November 11, 1994

NOTE TO: Joe Holonich

FROM: Jack Spraul

SUBJECT: STEEL SETS

Attached is a copy of the following documents I have received on the steel set problem at Yucca Mountain. The documents were FAXed to me Friday afternoon.

1. CAR YM-94-072 of 8/3 (and response of 8/31) regarding lack of documentation describing the rationale for assumptions found in the "Structural Steel Sets Analysis."

2. NCR YMSCO 95-7 of 10/28 (and conditional release of the same date) regarding a) supplier of welding services on steel sets not qualified and b) manufacturer of steel sets not qualified.

3. Specification with QA controls of 4/13 (through Revision 3 of 10/28) for "Steel Sets and Accessories Subsurface."

4. CAR YM-95-008 of 11/8 (without response) regarding a) lack of documentation to show a technical review of a purchase order for steel sets and b) purchase order for steel sets issued under Kiewit/PB procedures whereas, due to cost, it should have been issued under REECO procedures.

5. CAR YM-95-009 of 11/8 (without response) regarding the supplier of welding services on steel sets not qualified. This CAR appears to repeat the first item written-up in the NCR (item 2.a above).

6. CAR YM-95-010 of 11/8 (without response) regarding a) the fact that the steel set manufacturer's failure to use Kiewit/PB's Management Control Procedures as specified in the purchase order and b) the fact that the Kiewit/PB QA program documents do not adequately address the manufacture of quality-affecting items.

I am still waiting for a telephoned explanation from YMQAD of what has transpired and what is transpiring on this issue.

I'll keep you posted as I learn more.

300037

Distribution by HLPD. No further distribution required.

cc: Central Files
HLUR r/f
RJohnson
MLee

A(4):Steel.Set
November 11, 1994

QFX2 11/1
102.7

ITEM 1

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT U.S. DEPARTMENT OF ENERGY WASHINGTON, D.C.

8 CAR NO.: YM-94-072
PAGE: 1 OF 2
QA

CORRECTIVE ACTION REQUEST

1 Controlling Document	2 Related Report No.
OCRWM QARD, DOE/RW-0333P, Revision 01	YMP-94-01
3 Responsible Organization	**4 Discussed With**
M&O	J. Pye/S. Bonabien

5 Requirement:

1) QARD, Section 3.2.1.B states: "Design input shall be specified and approved on a timely basis and to the level of detail necessary to permit the design work to be carried out in a correct manner that provides a consistent basis for making design decisions, accomplishing design verification, and evaluating design changes." (Continued on next page)

6 Adverse Condition:

A lack of documentation exists describing the rationale for making assumptions and selecting data.

Discussion:

Examples of the lack of documentation are:

Structure Steel Sets Analysis, BABEAB000-01717-0200-0002, Revision 00:

- No rationale for selection of a conservative "rock raveling" value in Attachment I, Page I-1.
- No rationale for the selection of conservative "Rock Conditions" as presented in Attachment 1, Table 3.
- No rationale for selecting conservative seismic mean peak horizontal acceleration (0.37) as presented in Attachment II, Table 1.

9 Does a Significant Condition Adverse to Quality exist? Yes___ No X_ If Yes, Check One: ☐A ☐B ☐C ☐D ☐E	10 Does a stop work condition exist? Yes___ No X ; If Yes - Attach copy of SWO If Yes, Check One: ☐A ☐B ☐C	9 Response Due Date: 20 Working Days From Issuance

11 Required Actions: ☒ Remedial ☒ Extent of Deficiency ☒ Preclude Recurrence ☐ Root Cause Determination

12 Recommended Actions:
Revise the Structural Steel Sets Analysis to document the rationale for the selection of appropriate conservative data and assumptions.

7 Initiator	14 Issuance Approved by:
William R. Sublette 8-3-94	QADD Date 8/8/94
15 Response Accepted	16 Response Accepted
QAR R Rowe Date 9/12/94	QADD Date 9-14-94
17 Amended Response Accepted	18 Amended Response Accepted
QAR Date	QADD Date
19 Corrective Actions Verified	20 Closure Approved by:
QAR Date	QADD Date

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

8 CAR NO.: YM-94-072
PAGE: 2 OF 2
QA

CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

5 Requirements (continued)

2) QARD, Section 3.2.2G states: "Design documents shall be sufficiently detailed as to purpose, method, assumptions, design input, references, and units such that a person technically qualified in the subject can understand the documents and verify their adequacy without recourse to the originator." (Also see M&O QAP-3-9, Revision 3, Attachment I, Paragraph 10)

RESPONSE TO CAR NO. YM-94-072

Remedial Action:

Structural Steel Sets Analysis, BABEA0000-01717-0200-00002, Revision 00 will be revised and checked to ensure explanations supporting the engineering judgment used in the preparation of the analysis are present.

