COMANCHE PEAK RESPONSE TEAM RESULTS REPORT

ISAP: VII.b.3

Title: Pipe Support Inspections

**REVISION** 1

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Rev Dew Team

John CPRT-SRT Beck, Chairman

12/18/87 Date

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#### **RESULTS REPORT**

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# Pipe Support Inspections

 DESCRIPTION OF ISSUE IDENTIFIED BY NRC (NUREG 0797, Supplement No. 11, Page 0-282)

"The TRT conducted a series of inspections encompassing as-built safety-related pipe support... installations. These inspections were of completed systems or components that had been previously inspected and accepted by TUEC QC as meeting the respective construction and installation requirements."

#### Pipe Support Inspections

The TRT inspected 42 pipe supports in Unit 1, 37 of which were randomly selected while five originated from an alleger's list. Forty-six deviation: were identified in the supports inspected. Tables 1 and 2 summarize the results of this TRT inspection effort.

The TRT also inspected 9% pipe supports in Room 77N of the Safeguards Building, Unit 1. Table 3 summarizes the results of this TRT inspection effort.

- Deficiencies With High Rate of Occurrence

The TRT identified six specific deviation types which need further evaluation to assess their generic implications. The six deviation types are listed in Table 3. The TRT concern is that these deviation types may have a high rate of occurrence throughout plant safety-related systems.

#### 2.0 ACTION IDENTIFIED BY NRC

(NUREG D797, Supplement No. 11, Pages 0-277 and 0-278)

- "Evaluate the fRT findings and consider the implications of these findings on construction quality.....examination of the potential safety implications . . . should include, but not be limited to the areas or activities selected by the TRT."
- "Address the root cause of each finding and its generic implications..."

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#### RESULTS REPORT

#### ISAP VII.b.3 (Cont'd)

# 2.0 ACTION IDENTIFIED BY NRC (Cont'd)

- "Address the collective significance of these deficiencies ..."
- "Propose an action plan... that will ensure that such problems do not occur in the future."

#### 3.0 BACKGROUND

As described in Section 1.0, the NRC TRT inspected two samples of pipe supports in Unit 1 and Common areas. Although a substantial number (134) of the various types of pipe supports were included in the two NRC TRT samples, these samples were not necessarily selected using a statistically random selection method and, therefore, the supports in the samples are not necessarily representative of the total population of supports contained in Unit 1, Unit 2, and Common areas.

The original intent of ISAP VII.b.3 was to investigate the specific NRC TRT concerns by reinspecting the supports that had been inspected by the TRT to verify the validity of their findings. Bused on the results of this validation, additional supports would have been inspected is necessary to reach a final conclusion regarding the adequacy of construction of pipe supports at CPSES.

Subsequently, a decision was made to conduct a separate and broader investigation of the adequacy of construction of CPSES in accordance with ISAP VII.c, "Construction Reinspection/ Documentation Review Plan." Included within the scope of ISAP VII.c was a statistically based reinspection of pipe supports selected from Units 1, 2, and Common areas. As a result, the scope of ISAP VII.b.3 was changed to cover only the validation of the NRC TRT findings. The results of the reinspections conducted by ISAP VII.c and ISAP VII.b.3 will be combined during the collective evaluation phase of the Quality of Construction Program.

The issue of "Hilti Kwik" bolt embedment length raised by the NRC TRT (Item No. 5 in Table 3) is not addressed in this ISAP, but is addressed in ISAP VII.b.4, "Hilti Anchor Bolt Installation", and in the Cable Tray Design Adequacy Verification Program.

As stated above, the NRC TRT samples are not necessarily statistically representative of the entire population of pipe supports contained in Units 1, 2, and Common. Where construction deficiencies were identified, recommendations for additional evaluations and corrective action were based on root cause/generic

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#### **RESULTS REPORT**

#### ISAP VII.b.3 (Cont'd)

#### 3.0 BACKGROUND (Cont'd)

implication analysis results rather than sample expansion criteria. The non-safety-significant construction deviations identified during the ISAP VII.b.3 reinspections were evaluated on a limited basis for adverse trends by comparing them for commonality and reviewing them for an indication that an undetected deficiency could occur elsewhere in the CPSES supports. This analysis, coupled with the VII.c investigation for pipe supports, will allow conclusions to be drawn for the entire pipe support population. Where the individual or common deviations did not appear to indicate the likelihood of an undetected deficiency occurring elsewhere, the Results Report states that there was no indication of ar adverse trend. In certain instances QA/QC Program Deviation Reports (PDRs) were written to cover identified concerns relative to the implementation of QA program requirements.

#### 4.0 CPST ACTION PLAN

#### 4.1 Scope and Methodology

The objective of this action plan was to investigate the TRT findings pertaining to pipe supports (except as described in Section 3.0 above), to determine their validity and to assess their effect on the quality of construction.

The following tasks have been completed under this ISAP in order to accomplish the stated objective:

- Reinspected the TRT sample to investigate the extent to which the TRT identified deviations were valid.
- Evaluated deviations for safety significance and performed trend analyses.
- Determined the root cause, generic implications and programmatic concerns for construction deficiencies and adverse trends.
- 4.1.1 Verification of the TRT-Identified Deviations

The procedures and reference codes covering the pipe supports inspected by the TRT were reviewed, and reinspection checklists of TRT identified deviations were developed. Reinspection packages, including



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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

4.0 CPRT ACTION PLAN (Cont'd)

checklists, instructions and all documents and drawings necessary to perform and document the required reinspections were prepared.

Reinspection of hardware inspected by the TRT was performed. The reinspection results were compared to the TRT findings.

# 4.2 Participant's Roles and Responsibilities

The organizations and personnel that participated in this effort are described below with their respective scopes of work.

4.2.1 TUGCO - CPSES Froject

4.2.1.1 Scope

- Assisted in the identification and provision of all necessary specifications, drawings, procedures and other documentation necessary for the execution of this action plan.
- Assisted in establishing a list of all items in each pipe support population.
- Processed NCRs that were generated due to this action plan.

4.2.1.2 Personnel

Mr.	D.	Snow	TUGCO Q	A/QC	

Mr. J. Finneran TUGCO Engineering

4.2.2 CPRT QA/QC Review Team

4.2.2.1 Scope

All activities specific to this action plan that are not identified above are the responsibility of the QA/QC Review Team.

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

4.0 CPRT ACTION PLAN (Cont'd)

4.2.2.2 Personnel

Mr.	J.	L. Ha	ansel	Review Team Leader
Mr.	L.	F. Fe	endo	Issue Coordinator (Prior to 05/07/87)
Mr.	J.	Adam		Supervisor - SSEG (Prior

to 01/01/87)

4.2.2.3 Personnel

Mr.	J.	L. Hansel .	Review Team Leader
Mr.	J.	P. Tableriou	Issue Cooldinator (Effective 05/07/37)
Mr.	R.	Miller	Supervisor - SSEG (Effective 01/01/87)

#### 4.3 Qualifications of Personnel

Where tests or inspections required the use of certified inspectors, qualification was to the requirements of ANSI N45.2.6 at the appropriate level. Third-party inspectors were certified to the requirements of the third-party employer's Quality Assurance Program and specifically trained to the requirements of the quality procedures developed under this action plan.

Other participants were qualified to the requirements of the CPSES Quality Assurance Program or to the specific requirements of the CPRT Program Plan.

# 4.4 Procedures

This action plan was conducted in accordance with existing CPSES procedures and CPRT procedures as applicable to specific action plan activities. Inspection procedures developed for this action plan are as follows:

- QA/QC Review Team Quality Instruction QI-037:
   "Reinspection of Pipe Supports; TRT Issues Pipe Supports in Rm 77N, Safeguards Building, Unit 1."
- QA/QC Review Team Quality Instruction QI-058: "Reinspection of Pipe Supports; TRT Issues - 42 Pipe Supports."



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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

# 4.0 CPRT ACTION PLAN (Cont'd)

 QA/QC Review Team Quality Instruction QI-061: "Documentation Review of TRT Issues - 42 Fipe Supports."

#### 4.5 Acceptance Criteria

Acceptance criteria were based upon a review of the following:

- 4.5.1 Site construction procedures and QC inspection procedures acceptance criteria for pipe support installations.
- 4.5.2 A detailed review of specifications, drawings, referenced codes and standards in order to identify and verify minimum acceptance criteria necessary to evaluate the TRT findings.

QA/QC Review Team Quality Instructions identified in Section 4.4 and inspection checklists contained in these Quality Instructions were developed based on the results of this review. These Quality Instructions contain the minimum acceptance criteria necessary to validate the TRT findings.

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS

5.1 Summary of Action Plan Implementation

The January 8, 1985, letter from the NRC to TUGCO and SSER 11 were reviewed to identify the specific pipe supports inspected by the TRT. These supports are categorized into two populations:

- (1) TRT Issues Pipe Support in Room 77N, Safeguards Building, Unit 1 (PS7N), and
  - (2) TRT Issues 42 Pipe Supports (PS42).

The supports in each of these populations were reinspected by the CPRT to confirm the existence of the hardware deviations identified by the TRT.

More extensive inspections of pipe supports were performed under ISAP VII.c. These supports are included in the the following three VII.c populations:

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#### **RESULTS REPORT**

#### ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

- (1) Large Bore Pipe Supports-Rigid
- (2) Large Bore Pipe Supports-Non-Rigid
- (3) Small Bore Pipe Supports

The extent to which each pipe support was inspected (for PS7N and PS42 supports) was not limited to those specific characteristics against which deviations were found by the TRT on that support. Instead, each support in the PS42 population was inspected for all applicable characteristics for which deviations were found by the TRT in the PS42 population. Similarly, each support in the PS7N population was inspected for all applicable characteristics for which deviations were found by the TRT in the PS7N population was inspected for all applicable characteristics for which deviations were found by the TRT in the PS7N population.

The NRC did not identify which Code Class 1, 2 and 3 supports were inspected in Room 77N of the Safeguards Building; therefore, all Code Class 1, 2 and 3 pipe supports in Room 77N with attributes corresponding to those support characteristics identified by the TRT for the PS7N population were included on the PS7N population items list. As a result, the CPRT inspected 178 supports in Room 77N compared to the 92 supports inspected by the TRT in Room 77N.

### 5.2 Evaluation and Categorization of Inspection Findings

- 5.2.1 Comparison of CPRT Inspection Results With TRT Inspection Results
  - The TRT inspected 42 supports selected from Unit 1 and Common areas. The deviations found by the TRT for these supports are listed in Table 2. A comparison of the CPRT inspection results with the TRT inspection results was made for the purpose of verifying the TRT findings. The results of these comparisons are shown in Table 4. Based on this comparison it was concluded that the TRT inspection results are substantiated by the CPRT inspection results.

The TRT also inspected 92 snubber and strut type supports in room 77N. The deviations found by the TRT for these supports are listed in Table 3. A comparison of the CPRT inspection results with the TRT inspection results was made for the purpose of verifying the TRT findings. The results of these comparisons are shown

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

in Table 5. Based on this comparison it was concluded that the TRT inspection results are substantiated by the CPRT inspection results for those items reinspected.

