP/SPA Drawing Book.

14. Stress and Thermal Walkdown Records for "as-built" Fab. Iso. #'s SP-HBC-78-8, SP-HCB-133-1, SP-HCB-133-2, SP-HCB-133-3, SP-HBD-1538-1, SP-HCB-109-1, and SP-HCB-109-2.

15. <u>Quality Control Documentation Sampled</u>

- QCI P-1:00 — Verification of ASME III Documentation and N-Type Code Symbol Stamping

QCI P-1.10	Piping Subassembly Fabrication, Installation and Rework
QCI C-1.10	Installation of Grouting and Drypacking
QCI C-1.50	Installation and Testing of Expansion Anchors
QCI P-2.00	Pipe Hanger, Support, Restraint and Shock Suppressor Installation - Final Review
QCI P-2.10	Pipe Hanger, Support, Restraint and Shock Suppressor Installation
QCI T-1.00	Hydrostatic, Pneumatic and Preoperational In-Service Leak Testing

IRs were reviewed and associated with the above QCIs as applicable for the Diesel Fuel Oil Transfer Pipes as defined on Field Fabrication Isometric and for all (14) the hangers associated with that Isometric (SP-HBC-78-8).

WR-5A forms were reviewed for each weld on the piping system (Iso SP-HBC-78-8) for 2 Inch and Less Socket Welds.

WG:lec
GA-7