No deficiency exists for Item 3. The ESFDR contains the 0.37g as a requirement for ESF Design.

Extent of Deficiency:

The investigative actions performed by J. Pye and S. Bonabian and the conclusions reached regarding Structural Steel Sets Analysis for response to CAR YM-94-072 are as follows:

Item 1: Engineering judgment was used to reduce the in situ bulk density from 137 lbs/cu ft to 120 lbs/cu ft as a result of the effects of disturbance during tunneling which is a reasonable assumption and consistent with typical published ranges of bulk densities. This was explained in the analysis as a 12% reduction in bulk density.

Item 2: A load factor was identified from a standard classical reference - "Rock Tunneling with Steel Supports", 1946 by Proctor and White, published by Commercial Shearing Inc., by the Geotechnical LDE as indicated in Attachment 1 of the Structural Steel Sets Analysis BABEAB000-01717-0200-00002.

The load factor of 0.25B with the corresponding description, "Massive moderately jointed" with a propensity for loads to change erratically from point to point were selected on the basis of engineering judgment and field inspection of trench NRT-1, taking into account the geomechanical properties of the Pre-Rainier Mesa material, method of excavation, excavation rate and support installation capabilities of the TBM. Also taken into consideration was the fact that the referenced material is based on 50 year old tunneling technology and practice and as such is not representative of the rapid excavation and support technology employed by the YMP TBM system. The Structural Steel Sets Analysis BABEAB000-01717-0200-00002, Attachment 1 has been revised to include an explanation based on the above.

Item 3: The use of 0.37g is consistent with the ESFDR seismic design criteria. No deficiency exists.

Review indicates that the deficiency does not extend to the 2C Early Release products.

Corrective Action to Preclude Recurrence:

Assumptions and data used as input to design analyses based on engineering judgment will be explained in sufficient detail to clarify any subjective assessments, to the extent that a person technically qualified in the subject can understand the documents and verify their adequacy without recourse to the originator.

A documented training session will be conducted for all subsurface designers that are or will be involved in the preparation of analysis stressing the importance of providing the basis for assumptions and selecting data. Refer to QAP-3-9 Attachment I Item 7 requirements.

Responsible Individual: Bob Saunders
Date of Completion: 9/30/94

Alden M. Segrest, Manager
MGDS Development

Date 8/31/94

ITEM 2

YMP-006-R2
03/14/94

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
NONCONFORMANCE REPORT

NCR. No. Ymsco 95-7 Page 1 of 2

1. Initiator Name. W. Colglazier III Organization: REECo Date: 10/28/94

2. Description of Non-Conformance:
"See Attached"

3. ☑ Validation ☐ Invalidation ☑ Q ☐ Non-Q
Name: Daniel Swetak Organization: M&O QA Date: 10/28/94

4. Disposition Evaluation

☐ Rework ☐ Repair ☐ Use-As-Is ☒ Conditional Release
☐ Reject/Scrap ☐ Limited Use ☐ Discard

Justification/Comments:
"See Attachment 2" and "Attachment 3"

5. Disposition by:
Name: [signature] Organization: M&O Subsurface Design Date: 10/28/94

6. QA Concurrence with Disposition: Corrective Action: ☐ No ☑ Yes No. TBD
☐ Reportable ☑ Non-Reportable
Name: Daniel Swetak Organization: M&O QA Date: 10/28/94

7. Completion of Disposition:
Name: _____ Organization: _____ Date: _____
QA/QC Concurrence:
Name: _____ Organization: _____ Date: _____

8. Final Review:
Name: _____ Organization: _____ Date: _____

YMP-008-R2
03/14/94
NCR. No. Ymsco-95-7

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
NONCONFORMANCE REPORT
CONTINUATION PAGE

Page 2 of ___

1) Kiewit/PB procedure SPP-008, Rev. 2, *Welder/Welding Operator Performance Qualification* paragraph 3.0.2 states "Welder/Welding Operators Performance Qualification tests shall be conducted by the Kiewit/PB Welding Engineer or an approved Independent Testing Agency."

Kiewit/PB utilized Hayes Testing Laboratory, Inc. to qualify welders from Commercial Pantex Sika who performed welding on the Steel Sets during the fabrication process.

Hayes Testing Laboratory has not been qualified for supplying these services in accordance with Kiewit/PB MCP 7.0, Rev.4, *Control of Purchased and Services.*

2) These items (Steel Sets) were designed and to be manufactured as a "Q" Engineered Items in accordance with Specification BABEAB000-01717-02341, Rev. 1, and Drawings BABEAB000-01717-6300-02341-VD-01-1 2/2, Rev. 4, BABEAB000-01717-6300-02341-VD-02-1 2/2, Rev. 5 and BABEAB000-01717-6300-02341-VD-03-1 2/2, Rev. 2.