5.2.2 Description of Deviations

Tables 6 and 7 list the total number of CPRT deviation reports, construction deficiencies, and trends for each characteristic. Unclassified deviations are included in the total number of CPRT deviation reports listed in these tables. Unclassified deviations were not evaluated for safety significance as previously identified construction deficiencies, adverse trends or unclassified trends resulted in corrective action recommendations that encompass these deviations. The characteristics (column 1) are those identified by the TRT that are applicable to each population. The tables also list the total number of supports that ware reinspected for each characteristic.

Six construction deficiencies were identified as follows:

- No locking device for threaded fasteners
- Pipe clearances with support out-of-tolerance
  - Pipe clamp locknut loose
- Strut misalignment
- Load pin locking device (cotter pin) missing
- Broken and missing lockwire on snubber adapter plate bolting

One unclassified deviation that is the same type of deviation as has been identified in the ISAP VII.c pipe support populations as a construction deficiency is identified as follows:

Loose jam nut on barrel of strut

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

A construction deficiency for pipe clamp halves not parallel was identified in Revision 0 of this report. A subsequent reanalysis of the deviation by the SSEG determined that the deviation was not safetysignificant; therefore, it has been deleted from the list of construction deficiencies in this report.

# 5.3. Analysis of CPRT Findings for PS42 Pipe Supports (See Table 7)

5.3.1 No Locking Devices For Threaded Fasteners

There are a total of 56 threaded fasteners (studs and bolts with nuts securing them in place) on 19 supports. Forty-three fasteners on 17 supports have a deviation reported for no locking devices. Locking devices are an ASME Code requirement. ASME Code-approved locking devices are locknuts, upset threads, jam nuts and drilled and wired nuts.

The absence of locking devices increases the possibility for bolts and stude to work loose under operating conditions. Loose or missing bolts and stude could result in the loss of the pipe support capability to transfer loads by causing a load-carrying component to become disengaged from the support assembly. Therefore, these deviations were determined to be construction deficiencies. These deficiencies were consolidated into one generic construction deficiency for the identified deviations.

See Section 5.5.2 for root cause and generic implications analyses.

5.3.2 Minimum Edge Distance On Baseplate Violated

There are a total of 47 baseplates on 35 supports. Two baseplates on two supports have a deviation reported for violation of minimum edge distance (distance from center of bolt hole to edge of baseplates). Minimum edge distances are required to prevent the bolts from overstressing the baseplate between the bolt hole and the plate edge.

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#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

One baseplate had one bolt (1-inch diameter) with an edge distance of 1-3/8 inches. The design drawing specified 1-1/2 inches. The other baseplate had two bolts (3/4-inch diameter) with edge distances of 1-1/16 inches. The design drawing specified 1-1/8 inches. The minimum edge distances required by the ASME Code are 1-1/4 inches for 1-inch diameter bolts and 1-inch for 3/4-inch diameter bolts. It was concluded that the baseplates meet ASME Code requirements and the baseplates and bolts could perform their intended function. These deviations were evaluated to be not safety-significant. Review of the deviations did not indicate that an adverse trend existed.

5.3.3 Baseplate Hole Location Dimension Out of Tolerance

There are a total of 47 baseplates on 35 supports. Ten baseplates on nine supports have a deviation reported for baseplate bolt holes being out of location from those specified on the design drawings. Changes in bolt hole locations result in changes in baseplate stresses and bolt loadings.

The support member (e.g., tube steel) attachment locations on the baseplate are specified on the design drawings. The anchor bolt hole locations on the baseplates are specified on the design drawings relative to the centerline of the attaching support member. The tolerance on the drawing location dimensions is  $\pm 1/4$  inch.

Brown & Root construction procedure CP-CPM-9.10 allows alternate bolt hole patterns to be drilled in baseplates when the holes cannot be located as specified on the design drawing. This is done by construction craft personnel to avoid interferences with rebar. Upon completion of an alternate hole pattern, a Component Modification Card (CMC) is required to be initiated by construction if the alternate hole pattern is outside the location tolerance of  $\pm 1/4$  inch. The CMC is reviewed by engineering and, if approved, becomes an engineeringauthorized design change.

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# RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

The following paragraphs describe the specific baseplate hole deviations reported by the CPRT.

Four supports had baseplate bolt holes reported out of drawing location by less than 1 inch. Resulting baseplate stresses ranged from 10 percent to 74 percent of allowables and bolt loads ranged from 23 percent to 84 percent of allowables in the deviating condition.

Five supports had baseplate bolt holes reported out of drawing location by 1 inch or more. One of these supports had a hole out of location by 2-5/16 inches. Baseplate stresses ranged from 16 percent to 76 percent of allowables and bolt loads ranged from 19 percent to 72 percent of allowables in the deviating condition.

In addition to the nine supports with deviations identified by the CPRT, the TRT identified baseplate holes out of location on two PS47 supports. The following paragraphs describe the TRT findings and the CPRT findings for these two supports.

Two bottom bolt heles on one baseplate for support CC-1-126-010-F33R were reported by the TRT to be 3 inches closer to the centerline of the attaching frame member than was specified on the design drawing. The support had been final QC-inspected and accepted prior to the TRT inspection. The TRT inspected the support to Revision 2 of the design drawing. The design drawing was revised after the TRT inspections (Revision CP-1 issued June 26, 1985) to show field conditions by lowering the attaching frame member by approximately 3-1/4 inches relative to the baseplate. CPRT Inspections were performed to Revision CP-1; therefore, a deviation was not reported by the CPRT. Analysis of the baseplate and bolts for the field configuration shows that bolt loads and plate stresses are within allowable loads and within ASME allowable stresses. Bolt loads decreased by 7% and baseplate stress increased by 4.5% as a result of shifting the frame member down by approximately 3-1/4 inches on this particular support.

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

Bolt holes on one baseplate for support CC-X-039-007-F43R were reported by the TRT to be out of location from the location specified on the design drawing. Bolt holes were out of location by approximately 1 inch. This support also had been final QC-inspected and accepted prior to the TRT inspections. The TRT inspected the support to Revision 4 of the design drawing. The CPRT inspected the same support to Revision CP-1, which was issued after the TRT inspections to show the bolt holes as located in the field. Therefore, a deviation report was not generated by the CPRT. Eleven supports out of 35 supports with baseplates had baseplate bolt holes out of design location when supports CC-1-126-010-F33R and CC-X-039-007-F43R are included in the total.

Out of 11 supports with bolt holes out of location, CMCs had been prepared (prior to TRT) for eight of the supports (including CC-1-i26-010-F33R and CC-X-039-007-F43R) showing alternate bolt hole locations on the baseplates. These alternate bolt hole locations shown on the CMCs were not correct. The erroneous bolt hole locations shown on the CMCs were incorporated into the eight design drawings. CMCs were not prepared for the remaining three supports as required by procedures; therefore, the design drawings for these supports also have erroneous hole locations.

To summarize, incorrect CMCs were prepared and subsequently incorporated into the design drawings in eight of 11 cases. Brown & Root QC inspection did not detect the erroneous dimensions on the CMCs or on the design drawings. In three cases, CMCs were not prepared as required. Altogether 11 erroneous design drawings were issued as final as-built designs. It was determined that these supports could perform their intended function. None of the deviations was safety-significant.

A QA/QC Program Deviation Report (PDR 075) has been prepared to address the erroneous design drawings. See Section 5.6.6 for further discussion of this problem.

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#### **RESULTS REPORT**

#### ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

5.3.4 Spherical Bearing/Washer Gap Excessive

There are approximately 52 spherical bearings on 22 supports. Six bearings on five of these supports have a deviation reported for excessive gap between the spherical bearings and the bearing washers; one bearing on a support different from the above five was reported to be partially dislodged.

Spherical bearings are staked into the snubbers and struts. These bearings transfer loads between support members. NRC I&E Circular 81-05, "Self-Aligning Rod End Bushings For Pipe Supports", identified a problem with staked bearings becoming dislodged from snubbers and struts. Total bearing dislodgement would render the supports inoperable. Washers were provided by the support vendors to center the bearing in the gap between the cars of the bracket or pipe clamp and to prevent the bearings from becoming totally dislodged if the staking becomes ineffective.

A small gap between the bracket/clamp ears is, by itself, sufficient to prevent total bearing dislodgement. However, some designs do not have gaps small enough to prevent total dislodgement; therefore, bearing washers were provided to center the bearings in the gap between the bracket/clamp ears. Centering the bearing permits a larger gap to be used while still preventing total bearing dislodgement for some designs. The remaining gap or clearance between bearing and washers, after the bearing washers are installed, is required to be less than the thickness of one vendor-supplied washer.

One bearing had a 5/8 inch gap; the other five bearings had gaps of 3/16 inch or less. The bearing with the 5/8 inch gap had two 1/8 inch thick washers installed, one on each side of the bearing within a rear bracket. These washers are thinner than required and resulted in the excessive gap. One bearing within a pipe clamp has a 3/16 inch gap reported and no spherical bearing washers were installed. Two washers 3/32 inch thick should have been installed. The absence of washers resulted in the excessive gap. The four remaining bearings had gaps of 3/16 inch or less. All of these had spherical bearing washers installed. It was

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

determined that the bearings on all five of these supports were not dislodged and they could perform their intended function. All of these deviations were evaluated to be not safety significant.

One support that did not have excessive spherical bearing gaps did have a bearing dislodged by 1/16 inch (not totally dislodged). It was determined that this support could perform its intended function and that the deviation was not safety significant.

It should be noted that correct installation of the vendor specified washers is not sufficient to prevent partial dislodgement of the spherical bearings. Missing washers or excessively thin washers only increase the amount of possible dislodgement and could lead to total dislodgement for some designs. A QA/QC Program Deviation Report (PDR 076) has been prepared to document these conditions. See Sections 5.4.1 and 5.6.5 for further discussion of this problem.

#### 5.3.5 Spherical Bearing Contamination

There are approximately 52 spherical bearings on 22 supports. Thirty-two bearings on 15 of these supports have a deviation reported for paint deposits on spherical bearing surfaces. The spherical bearings transfer pipe support loadings from snubbers and struts to other pipe support components while allowing pipe movements in unrestrained directions.

It was determined that the paint did not reduce the load carrying capability or limit the movement of the spherical bearings. All of the deviations were evaluated to be not safety-significant, and a review of the deviations did not indicate that an adverse trend existed. Corrective action has been initiated by TUGCO to inspect the spherical bearings for freedom to gimbal via the Hardware Validation Program. This is a pipe support reinspection program initiated by TUGCO which, together with other corrective action programs, covers most safety-significant pipe support hardware attributes.

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# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

# 5.3.6 Snubber Adapter Plate Bolting - Insufficient Thread Engagement

Extension kits and brackets are connected to snubbers by bolting them to snubber adapter plates. Brown & Root construction and inspection procedures specify minimum thread engagement lengths of bolts in snubber adapter plates. These minimum bolt engagement lengths are less than the thickness of the snubber adapter plates.

The TRT concerns were that minimum bolt engagement lengths should be equal to the snubber adapter plate thickness and that the minimum bolt engagement allowed by the Brown & Root rescedures is inadequate. CPRT inspection results reported bolts with thread engagement less than the thickness of the plate; however, no deviations from the minimum engagement lengths used by Brown & Root were reported. Design concerns relative to snubber adapter plate bolting have been transmitted to the Project on QA/QC-RT-10046. The adequacy of this condition will be evaluated by the Project.

#### 5.3.7 Insufficient Thread Engagement, Threaded Rod

There are approximately 30 threaded rods in the coupling or strut on 18 supports. One threaded rod 1/2 inch in diameter on one spring type support has a deviation reported for the threaded rod not being visible through the coupling sight hole. Sufficient thread engagement is assured when the threaded rod is visible through the sight hole.

It was determined that 5/8-inch of thread engagement existed on the support, allowing development of full rod strength, and that the support could perform its intended function. This deviation was evaluated to be not safety-significant.

Another deviation was reported for a strut type support that did not have a sight hole through which threaded rod engagement could be verified. This condition was evaluated, and it was found that a star stamp was present on one end of the strut body. The star stamp indicates that the threads at the end of the rod engaged in the strut body had been upset (spoiled) to prevent the rod from becoming disengaged (unscrewed)



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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

and to assure proper thread engagement. Dimensional checks were made for the other end, which determined that sufficient thread engagement existed. It was determined that the support can still perform its intended function.

Both deviations were evaluated to be not safety-significant, and a review of the deviations did not indicate that an adverse trend existed.

5.3.8 Snubber/Strut Load Pin Locking Device Broken Or Missing

There are a total of 64 load pins on 24 supports. Two load pins on two of these supports have a deviation reported for broken or missing cotter pins or snap rings. The cotter pins and snap rings hold load pins in place. The load pins hold components of the pipe support assembly together. A support will lose its load carrying ability if the load pin is not present or not properly engaged in the support assembly.

One load pin had a broken cotter pin and one load pin had a missing snap ring. A construction deficiency exists for a missing cotter key on # PS7N support. The corrective action that has been recommended as a result of the construction deficiency extends to these supports. Therefore, no trend evaluation was performed for these deviations. See Section 5.4.2 for a description of the construction deficiency, for analysis of additional similar deviations, and for conclusions.

5.3.9 Load Side of Pipe Clamp Halves Not Parallel

There are a total of 21 pipe clamps on 18 supports. Seven pipe clamps on seven of these supports have deviations reported for load side of pipe clamp (ears) not parallel.

Clamps that are out of parallel by excessive amounts could result in the load pin being overstressed, increase the gaps between the spherical bearings and washers, or cause interference between clamps and support eyerods.



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# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

Three clamps had ears that were spread apart 3/16 inch or less, resulting in increases in load pin stress. None of these clamps had excessive spherical bearing gaps. The load pin stresses were within ASME Code allowable stress. It was determined that these clamps could perform their intended function.

One clamp had ears that were spread apart 5/16 inch, causing an increase in load pin stress. In its deviating condition, the stress in the load pin is approximately 23% of the allowable. It was determined that this clamp could perform its intended function.

Three clamps had ears that were inclined closer together by 3/16 inch or less. The load pin stresses were not increased by this condition. It was determined that this clamp did not interfere with the support eyerod and it could perform its intended function.

None of these deviations was evaluated to be safety-significant. See Section 5.4.3 for analysis of additional similar deviations and for conclusions.

# 5.3.10 Pipe Clearance With Support Out of Tolerance

A total of 22 supports have clearances specified between pipe and support. Eight of these supports have a deviation for pipe clearances out of tolerance. The specified clearances between pipe and support allow the support to restrain the pipe in the desired direction while permitting pipe movement relative to the support in unrestrained directions. Deviations from the specified clearance could impair the function of the support or piping system.

One box frame support for a 12 inch pipe has 0.012 inch total clearance top to bottom between pipe and support, 0.032 inch total clearance side to side. Minimum required clearance top to bottom is 0.032 inch. Minimum required clearance side to side is 0.062 inch. One box frame support for a 12 inch pipe has 0.027 inch total clearance top to bottom between pipe and support. Minimum required clearance top to bottom

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# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

is 0.032 inch. It was determined that the diametrical expansion of these pipes will not reduce the clearance to zero inches and the supports can perform their intended function.

One box frame support for a 12 inch pipe has more than 3/16 inch total clearance side to side between pipe and support. Maximum permitted clearance is 3/16 inch. It was determined that the clearance on one side of the pipe is 0 inches and is 3/16 inch to 1/4 inch on the other side of the pipe. The clearance varies from 1/4 inch to approximately 3/16 inch across the width of the box frame structural member. It was determined that the support could perform its intended function.

One box frame support for a 12 inch pipe has no clearance top to bottom. Minimum required clearance top to bottom is 0.032 inch. One box frame support for a o inch pipe has 0.025 inch clearan's between pipe and support at top and 0.025 inch clearance at bottom. No clearance is permitted between the bottom of the pipe and the support (in the gravity direction). Ong box frame support for a 10 inch pipe has 0.015 inch clearance between pipe and support at top and 0.015 inch clearance at the bottom. Another box frame type support for a 1-1/2 inch pipe has 0 inch clearance between pipe and support at top and 1/16 inch clearance at bottom. No clearance is permitted between the bottom of the pipe and the support (in the gravity direction). It was determined that one of these supports could perform its intended function. Safety significance evaluations were not performed on the deviations on the other three supports because these deviations were already addressed by an existing corrective action program.\* Therefore, these deviations were left as unclassified deviations.

One deviation is for no clearance between a pipe (specifically a circumferential butt weld) and a steel plate on a U-bolt type support, which bound the pipe in the support. It was determined that the bound pipe

This corrective action program is the Project's Hardware Validation Program (HVP) in which all safety-related pipe supports will be reinspected for a large number of attributes.

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#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

would cause an equipment nozzle to become overloaded and resulted in a construction deficiency. Therefore, no trend evaluation was performed for these deviations.

See Section 5.5.3 for root cause and generic implications analyses for this construction deficiency.

5.3.11 Pipe Clamp Locknut Loose

There are a total of 12 pipe clamp bolts with nuts and locknuts installed on four supports. They are all ITT-Grinnell supports, which are supplied with locknuts. One of these supports has a deviation reported for a loose locknut on a pipe clamp bolt. The locknut prevents the nut from turning relative to the bolt that holds the two halves of the pipe clamp together.

The loose locknut increases the probability that the pipe clamp bolt will work loose. A generic construction deficiency has already been identified for missing locking devices (see Section 5.3.1). Because this deviation was judged to have the same effect on support functionality as the deviations that comprised the generic construction deficiency, it was included in the same safety-significance evaluation as the deviations for missing locking devices and was determined to be a construction deficiency. See Section 5.5.4 for root cause and generic implication analyses for this construction deficiency.

# 5.3.12 Snubber/Sway Strut Misalignment

There are a total of 26 snubbers and struts on 22 supports. Two struts on two of these supports have a deviation reported for strut misalignment. The snubbers and struts transfer loadings from the pipe to the building.

Two struts were reported out of alignment with the associated pipe clamps/brackets. One of these deviations was reported for a strut that was not within location tolerances, causing the angle between strut and pipe clamp to change. This resulted in changed support loadings; however, it was determined that this support could perform its intended function. The

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

second deviation was reported for a strut out of alignment with a pipe clamp by more than the allowable 5 degrees offset angle. This caused additional moment forces on the support components that resulted in a construction deficiency. Therefore, no trend evaluation was performed for these deviations.

See Section 5.5.5 for root cause and generic implications analyses.

# 5.3.13 Snubber Cold Set Dimension Does Not Match Drawing

The length of the snubber is the initial distance from the load pin center line to the back of the snubber (e.g., length of installed snubber) when the pipe is in the cold condition prior to system preoperational tests. The snubber length is specified to prevent the snubbers from "bottoming" during expected pipe movements.

Snubbers are designed to extend and retract, allowing the pipes to expand thermally and to move under steady forces, such as deadweight loads. The piping systems move at snubber locations during system tests due to thermal expansion and deadweight loads, and do not necessarily return to their initial positions when they cool down or when the system fluid is removed. In order to assure the snubbers do not "bottom", TUGCO test procedures require the snubber lengths to be measured and recorded during system preoperational tests. Snubbers that have measured lengths that could cause bottoming are identified during testing and referred to engineering for further action. The measured lengths of the remaining snubbers are accepted, even if they differ from the initial design drawings,

There are 13 snubbers in the PS42 support population. The snubber lengths on seven snubbers were recorded as being out-of-tolerance from the dimensions shown on the design drawings by the CPRT. (Deviation reports were not required by the QI for these dimensions. Recording of the dimensions was required only because snubber length, though not recreatable after testing, was a TRT concern.)

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#### **RESULTS REPORT**

#### ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

The lengths on five snubbers are within ± 1/8 inch of the accepted lengths during testing; therefore, these dimensions meet construction requirements and do not have an adverse effect on the operability of the snubber.

One support, which was removed (eliminated) after CPRT inspection, was out of tolerance by 1/16 inch. This would not have had an adverse effect on the operability of the snubber.

The remaining support differed from the test dimension by 1/4 inch. It was determined that there is no adverse effect on the operability of this snubber.

No safety-significant findings were identified and review of the findings did not indicate that an adverse trend existed.

# 5.3.14 Snubber Orientation Does Not Match Drawing

The snubber orientation (end to end) is specified on the pipe support design drawings. Brown & Root construction and inspection procedures permit the snubber assemblies to be installed 180° end to end from the orientation shown on the drawing.

This characteristic was observed, and the results recorded, because the issue was raised by the TRT. Deviation reports were not required to be initiated because reverse orientation of the snubbers is permitted by Brown & Root procedures and does not prevent the snubber from performing its intended function. Snubbers transfer loadings between the pipe and building in their axial direction only. Reversal of the snubbers (end to end) does not effect the loadcarrying ability or the function of the snubber. The CPRT inspectors recorded three snubbers reversed (end to end) from the orientation shown on the drawing. Based on the above information, it was determined that reversal of the snubbers has no safety significance.

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# RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

5.3.15 Component Type/Model Does Not Match Drawing

A total of 30 supports have Hilti bolts. Two of these supports have a deviation reported for Hilti bolts that do not match those specified on the drawing. These deviations are addressed in the Results Report for ISAP VII.b.4, "Hilti Anchor Bolt Installation."

No other deviations were reported for component type/model not matching drawing.

The TRT identified supports SI-1-090-006-C41K and RC-1-052-020-C41K as having snubber model numbers that do not match the model numbers on the design drawing bill of material. Support RC-1-052-020-C41K contains one snubber assembly that is specified in the bill of material by NPSI number SMA-IL-SO. Assemblies are composed of the snubber plus additional hardware. Inspections determined that the correct model snubber is installed. The model number marked on the snubber is PSA-IL, which was supplied to NPSI by Pacific Scientific for use in their SMA-IL-SO assembly.

Support SI-1-090-006-C41K contains two snubber assemblies that are specified in the bill of material by NPSI number SMA-3-BA. The installed snubbers are marked PSA-3. Inspections determined that the correct model snubbers are installed. The model number PSA-3 that was marked on the snubbers, which were supplied to NPSI by Pacific Scientific for use in their SMA-3-BA assembly, is a Pacific Scientific model number.

5.3.16 No Identification For Support Materials, Parts, and Components Identified

> A replacement part (sway strut eyerod) for support CT-1-013-014-S32R was identified by the TRT as not having material identification on the hardware or in the support documentation package traceable to the origin of the part. The material identification log (MIL) did not list any identification traceable to the origin of the replacement part. A similar problem was identified by the TRT for pipe supports CC-1-126-012-F33R, CC-X-039-005-F43R, and AF-1-035-011-S33R.

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

At the time of installation, it was acceptable by procedure for QC to sign off on the design drawing Bill of Materials for material acceptability. No material identification log was found for these supports, however, a QC-signed Bill of Material was located in each support package. All materials on the above supports and on support CC-1-126-013-F33R, which was also reviewed for material traceability, were traceable to a heat number, to a material identification code, or to a receiving and inspection report that gave acceptable heat numbers.

Material identification evaluations in this section were limited to the five supports identified by the TRT. No deviations were identified during these evaluations.

# 5.3.17 Weld Porosity Excessive

No deviations were reported for weld porosity.

#### 5.3.18 Weld Undercut Excessive

No deviations were reported for weld undercut.

# 5.3.19 Weld Length Undersized

No deviations were reported for weld length being undersized. However, in the course of evaluating the construction adequacy of welding in ISAF VII.c it was found that engineering had not issued complete instructions for certain types of tube steel welded connections. This condition was reported on a QA/QC Program Deviation Report (PDR-04). The adequacy of this condition is being evaluated in the pipe support stress reconciliation analysis.

5.3.20 Weld Leg Or Effective Throat Undersize

There are approximately 430 welded joints on 43 supports. Four welded joints on four supports have deviations reported for undersize weld leg (or effective throat). The strength of the weld is directly proportional to the weld effective throat size.

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# RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

One of these welds was reported as being undersize due to excessive grinding. This deviation is discussed in Section 5.3.24.

Three fillet welds were reported as being undersize by 1/32 inch to 1/16 inch for portions of their lengths. An evaluation determined that these welds could adequately carry the loadings, and weld strength was within ASME Code allowables. All deviations for undersize welds were evaluated to be not safety significant, and a review of the deviations did not indicate that an adverse trend existed.

5.3.21 Weld Called Out on Drawing Does Not Exist in Field

No deviations were reported for missing welds; however, the design drawing for support CC-1-126-013-F33R specified a 1/4-inch fillet weld connecting Item 5 to Item 6. This weld does not exist on the support. Component Modification Card (CMC) 87927, Revision 4, issued March 2, 1983, deleted this weld but this change was not incorporated into the design drawing.

5.3.22 Welds Added in Field are not Reflected on Drawing

Approximately 16 additional welds were identified on support AF-1-001-702-S33R. These welds were not specified on Revision 2 of the design drawing used during CPRT inspections.

Four additional welds were located in four inside corners of the support frame. The previous revision (Revision 1) of the design drawing specified welds in these locations. The four welds appear to be extra due to a drawing error and do not adversely affect the function of the support.

The remaining extra welds are on shim plates between pipe and frame. The design drawing specifies "field shim to suit" via a note on the design drawing. These shims and their associated welds are required to meet maximum allowable clearance requirements between pipe and frame.

These 16 additional welds were not identified as deviations. The QI required additional welds to be recorded only. No extra welds were reported on other supports.

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

5.3.23 Excessive Grinding Resulting In Minimum Thickness Violations (Weld Cleanup)

> There are 43 supports with approximately 430 welded joints. One of these supports has a deviation reported for excessive grinding of weld and plate. One fillet weld was reported with the effective throat reduced up to 1/16 inch below the specified size for approximately 25% of its length due to excessive grinding. Also, the adjacent plate thickness was reduced up to 3/32 inch below specified plate thickness of 1/4 inch in the vicinity of the reduced weld.

> It was determined that the weld stress at the undersized throat area and the plate shear stress at the reduced thickness area resulting from the maximum applied loads are 21 and 15 percent of allowable stress, respectively, in the deviatiog condition. Consequently, the weld can easily carry the design loads. The deviation was not safety-significant. No trend analysis was performed for this single deviation.

> It was determined that the bending stresses in the plate (remote from the defects due to grinding) exceeded the allowable stress by 80%. The plate is only 1/4 inch thick and appears to be undersized due to an incorrect design. Design Adequacy Request No. 170 was submitted to DAP for evaluation of the undersized plate. Evaluation of this condition resulted in DIR-2457 being issued to the Project identifying the problem.

5.3.24 Lack of QC Inspector Initials (for Acceptance) On Weld Data Card

> A total of five pipe supports were reviewed for the presence of QC inspector initials for inspection hold points on Multiple Weld Data Cards. One of these pipe supports has a deviation reported for lack of QC Inspector initials on a Multiple Weld Data Card (MWDC) for an inspection hold point. The inspection hold point was for additional welding required by CMC 87927, Revision 5 dated one day after the last inspection on the MWDC. No alternate documentation could be located to substantiate that the QC inspector was present to perform the requisite inspections at the holdpoint. However, a review of the MWDCs, the Weld Filler Material Log, and the CMCs provided assurance that the

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

additional welds on the support were properly performed and inspected. It was concluded that the CMC was prepared after the work was completed for the purpose of changing the design drawing. No trend analysis was performed for this single deviation. The deviation was not safety-significant.

5.3.25 Support ID Missing or Incorrect

All 43 supports are required to be marked with an identification number given on the design drawing. Three of these supports have a deviation reported for missing identification numbers and two have a deviation reported for illegible identification numbers. These five supports are plain steel frame type supports.

Zach support configuration and location was found to be in general agreement with the design drawing and hanger location drawing. Each of these supports also has a documentation package in the vault with inspection reports and drawings; confirming that these supports were QC-inspected and accepted.

These deviations had no effect on the load-carrying capacity of the support or on the ability of the support to perform its function and were evaluated to be not safety-significant. Therefore, no trend analysis was performed.

5.3.26 Configuration Does Not Match Drawing

Out of a total of 43 supports, seven deviations were reported on a total of six supports for configuration not matching the drawing.

One deviation was reported for a steel member welded to a baseplate that was rotated 6 degrees. An evaluation indicated that the allowable stresses were not exceeded and the support could perform its intended function.

One deviation was reported where three shims between pipe and steel frame were installed; two were specified on the drawing. An evaluation concluded that there was no change in the support stresses due to the added shim and the support could perform its intended function.

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#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

Two deviations were reported for a dimension (distance from building wall to centerline of pipe) being out-of-tolerance. This distance is shown on the pipe support design drawing and is used to determine pipe support component lengths to ensure the support will adequately span this distance when installed in the field. One deviation was for a strut support that deviated by 2-1/8 inches and one for a snubber support that deviated by 2 inches on 4 foot and 7 foot dimensions respectively. An evaluation concluded that the supports were well within their length adjustment range as installed and could perform their intended function.

One deviation was reported for a sheet metal plug installed inside a stanchion; the plug was not shown on the drawing. An evaluation concluded that the plug was deliberately installed to act as insulation protection for the pipe run and does not change the stress levels in the support. It was concluded that the support could still perform its intended function.

One deviation was reported for a larger beam installed than is specified on the drawing. An evaluation concluded that the larger beam did not result in an increase of the stress levels in the support and the support could still perform its intended function.

One deviation was reported for a baseplate being 1-inch thick. The drawing specified a 7/8-inch baseplate. An evaluation concluded that the stresses in the baseplate decreased and consequently there was no detrimental impact on the functional capability of the support. It was determined that the support can still perform its intended function.

All of these deviations were evaluated to be not safety-significant, and review of the deviations did not indicate that an adverse trend existed.

5.3.27 Loose Locknut (Jam Nut) on Barrel of Strut

There are a total of 17 locknuts on 13 struts contained in 11 supports. Struts are fixed-length load-carrying support members. One of these supports has a deviation reported for a loose locknut on the barrel of a strut.

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#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

One chreaded eyerod is screwed into each end of the strut barrel. The eyerods at the ends of the strut barrel have opposite-hand threads. The locknut adjacent to the barrel of the strut prevents the strut barrel from turning relative to the eyerods to prevent the strut length from extending or contracting. Changes in strut length could change the loadings on the strut, thereby rendering the strut inoperable.

This deviation is comparable to the construction deficiency identified for Loose Jam Nuts in the ISAP VII.c Large Bore Pipe Supports-Rigid population. Corrective action has been recommended to TUGCO for the construction deficiency identified in ISAP VII.c. Therefore, it was decided not to evaluate this deviation, and it was declared to be an unclassified deviation. It was concluded that the root cause and generic implication analysis and the recommended corrective action in Section 5.6.1 of this Results Report and in the ISAP VII.c Results Report is sufficient to assure appropriate corrective action.

# 5.3.28 QC Inspector Qualification

There were eight deviations written for improper certification of QC inspectors. These deviations, which involved seven inspectors, were referred to the ISAP I.d.1 Issue Coordinator for evaluation. One deviation was invalidated. The remaining six QC inspectors were evaluated in accordance with ISAP I.d.1 evaluation methodology. It was determined that five of the inspectors were qualified and one inspector was not properly qualified during this evaluation process. These deviations and inspector qualifications are addressed in the Results Report for ISAP I.d.1, "QC Inspector Qualifications." Refer to that report for conclusions.

# 5.4 Analysis of PS7N Pipe Support Deviations (See Table 6)

5.4.1 Excessive Spherical Bearing Clearance

There are approximately 360 spherical bearings on approximately 150 supports. Fifty-three bearings on 43 of these supports have a deviation reported for excessive gap between the spherical bearings and the bearing washers.

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

One bearing in a rear bracket did not have any spacers installed. Another was partially dislodged by 1/8-inch. It was concluded that all of the bearings as found could perform their intended function. These deviations were evaluated to be not safety-significant.

See Section 5.3.4 for analysis of excessive bearing gaps and partially dislodged bearings.

# 5.4.2 Load Pin Locking Device Missing

There are approximately 390 load pins on 166 supports. Sixteen supports have a deviation reported for broken, missing, or undersized cotter plus or map rings. The cotter pins and snap rings hold load thus in place. The load pins hold components of the pipe support assembly together. A support will lose its load-carrying ability if the load pin is not present or not properly engaged in the support assembly.

One support has two missing cotter pins, one on each load pin. The load pin axes are in the vertical (gravity) direction. The top cotter pin for one of the load pins is missing; the bottom cotter pin for the other load pin is missing. It was determined that the load pin with the missing top cotter pin could slip out of the support assembly, causing the support to be imoperable. It was determined that the missing cotter pin is a construction deficiency. The remaining deviations were either shown to be not safety-significant or were not classified because they were similar to the one that was determined to be a construction deficiency and would be addressed appropriately by the recommended corrective action.

See Section 5.5.6 for root cause a 1 generic implications analyses.

# 5.4.3 Pipe Clamp Halves Not Parallel

There are approximately 150 pipe clamps on 138 supports. Approximately forty-five of these supports have deviations for load side pipe clamp halves not parallel. Pipe clamps, when properly installed with the correct parts and bolt tightness, should have the load side of the pipe clamp approximately parallel.

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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

Approximately sixteen clamps had ears that were inclined closer together. The load pin stresses were not increased by this condition; neither was the spherical bearing gap increased. It was determined that the clamp ears did not interfere with the support eyerods and the clamps could perform their intended function.

Approximately 30 clamps had ears that were spread apart, causing increases in load pin bending stress. The load pins had bending stresses within ASME Code allowables. It was determined that these load pins could perform their intended function. None of these clamps had excessive bearing gaps. These deviations were evaluated to be not safety-significant.

A similar deviation was identified in the ISAP VII.c "Large-Bore Pipe Support-Rigid" population, Appendix 25, as a construction deficiency. Therefore, no trend analysis was performed for these deviations. Corrective action has been recommended by ISAP VII.c and has been incorporated into the Hardware Validation Program (HVP). This corrective action requires the reinspection of pipe clamps for the installation of the correct spacer.

Additionally, TUGCO has issued Design Change Authorization (DCA) 49801 limiting the maximum gap between the pipe clamp halves at the load pin location on NPSI model SPC-06 pipe clamps. The DCA is based on a NPSI letter recommending further conservation on the SPC-06 pipe clamp. The gap is controlled by the installation of the proper space. No other gap dimensional limitations at the load pin locations were specified by NPSI for other pipe clamp sizes, other than the inherent gaps which result from the proper installation of the pipe clamps.

The corrective action in ISAP VII.c and the issuance of the DCA by TUGCO as described above, combined with pipe clamp installation in accordance with vendor instructions, provide adequate assurance that vendor requirements for parallelism are met. The vendor installation instructions should be retained in TUGCO construction and inspection procedures.

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

A construction deficiency for an NPSI SPC-06 pipe clamp with halves not parallel was identified in Revision 0 of this report for one of the above deviations based on an analysis by SSEG. A subsequent reanalysis of the deviation considering the load applied at the ends of the load paddle rather than distributed over the load paddle width and considering the load reacting at the inside edge of each clamp ear rather than at the center of each ear was performed by Stone & Webster. The SSEG determined from the results of this analysis that the deviation was not safety-significant.

Design concerns relative to the adequacy of pipe clamp load pins have been transmitted to the Project on QA/QC-RT-10046. The adequacy of load pins will be evaluated by the Project.

5.4.4 Snubber Adapter Plate Bolting - Insufficient Thread Engagement

> CPRT reinspection results reported snubber adapter plate bolts with less than full thread engagement in the snubber adapter plate; however, no deviations from the CPRT reinspection procedure requirements were reported. See Section 5.3.6 of this report for additional discussion on this subject.

5.4.5 No Locking Devices For Threaded Fasteners

There are approximately 320 threaded fasteners (studs and bolts with nuts securing them in place) on 144 supports. Approximately 300 fasteners on 136 of these supports have a deviation reported for no locking devices. One of the supports without locking devices was a frame type support fabricated from tube steel containing SA-36 threaded rod in a structural joint. Three of the supports are snubbers with broken and missing lockwires on adapter plate bolting. The remaining supports had missing locking devices, primarily on pipe clamp bolting.

The absence of locking devices increases the possibility for bolts and studs to work loose under operating conditions. Loose or missing bolts and studs could result in the loss of the pipe support capability to transfer loads by causing a load-carrying component to become disengaged from the support assembly.

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# RESULTS REPORT

# (Cont'd)

. 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

All of these deviations were evaluated in a single safety significance evaluation and were determined to be construction deficiencies. The construction deficiencies for missing locking devices were incorporated into the generic construction deficiency identified in Section 5.3.1. The construction deficiencies for broken and missing lockwires were consolidated into a generic construction deficiency for broken and missing lockwires on snubber adapter plate bolting. See Section 5.5.2 for root cause and generic implication analyses for the construction deficiency on missing locking devices and Section 5.5.7 for root cause and generic implications for the construction deficiency on broken and missing lockwires.

# 5.4.6 Support ID Missing or Incorrect

All 178 supports are required to be marked with an identification number given on the design drawing. One of these supports has a deviation reported for a snubber with an incorrect identification number. The identification number on the support drawing is SI-1-079-009-S42K. The number on the installed snubber is SI-1-076-002-S22K. Inspection records show that the installed snubber was salvaged from support SI-1-076-002-S22K. Another support containing a snubber has a deviation reported for no identification number. It was determined that these snubbers are the correct model and size and there is no effect on the load-carrying capacity of the support or on the ability of the support to perform its function. No other deviations were reported for missing or incorrect support identification. No trend evaluation was performed for these two deviations.

# 5.5 Root Cause and Generic Implication Evaluation

This section provides the root cause and generic implications analyses for the construction deficiencies identified during the implementation of this Action Plan. These are listed below.

#### Construction Deficiencies

 No Locking Devices for Threaded Fasteners (See Section 5.3.1 and 5.4.5)

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

- Pipe Clearance with Support Out of Tolerance (See Section 5.3.10)
- Pipe Clamp Locknut Loose (See Section 5.3.11)
- Strut Misalignment (See Section 5.3.12)
- Load Pin Locking Device (Cotter Pins) Missing (See Section 5.4.2)
- Broken and Missing Lockwire on Snubber Adapter Plate Bolting (See Section 5.4.5)
- 5.5.1 Background Information

Brown & Root fabricated, installed and inspected the ASME Code Class 1, 2, and 3 pipe supports in Unit 1 and Common areas. Fabrication and installation of most of the Unit 1 and Common supports commenced in the latter part of 1979 and continued through 1983. Most of the supports were QC-inspected during this period. Fabrication, installation and inspection were performed to the Brown & Root procedures listed below.

- CP-CPM-9.10, "Fabrication of ASME Related Component Supports", effective from 9/30/80 to present (Revision 15).
- QI-QAP-11.1-28, "Fabrication Installation Inspections of ASME Component Supports, Class 1, 2, and 3", effective from 9/8/80 to present (Revision 34).
- QI-QAP-11.1-28A, "Installation Inspections of ASME Class 1, 2, and 3 Snubbers", effective from 10/29/82 to present (Revision 5).
- CP-QAP-12.1, "Inspection Criteria and Documentation Requirements Prior to System N-5 Certification", effective 2/22/82 to present (Revision 6).

When a sufficient amount of piping, equipment, and pipe supports was installed (permanent supports and sometimes temporary supports), the Startup Group, which was not under Brown & Root supervision, performed

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#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

system tests. These tests commenced in the latter part of 1980 for most of the systems in Unit 1 and Common and continued into 1983.

Final system walkdown inspections and N-5 certification by Brown & Root were completed in the latter part of 1983 for Unit 1 and Common.

After N-5 certification (1983), Brown & Root turned the systems over to TUGCO. The TUGCO Startup Group checked the cold position spring hanger and snubber settings on systems using TUGCO Startup Procedure XCP-ME10. All ASME III systems in Unit 1 and Common Areas were turned over to TUGCO Operations by the latter part of 1984.

In early 1985 the TUGCO Operations Group performed thermal expansion tests on systems that operate above 200°F to check and adjusted (if necessary) snubber travel settings and spring hanger settings at various temperature plateaus using TUGCO Startup Preoperations Test Procedure 1-CP-PT-55-11.

The CPRT performed the bulk of their pipe support inspections during the latter part of 1985, two years or more after the supports were QC inspected and accepted. The CPRT found some supports that were misaligned, bent, had loose nuts and broken and missing cotter keys, all of which could have occurred after the supports were initially QC inspected and accepted. Therefore a QA/QC Program Deviation Report (PDR-061) was prepared to identify a situation where adequate procedures and controls for preserving pipe supports in their proper QC-inspected and accepted configuration, were apparently not in place.

5.5.2 No Locking Devices on Threaded Fasteners

A construction deficiency exists for No Locking Devices on Threaded Fasteners. This deficiency is comparable to construction deficiencies identified for Inappropriate Locking Devices in the following three populations of ISAP VII.c, "Construction Reinspection/Documentation Review Plan":

> Large-Bore Pipe Supports - Rigid Large-Bore Pipe Supports - Non-Rigid Small-Bore Pipe Supports

#### RESULTS REPORT

### ISAP VII.b.3 (Cont'd)

# 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

It was determined that the root cause and generic implications analyses performed for these VII.c construction deficiencies encompass the deficiency identified for No Locking Devices on Threaded Fasteners in this ISAP. See Section 5.6.1 for recommended corrective action.

5.5.3 Pipe Clearance with Support Out of Tolerance

A construction deficiency exists for a pipe wedged between a U-bolt and a steel plate on support CC-X-039-005-F43R. The pipe wall is bearing against the U-bolt and a pipe circumferential butt weld near the U-bolt is bearing against a steel plate on the support diametrically opposite from each other.

The pipe support design drawing specified 1/16 inch clearance between the pipe and U-bolt and between the pipe and the plate. Brown & Root Construction Procedure CP-CPM-9.10 gives generic tolerances for the pipe clearance specified on the drawing. Brown & Root inspection procedure QI-QAP-11.1-28 gives the same generic tolerances as Construction Procedure CP-CPM-9.10 for pipe clearance dimensions.

The fact that the weld was within the support envelope is an apparent violation of Gibbs & Hill Pipe Hanger and Support Specification 2323-MS-46A, which contains requirements for minimum axial distances between pipe circumferential butt welds and pipe supports. However, neither the Gibbs and Hill Piping Erection Specification 2323-MS-100, which provides requirements for support erection, nor the Brown & Root construction and inspection procedures contains these requirements. However, as previously stated, clearance requirements between pipe and support were included in the Brown & Root procedures.

The same construction and inspection procedures that pertain to pipe support clearances are applicable to both U-bolt and frame type supports. Therefore, the root cause and generic implications analyses will be the same for both cases.

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#### **RESULTS REPORT**

#### ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

An adverse trend exists for Gaps or clearance in the following populations of ISAP VII.c:

Large-Bore Pipe Supports - Rigid Small-Bore Pipe Supports

It was determined that the root cause and generic implications analyses performed for the adverse trends addressing Gaps in the aforementioned populations encompass the construction deficiency for unacceptable clearance in this ISAP. See Section 5.6.3 for recommended corrective action.

#### 5.5.4 Pipe Clamp Locknut Loose

A construction deficiency exists for a loose locknut on an ITT Grinnell pipe clamp bolt. ITT Grinnell pipe clamp bolts are supplied with nuts and locknuts.

The support, including pipe clamp, was installed in mid-1980 and inspected on 6/13/80. This was prior to the issuance of QI-QAP-11.1-28 and CP-CPM-9.10.

The rod ends on the strut were adjusted and the support was inspected on 6/4/82. The inspection was documented on a Hanger Inspection Report (HIR), Attachment 2 of QI-QAP-11.1-28. This procedure requires fasteners to be tightened securely.

The support was inspected for N-5 certification on 7/11/83 in accordance with CP-QAP-12.1; Revision 7. This procedure did not require a check for fasteners to be tightened securely.

Because of the long period of time between the last documented inspection and the CPRT inspection, and due to the limited amount of information available, it is not possible to determine the specific root cause for this deficiency. A QA/QC Program Deviation Report, PDR-061, has been initiated to address the preservation of pipe supports in their QC-accepted configuration. See Section 5.6.1 for recommended corrective action.

It should be noted that loose locking devices were also found in VII.c inspections of pipe supports.

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

5.5.5 Strut Misalignment

A construction deficiency exists for an ITT Grinnell strut that is offset 6° with respect to the rear bracket and offset 8° with respect to a pipe clamp. The maximum allowable offset is 5°. Also, the rods that connect the strut body to the rear bracket and clamp were bent. The bent rod may have caused the centerline of the strut to go out of alignment.

A CMC dated 8/5/80 required the pipe clamp to be shifted several inches along the axis of the pipe from the specified position to avoid a pipe butt weld. The clamp was moved and the support was inspected and found satisfactory by QC on 9/17/80.

An item removal notice was issued on 2/10/81 to remove the support to allow the craft to work on the pipe. Records indicate that the support was reinstalled, inspected and found satisfactory by QC on 2/18/81. The inspection procedure in effect at the time was QI-QAP-11.1-28, Revision 4, issued 12/8/80, which gives the following offset requirements with respect to the pipe clamp and rear bracket centerlines:

> "Sway Strut Unit - maximum sway strut misalignment shall not exceed 6° for NPSI and 5° for ITT-Grinnell from the center line of the sway strut (12° and 10° included angle)."

A CMC dated 7/1/82 required the weld that attaches the rear bracket to the baseplate to be increased in size. The weld size was increased and the support was inspected for welding only and found satisfactory on 9/2/82.

The support was inspected for N-5 certification on 4/13/83 in accordance with CP-QAP-12.1, Revision 5 issued 3/16/83. Although this procedure does not require a check for strut offset angles, the damage (bent rod) probably would have been apparent. The CPRT inspection that identified the deficiency was performed during the latter part of 1985, more than four years after the last QC inspection for offset.

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#### RESULTS PEPORT

### ISAP VII.b.3 (Cont'd)

... 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

Because of the long period of time between the last documented inspection for strut offset, it is not possible to determine the specific root cause for this deficiency.

A QA/QC Program Deviation Report (PDR-061) has been initiated to address the preservation of pipe supports in their QC-accepted configuration. Corrective action will be taken by TUGCC. See Section 5.6.4 for recommended corrective action.

5.5.5 Load Pin Locking Device (Cotter Fins) Missing

A construction deficiency exists for a missing cotter pin on the upper end of a load pin on a strut type support. This deficiency is comparable to the construction deficiency identified for Fasteners (broken cotter keys) in the following population of ISAP VII.c:

Large-Bore Pipe Supports - Non-Rigid

It was determined that the root cause and generic implications analyses performed for the construction deficiencies addressing Fasteners in the aforementioned ISAP VII.c population encompass the deficiency identified for Load Pin Locking Device (Cotter Pins) Missing in this ISAP. See Section 5.6.2 for recommended corrective action.

5.5.7 Broken and Missing Lockwire on Snubber Adapter Plate - Bolting

> Construction deficiencies exist for missing and broken lockwire on snubber adapter plate bolting. These construction deficiencies were included in a generic construction deficiency for no locking devices on threaded fasteners. The root cause and generic implications for these construction deficiencies are similar to those identified for Fasteners (broken cotter keys) in the following population of ISAP VII.c:

> > Large-Bore Pipe Supports - Non-Rigid

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#### RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

. 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

The same procedures involving removing and replacing cotter keys apply to lockwire. It was determined that the root cause and generic implications analyses performed for the construction deficiencies addressing Fasteners in the aforementioned ISAP VII.c population encompass the deficiency identified for broken and missing lockwire on snubber adapter plate bolting. See Section 5.6.1 for recommended corrective action.

# 5.6 Recommended Corrective Actions

Most of the findings encountered in this results report were also identified in the ISAP VII.c populations; therefore, the majority of the corrective actions will also be covered by ISAP VII.c corrective actions for similar findings.

The recommended corrective actions below include those for safety-significant findings and those for PDRs resulting from implementation of this ISAP.

5.6.1 No Locking Devices for Threaded Fasteners; Pipe Clamp Locknut Loose; Broken and Missing Lockwire on Snubber Adapter Plate Bolting; Loose Jam Nut on Barrel of Strut

> There are three construction deficiencies and one unclassified deviation for missing and loose locking devices on threaded fasteners.

It is recommended that all ASME Class 1, 2, and 3 pipe support bolts and studs, other than high strength bolts used in high strength bolt applications, be inspected for the presence of approved locking devices and for proper locking device installation/tightness. This inspection effort should include locking devices used on vendor-supplied ASME Class 1, 2, and 3 support components such as jam nuts used on the barrel of struts and safety wire used on snubber bolting.

5.6.2 Load Pin Locking Device Broken or Missing

A construction deficiency exists for a missing cotter pin on a strut type support in Room 77N.

It is recommended that all ASME Code Class 1, 2, and 3 pipe supports and Class 5 and 6 pipe supports within the ASME III pipe stress boundary be inspected for broken, missing, and undersized cotter pins and snap

#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

rings. Broken, missing or undersized cotter pins and snap rings should be replaced with vendor qualified or engineering-approved items. The inspection and rework effort should be performed on the basis of engineering-approved procedures which indicate specific cotter pin/snap ring sizes for load pins for each support model/size.

5.6.3 Pipe Clearance With Support Out of Tolerance;

A construction deficiency exists for insufficient clearance between a U-bolt pipe support and a pipe circumferential butt weld on a PS42 pipe support.

It is recommended that inspection procedures be modified to include minimum axial distances between pipe butt welds and supports so as not to impair the function of the support, pipe or adjacent equipment. All ASME Code Class 1, 2, and 3 pipe supports (including frame type supports) and Class 5 and 6 pipe supports within the ASME III pipe stress boundary should be inspected to this new criterion for proper axial distance from pipe welds and to existing criteria for proper gap (clearance) between pipe and support.

# 5.6.4 Strut Misalignment

A Construction Deficiency exists for a strut misaligned with a pipe clamp for a PS42 support.

All snubbers, struts and spring type supports on all ASME Code Class 1, 2 and 3 pipe supports and Class 5 and 6 pipe supports within the ASME III pipe stress boundary should be inspected for correct angularity of the support centerline with respect to pipe support clamps and pipe support brackets; for damage such as bent rods; and for angular or linear dimensions that affect support orientation with respect to the building and piping as shown on the design drawings.

QA/QC Program Deviation Report O61 was issued to TUGCO. It documented inadequacies in current procedures and controls for effectively maintaining completed pipe supports in the QC-accepted configuration. This PDR was evaluated by the QA/QC Review Team to determine if

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#### **RESULTS REPORT**

### ISAP VII.b.3 (Cont'd)

. 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

it should be classified as a QA/QC program deficiency. Because the action required to correct existing procedures and develop any additional procedures that might be required is not considered extensive, the QA/QC Review Team determined that PDR 061 is not a QA/QC program deficiency. Past hardware problems are being resolved by the corrective action developed to resolve the related construction deficiency.

5.6.5 Spherical Bearing/Washer Gap Excessive; Spherical Bearing Partially Dislodged

QA/QC Program Deviation Report 076 has been issued to TUGCO with the following recommendations.

All ASME III Code Class 1, 2 and 3 snubbers and struts and Class 5 and 6 snubbers and struts within the ASME III pipe stress boundary should be inspected for proper spherical bearing seating in the eyerod; installation of acceptable spherical bearing spacers; and proper gap between the spherical bearing and bearing spacers. The sizes of vendor-supplied spherical bearing spacers and maximum allowable gaps in rear brackets and pipe clamps for each type/size snubber and strut should be determined and specified in the inspection procedures.

PDR-076 was evaluated by the QA/QC Review Team to determine if it should be classified as a QA/QC program deficiency. The procedural changes that are required to assure proper installation and inspection of spherical bearings to prevent recurrance of the identified problems are not extensive. In addition, the Hardware Validation Program developed by TUGCO had already addressed reinspections in this area. Based on these factors, the QA/QC Review Team determined that this PDR was not a QA/QC program deficiency.

5.6.6 Baseplate Hole Location Dimension Out of Tolerance

QA/QC Program Deviation Report 075 has been issued to TUGCO with the following recommendations.

Baseplates on all ASME III Code Class 1, 2 and 3 supports and Class 5 and 6 supports within the ASME III pipe stress boundary should be inspected for compliance

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# RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

. 5.0 IMPLEMENTATION OF ACTION PLAN AND DISCUSSION OF RESULTS (Cont'd)

with final design drawings for proper hole locations, support member locations on baseplates, and edge distances.

PDR-075 was evaluated by the QA/QC Review Team to determine if it should be classified as a QA/QC program deficiency. No extensive procedural evaluation or revisions are required to prevent recurrence of this problem. In addition, pipe support corrective action (see DCN-5 dated February 13, 1987 and Appendix 2 to

Procedure CP-QAP-12.1, Revision 18) developed by TUGCO included reinspection of bolt hole locations. Based on these factors, the QA/QC Review Team determined that this PDR was not a QA/QC program deficiency.

#### 6.0 CONCLUSIONS

The CPRT reinspected 220 supports for the purpose of substantiating the TRT findings and assessing the impacts of the TRT findings on construction quality. Additionally, more than 300 supports were reinspected under ISAP VII.c for the purpose of assessing construction quality. Many of TRT findings were substantiated.

Corrective actions were recommended in this report for construction deficiencies, program deviation reports and unclassified deviations. TUGCO has initiated corrective action for many of the recommendations. Areas where corrective action has not been recommended in this report are welding and pipe support documentation. No inspection findings impacting support functional capability were identified in these areas.

The recommendations in this Results Report and in the ISAP VII.c and ISAP I.d.l Results Reports are sufficient to satisfactorily resolve the TRT issues.

#### 7.0 ONGOING ACTIVITIES

There are no ongoing activities.

8.0 ACTION TO PRECLUDE OCCURRENCE IN THE FUTURE

Implementation of the recommendations in this report and in the ISAP VII.c Results Report will preclude occurrence in the future.

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# RESULTS REPORT

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# ISAP VII.b.3 (Cont'd)

# Table 1

# Pipe Supports in Unit 1

Supports Inspected by TRT As-Built Group	*42
Class 1 Supports Inspected	4
Class 2 Supports Inspected	14
Class 3 Supports Inspected	24
Hangers With Problems	26
Total Problems Identified	46
Procedure Adequacy Problems	5
Hardware-Related Problems	16
As-Built Drawing Related Problems	8
Component Identification Problems	2
Weld-Related Problems	10
QC Record Problems	1
Matarial Identification Problems	4
Welds Inspected Without Paint by TRT	305
Welds Inspected With Paint by TRT	89
Total Welds Inspected by TRT	394
Welds Needing Weld Repair	10
% of Welds Inspected	2.5%
Supports Needing Welding Repair	6
I of Supports Inspected	14%

BUILDING	SYSTEM	NO. OF SUPPORTS INSPECTED
Containment	Safety Injection (SI)	1
Containment	Reactor Coolant (RC)	6
Containment	Residual Heat Removal (RHR)	2
Fuel Handling	"Component Cooling (CC)	11
Safeguards	Residual Heat Removal (RHR)	1
Safeguards	Containment Spray (CT)	8
Safeguards	Demineralized Water (DD)	1
Safeguards	Auxiliary Feedwater (AF)	8
Auxiliary	Chemical Volume & Control (CS)	1
Safeguards	Main Steam (MS)	2
Safeguards	Chilled Water (CH)	1



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#### **RESULTS REPORT**

# ISAP VII.b.3 (Cont'd)

# Table 2

# Pipe Supports in Unit 1\*

	PROBLEM CATEGORY	HANGER NO.	NO. OF PROBLEMS	TYPE
1.	No locking device for threaded fasteners	RC-1-901-702-C82S CS-1-085-003-A42K	2	Hardware problem
2.	Min. edge distance (on base plate) violated	CC-X-039-006-F43R	1	Hardware problem
3.	Base plate hole-location dimensions out of tolerance	CC-X-039-007-F43R CC-1-126-010-F33R CC-1-126-011-F33R CC-1-126-012-F33R	4	As-Built problem
4.	Spherical bearing/washer gap excessive	CC-1-126-015-F43R RC-1-052-016-C41K RC-1-052-020-C41K MS-1-416-001-S33R	4	Hardware problem
5.	Spherical bearing contamination	SI-1-090-006-C41K MS-1-416-002-S33K**	2	Hardware problem
6.	Snubber adapter plate-insufficient thread engagement	MS-1-416-002-S33K SI-1-090-006-C41K CT-1-013-012-S32K	3	Procedure problem
7.	Insufficient threaded eng'mt, threaded rod (sight holes)	RC-1-901-702-C82S	1	Hardware problem

<sup>\*</sup> All 42 pipe supports inspected by TRT had been previously accepted by site QC.

<sup>\*\*</sup> Revision 2 (dated January 7, 1983) of pipe support drawing changed the mark number from MS-1-416-002-S33R to MS-1-416-002-S33K.



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# **RESULTS REPORT**

ISAP VII.b.3 (Cont'd)

> Table 2 (Cont'd)

	PROBLEM CATEGORY	HANGER NO.	NO. OF PROBLEMS	TYPE
8.	Snubber/Strut load pin'locking device broken or missing	AF-1-001-014-S33R	1	Hardware problem
9.	Load side of pipe clamp halves not parallel	AF-1-001-001-S33R AF-1-001-014-S33R	2	Procedure problem
10.	Pipe clearances with support out of tolerance	CC-1-126-013-F33R AF-1-001-702-S33R	2	Hardware problem
11.	Pipe clamp locknut loose	AF-1-035-011-S33R	1	Hardware problem
12.	Snubber/Sway strut misalignment	CC-1-126-014-F43R RC-1-052-020-C41K	2	Hardware problem
13.	Snubber cold set dimension does not match drawing	CS-1-085-003-A42K	1	As-Built problem
14.	Snubber orientation does not match drawing	CT-1-005-004-S22K CT-1-013-010-S22K	2	As-Built problem
15.	Component type/model no. installed does not match drawing	SI-1-090-006-C41K RC-1-052-020-C41K	2	Compon. ID problem
16.	No identification for support materials, parts, and components identified.	CT-1-013-014-S32R CC-1-126-012-F33R CC-X-039-005-F43R AF-1-035-011-S33R	4	Material identification problem
17.	BRP column line dimension does not match BRHL dimension	Support not affected	ed 1	As-Built problem
18.	Weld porosity excessive	AF-1-001-001-S33R	1	Weld-related proble



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RESULTS REPORT

ISAP VII.b.3 (Cont'd)

> Table 2 (Cont'd)

	PROBLEM CATEGORY	HANGER NO.	NO. OF PROBLEMS	TYPE
19.	Weld undercut excessive	AF-1-001-702-S33R	1	Weld-related problem
20.	Weld length undersized	AF-1-001-001-S33R	1	Weld-related problem
21.	Weld leg or effective throat undersized	AF-1-001-001-S33R RH-1-006-012-C42R CC-X-039-007-F43R	3	Weld-related problem
22.	Weld called out on drawing does not exist in field	CC-1-126-013-F33R	1	Weld-related problem
23.	Welds added in field are not reflected on drawing	AF-1-001-702-S33R numerous welds	1	Weld-related problem
24.	Excessive grinding resulting in min. thickness violations (weld clean-up)	AF-1-037-002-S33R CT-1-013-014-S32R	2	Weld-related problem
25.	No QC Buy-off on weld data card	CC-1-126-013-F33R	_1	QC record problem
			46 Total by TRI	problems identified

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#### RESULTS REPORT

ISAP VII.b.3 (Cont'd)

Table 3

Summary of Additional TRT Inspections

AREA: Room 77N, El 810'-6" Unit 1, Safeguards Bldg.

	DEVIATION TYPE	NO. OF SUPPORTS INSPECTED	NO. OF SUPPORTS WITH DEVIATIONS	Z SUPPORTS WITH DEVIATIONS
Item 1.	Excessive Spherical Bearing Clearance	92	5	5.42
Item 2.	Load Pin Locking Device Missing	92	14	15.2%
Item 3.	Pipe Clamp Halves Not Parallel	40	9	22.5%
Item 4.	Snubber Adapter Plate Bolts With Less Than Full Thread Engagement	e 19 nt	*13	to be determined

AREA: Cable Spread Room 133, El 807'-0" Unit 1, Auxiliary Bldg.

DEVIATION	NO. OF BOLTS INSPECTED	NO. OF BOLTS WITH DEVIATIONS	Z BOLTS WITH DEVIATIONS
tem 5.** Hilti Kwik Bolt Does Not Meet Minimum Embedment	24	3	12.5%

Area: Unit 1

. Item 6. Locking Devices for Threaded Fasteners

1 × 1

\* Bolts had less than full thread engagement.

\*\* Found by the TRT during inspections of electrical support baseplates.

\*\*\* Taking into account the "allowed" slippage of the bolt for a distance of one nut thickness due to torquing (Ref. "Installation of Hilti Drilled-In Bolts" 35-1195-CEI-20, Revision 3, Paragraph 3.1.4.1) and the minimum specified embedment, the above Hilti bolts violated the "effective" embedment requirements.



#### **RESULTS REPORT**

ISAP VII.b.3 (Cont'd)

# Table 4

# Comparison of Inspection Results for PS42 Supports

HANGER #/ PACKAGE #	TRT FINDINGS	CPRT FINDINGS*	REMARKS
AF-1-001-001-S33R 1-S-PS42-01	<ol> <li>Load side of pipe clamp halves not parallel</li> </ol>	1. Not able to verify.	The NRC letter dated January 8, 1985 says this
	2. Weld porosity excessive	2. Same as 1. above.	support was scrapped and
	3. Weld length undersized	3. Same as 1. above.	rebuilt after the TRT
	<ol> <li>Weld leg or effective throat undersized</li> </ol>	4. Same as 1. above.	inspection.
AF-1-001-702-S33R	1. Pipe clearances with support	1. Verified	1. Out of tolerance.(.015"
1-5-1542-04	out of tolerance		clearance or top and bottom)
	2. Weld undercut excessive	2. Not able to verify	2. Weld undercut was
*	<ol> <li>Welds added in field are not reflected on dwg.</li> </ol>	3. Verified	repaired prior to TRT inspection.
AF-1-001-014-S33R I-S-PS42-02	<ol> <li>Snubber/strut load pin locking device broken or missing (broken cotter pin)</li> </ol>	<ol> <li>Verified</li> </ol>	
	<ol> <li>Load side of pipe clamp halves not parallel</li> </ol>	2. Verified	

\* All of the CPRT findings are not shown in this table. Only the CPRT findings that correspond to the TRT findings for the twenty-six (26) supports are shown in this table.



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# RESULTS REPORT

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ISAP VII.b.3 (Cont'd)

> Table 4 (Cont'd)

PACKAGE	TRT FINDINGS	CPRT FINDINGS	REMARKS
AF-1-035-011-533R	1. Pipe clamp locknut loose	1. Verified	
I-S-PS42-05	2. No identification for support materials, parts and components on the Material Identification Log	2. Verified	
	(MIL) or in documentation package.		
AF-1-037-022-S33R I-S-PS42-07	<ol> <li>Excessive grinding resulting in min. thickness violations of baseplate and weld size at basepl</li> </ol>	<ol> <li>Verified</li> <li>ate.</li> </ol>	
CC-1-126-010-F33R I-S-PS42-09	<ol> <li>Base plate hole location dimensions out of tolerance (support member 3" lower than specified relative to upper bolt</li> </ol>	1. Verified	<ol> <li>Revision CP-1 (Issued June 26, 1985) lowered the centerline of the support by</li> </ol>
	holes)		approximately 3-1/4" from its position on the previous Revision CPRT inspections were performed to revision CP-1 and acceptance
CC 1 12/ 011 P22P			satisfactory.
I-S-PS42-10	out of tolerance	1. Verified	



# RESULTS REPORT

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ISAP VII.b.3 (Cont'd)

# Table 4 (Cont'd)

HANGER #/ PACKAGE	TRT FINDINGS	CPRT FINDINGS	REMARKS
CC-1-126-012-F33R I-S-PS42-11	<ol> <li>Base plate hole location dimensions out of tolerance</li> </ol>	1. Verified	
	<ol> <li>No identification for support materials, parts and components on the Material Identification Log (MIL) or in documentation package.</li> </ol>	2. Verified	
CC-1-126-013-F33R I-S-PS42-12	<ol> <li>Pipe clearances with support out of tolerance</li> </ol>	1. Verified	
	<ol> <li>Weld called out on dwg. does not exist in field (1/4" fillet connecting item 5 to item 6 missi*g)</li> </ol>	2. Verified	<ol> <li>CriC 87927 Revision 4         (Issued March 2, 1983)         changed the weld symbol         to delete this weld but         has not been         incorporated into the         drawing.</li> </ol>
	<ol> <li>No QC inspector initials or signature in signature block on weld data card</li> </ol>	3. Verified	
CC-1-126-014-F43R I-S-PS42-13	<ol> <li>Snubber/sway strut misalignment (exceeded 5° from centerline of strut</li> </ol>	<ol> <li>Verified</li> </ol>	
CC-1-126-015-F43R I-S-PS42-14	<ol> <li>Spherical bearing/washer gap excessive</li> </ol>	1. Verified	

# RESULTS REPORT

ISAP VII.b.3 (Cont'd)

# Table 4 (Cont'd)

HANGER #/ PACKAGE #	TRT FINDINGS	CPRT FINDINGS	REMARKS
CS-1-085-003-A42K I-S-PS42-20	<ol> <li>No locking device for threaded fasteners on clamp bolts</li> </ol>	1. Verified	
	<ol> <li>Snubber cold set dimension does not match dwg.</li> </ol>	2. Verified	<ol> <li>Per QI-058 the ERC inspector was required to record the cold set dimension. Recorded was 8-3/4" versus 8-1/8" required. An out of scope observation has been generated per CPP-020.</li> </ol>
CT-1-005-004-S22K I-S-PS42-21	<ol> <li>Snubber orientation does not match dwg. (installed opposite end to end)</li> </ol>	1. Verified	
CT-1-013-010-S22K I-S-PS42-24	<ol> <li>Snubber orientation does not match dwg. (installed opposite end to end)</li> </ol>	1. Not able to verify.	<ol> <li>This type of finding has been verified for other similar type supports.</li> </ol>
CT-1-013-012-S32K I-S-PS42-26	<ol> <li>Snubber adapter plate bolts with less than full thread engagement</li> </ol>	1. Verified	



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# RESULTS REPORT

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ISAP VII.b.3 (Conz'd)

> Table 4 (Cont'd)

HANGER #/ PACKAGE #	TRT 'FINDINGS	CPRT FINDINGS	REMARKS
CT-1-013-014-S32R I-S-PS42-28	<ol> <li>No identification for support mat'l, parts and components on the Material Identification Log (MIL) or in documentation package (for sway strut eyerod)</li> </ol>	1. Verified	
	<ol> <li>Excessive grinding resulting in min. thickness violations (notching of rear brackets during weld clean-up)</li> </ol>	2. Not able to verify.	<ol> <li>This type of finding been verified for other supports.</li> </ol>
CC-X-039-005-F43R I-S-PS42-15	<ol> <li>No identification for support mat'l, parts and components on the Material Identification Log (MIL) or in documentation package.</li> </ol>	<pre>l. Verified</pre>	
CC-X-039-006-F43R I-S-PS42-16	<ol> <li>Minimum edge distance (for base plate holes) violated</li> </ol>	l. Verified	
CC-X-039-007-F43R I-S-PS42-17	<ol> <li>Base plate hole location dimensions out of tolerance</li> </ol>	1. Verified	<ol> <li>TRT inspection performed to Revision 4 (Issued April 25, 1983). ERC inspection performed and accepted to Revision CP-1</li> </ol>
	<ol> <li>Weld leg or effective throat undersized (5/16" Fillet 1/16" undersized across top of tube steel)</li> </ol>	2. Not able to verify.	to Revision Cr-1.
MS-1-416-001-S33R I-S-PS42-31	<ol> <li>Spherical bearing/washer gap excessive</li> </ol>	1. Verified	

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# RESULTS REPORT

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ISAP VII.b.3 (Cont'd)

> Table 4 (Conc'd)

HANGER #/ PACKAGE #	TRT FINDINGS	CPRT FINDINGS	REMARKS
MS-1-416-002-S33K	1. Spherical bearing contamination	1. Verified	
I-S-PS42-32	<ol> <li>Snubber adapter plate bolts with less than full thread engagement (0.095 " less than full engagement)</li> </ol>	2. Verified	
RC-1-052-016-C41K I-S-PS42-34	<ol> <li>Spherical bearing/washer gap excessive</li> </ol>	1. Verified	1. Spacers not installed.
RC-1-052-020-C41K I-S-PS42-35	<ol> <li>Spherical bearing/washer gap excessive</li> </ol>	1. Not able to verify.	<ol> <li>This type of finding has been verified for other similar type supports.</li> </ol>
	<ol> <li>Snubber/sway strut misalignment (exceeded 5° from centerline of snubber)</li> </ol>	2. Not able to verify.	2. Same as 1. above.
	<ol> <li>Component type/model no. (snubber zodel number) does not zetch dwg.</li> </ol>	3. Verified	
RC-1-901-702-C82S I-S-PS42-37	<ol> <li>No locking device for threaded fastener (load bolt) at beam attachment.</li> </ol>	1. Verified	
	<ol> <li>Insufficient thread engagement (threaded rod not visible through sight hole)</li> </ol>	2. Verified	
RH-1-006-012-C42R I-S-PS42-40	<ol> <li>Weld leg or effective throat undersized (1/4" fillet connecting item 5 to item 7)</li> </ol>	l. Verified	



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# **RESULTS REPORT**

ISA? VII.b.3 (Cont'd)

Table 4 (Cont'd)

HANGER #/ PACKAGE #	TRT PINDINGS	CPRT FINDINGS	REMARKS
SI-1-090-006-C41K I-S-PS42-42	1. Spherical bearing paint contamination	1. Verified	
	<ol> <li>Snubber adapter plate bolts with less than full thread engagement.</li> </ol>	2. Verified	
	<ol> <li>Component type/model no. does not match dwg.</li> </ol>	3. Verified	

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# **RESULTS REPORT**

ISAP VII.b.3 (Cont'd)

#### Table 5

Comparison of Inspection Results for PS7N Supports

AREA: Room 77N, E1 810'-6" Unit 1, Safeguards Bldg.

		CHARACTERISTIC	INSP	ECTED	NO. OF	SUPPORTS VIATIONS		
			TRT	CPRT	TRT	CPRT		
Item	1.	Excessive Spherical Bearing Clearance	92	150 (approx)	5	43		
Item	2.	Load Pin Locking Device Missing	92	166	14	16***		
Item	3.	Pipe Clamp Halves Not Parallel	40	138	9	45		
Item	4.	Snubber Adapter Plan Bolts With Less Than Full Thread Engageme	te 19 ant	35	*13	0		
			AREA: U	nit 1				
Item	6.	Locking Devices for Threaded Fasteners		144		136		
			AREA:	Cable Spr Unit 1, A	ead Room 133 uxiliary Blo	3, El 807'-	0"	
		CHARACTERISTIC	NO. OF I	BOLTS	NO. OF	BOLTS		
Item	5.**	Hilti Kwik Bolt Does Not Meet Minimum Embedment	(IS em) tra cal tra	SAP VII.b bedment 1 ay suppor ble tray ay design	.4 Results F engths for a ts. Hilti t supports are adequacy ve	Report a/idr all populat olt embedm addressed crification	esses Hilti ions except ent lengths under the co program.)	bolt cable for able

Number of bolts (not supports) with less than full thread engagement. \*

Found by the TRT during inspections of electrical support baseplates. Refer to \*\* ISAP VII.b.4 Results Report for Hilti Bolt inspection results.

\*\*\* Included are supports with missing, broken and undersized locking devices.

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# RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

# Table 6

# CPRT Deviation Reports for PS7N

Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
Excessive spherical bearing clearance.	150 (approx)	43	0	Trend	
Load pin locking device missing.	166	16	1	N/A*	
Pipe clamp halves not parallel.	138	46	0	None	QA/QC-RT- 10046
Snubber adapter plate bolts with less than	35	0	0	None	QA/QC-RT- 10046
required engagement.					

 Adverse and unclassified trends have not been declared for characteristics with one or more construction deficiencies due to the extent of the recommended corrective action.

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RESULTS REPORT

ISAP VII.b.3 (Cont'd)

Table 6 (Cont'd)

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Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
Missing locking device for threaded fasteners.	144	140	l (Generic for 140 DRs)	N/A	Generic DR includes construction deficiencies for snubber lockwire.
Support ID missing or incorrect	178	2	0	None	

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# RESULTS REPORT

# ISAP VII.b.3 (Cont'd)

# Table 7

# CPRT Deviation Reports for PS42

Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
No locking devices for threaded fasteners.	19	18	l (Generic for 18 DRs)	N/A*	
Minimum edge distance on baseplate violated.	35	2	0	None	
Baseplate hole location dimen out of tolerance.	35	9	0	Trend	QA/QC PDR 075 written.
Spherical bearing/ washer gap excessive.	22	5	0	Trend	QA/QC PDR 076 written.
Spherical bearing contamination.	22	15	0	Trend	

Adverse and unclassified trends have not been declared for deviation types with one or more construction deficiencies due to the extent of the recommended corrective action.

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# RESULTS REPORT

ISAP VII.b.3 (Cont'd)

> Table 7 (Cont'd)

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Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
Snubber adapte plate insufficient thread engagem	er 11	0	0	None	QA/QC-RT- 10046
Insufficient thread engagement threaded rod	18	2	0	None	
Load pin locking device broken or missing.	24	2	0	N/A*	CD identi- fied for PS7N support.
Load Side of pipe clamp halves not parallel.	18	7	0	None	
Pipe clearance with support out of tolerance.	22	8	1	N/A*	
Pipe clamp locknut loose.	4	1	l (Included in generic	N/A* cD)	
Snubber/strut misalignment.	22	2	1	N/A*	

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# RESULTS REPORT

ISAP VII.b.3 (Cont'd)

Table 7 (Cont'd)

Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
Snubber cold* set dimension does not match drwg.	11	0	0	None	
Snubber * orientation does not match drwg.	11	0	0	None	
Component type/model does not match drwg.	43	2	0	None	
No identificati for support materials, part and components on hardware or in documentatio package. (e.g. on MIL)	on 5 s n _ ,	0	0	None	
Weld porosity excessive	43	0	0	None	
Weld undercut excessive.	43	0	0	None	

\* No

\* Not a deviation per QI-058, the only requirement is to record snubber cold set dimensions and to identify those snubbers rotated 180°.

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# RESULTS REPORT

ISAP VII.b.3 (Cont'd)

Table 7 (Cont'd)

Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
Weld length undersize	43	0	0	None	
Weld leg or effective throat undersis	43 ze.	3	o ·	None	
Weld on drawing does not exist in field.	g 43	0	0	None	
Welds added in field not on drwg.	* 43	0	0	None	
Excessive grinding resulting in minirum thickness violations (weld cleanup)	43	1	0	None	Design Adequacy Request 170
No QC inspector initials (no QC acceptance of buy-off) on we data card.	r 5 or Id	1	0	None	

\* Not a deviation per QI-058, the only requirement is to record extra weld.

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# RESULTS REPORT

ISAP VII.b.3 (Cont'd)

Table 7 (Cont'd)

Character- istic	Number of Supports	Number of Deviation Reports	Number of Construction Deficiencies	Trends	Remarks
Support ID missing or incorrect	43	5	0	None	
* Configuration Does Not Mate Drawing	n 43 ch	7	0	None	
* Loose locknu on barrel of strut	t 11	1	0 (Unclassified Deviation)	N/A	

\* These deviation types were not explicitly identified by the TRT.

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