Engineered Items are required to be manufactured in accordance with an approved quality supplier. The Steel Sets were manufactured by Commercial Pantex Sika, Inc.. Commercial Pantex Sika, Inc. was not qualified by Kiewit/PB as a supplier of quality items or services.

Attachment 2

Disposition (Conditional release) For NCR YMSCO-95-7

Justification

Install steel sets as necessary for personnel safety to the extent possible in accordance with the latest version of Specification BABEAB000-01717-6300-02341. Revision 3 of this specification has been approved by the M&O and will be submitted on October 29, 1994, to DOE for 6.2 review and Acceptance For Construction. Maintain installation records for future evaluation of the steel sets fabrication and installation, and for final disposition of any steel sets installed in accordance with this disposition. The Constructor shall provide additional information regarding the specific deficiencies identified in this NCR.

By following the referenced specification the steel sets will remain accessible for inspection, and traceability will be maintained.

It is not anticipated that the steel sets will be removed, however, if necessary supplementary ground support will be installed.

10/28/94

ITEM 3

HIHGHME 1 3

CRWMS/M&O

Specification Cover Sheet

Complete only applicable items

1. WBS 1.2.6
QA QA
Page 1 Of 14

2. TITLE OF SPECIFICATION
STEEL SETS AND ACCESSORIES SUBSURFACE

3. DOCUMENT IDENTIFIER	4. REVISION NO.
BABEAB000-01717-6300-02341 REV 03	03

5. QA CLASSIFICATIONS
Includes permanent items classified QA-1 and QA-5.

THIS SPECIFICATION INCLUDES QA CONTROLS X YES ___ NO

TBV-192
TBV-193
TBD-147

6. Revision Number/Date	7. Pages Added	8. Pages Deleted	9. Description of Revision
00 04/13/94	11	0	Issue for Advance Procurement
01 06/24/94	0	0	Reissue for Advance Procurement Change "Contractor" to "Constructor" Article 1.01: delete "complete" after the "tunnel" Paragraph 1.03B1: change "93" to "91" Paragraph 1.03B2: change "90" to "93a" Paragraph 1.04B: include QA Classification and QA control information Paragraph 1.04C: delete "For Commercial Grade Items:" Paragraph 1.04F: delete "performed by the fabricator in the shop" Paragraph 1.04F1: delete "and all cut edges" and "for defects prior to welding in accordance with" add "Section 3.2" Paragraph 1.04F3: delete "shop" Paragraph 1.04F4: delete and renumber accordingly 1.04F4: change "approval" to "review and acceptance" and Paragraph numbers to "1.04F1, 1.04F2, and 1.04F3" Paragraph 1.04F5: change "100 percent" to "20 percent" Delete Paragraph 1.04F6 Paragraph 1.04G1: delete "All shop" change "100" to "20" add "by Constructor QC during installation" Paragraph 1.04G3: delete "All shop and field" change "100" to "Constructor's option and 20" add "A tension measuring device shall be required at the job site." Paragraph 1.04H: add "Accessories" and the codes to following for each test Paragraph 1.04I1a: change "10 tons" to "50 tons" and add "C8 shape" Paragraph 1.04I1b: change "two" to "five" and add "lagging C8"

		Date
10. ORIGINATOR	[signature]	10/28/94
11. CHECKER	John H Pye (FOR. E. SEDENIK	10/28/94
12. LDE	John H Pye	10/28/94
13. VERIFIER	Stanley O Bailey	10/28/94
14. DEPARTMENT MANAGER	[signature]	10/28/94
15. QUALITY ASSURANCE	[signature]	10/28/94

CRWMS/M&O

Specification Cover Sheet Continuation

WBS 1.2.6
QA QA
Page 2 Of 14

Complete only applicable items

2. TITLE
STEEL SETS AND ACCESSORIES SUBSURFACE

3. DOCUMENT IDENTIFIER
BABEAB000-01717-02341 REV 03

4. REVISION NO
03

5. Revision Number/Date	6. Pages Added	7. Pages Deleted	8. Description of Revision
01 06/24/94	0	0	Add Paragraph 1.04I1c and 1.04I1d Paragraph 2.02D1: change "1.04E" to "1.04F" Article 3.01: add "in the tunnel" and delete the last sentence Paragraph 3.02A: change "Paragraph 1.04F" to "1.04G.2 to 1.04G.3" Paragraph 3.04E1: change "plane of each set with in" to "of concrete segment or at" and "invert" to "concrete" Paragraph 3.04E2: change "locations as required by installation needs" to "610 mm (2 feet) centers and at the middle third of each invert segment" Paragraph 3.04G: delete "Correct poor" change "presence of the A/E" to "A E review" Paragraph 3.04H: add "blocking after installation of the steel sets" Add Paragraph 4.01E Constructor's records
02 07/11/94	0	0	Approved but not issued
03 10/28/94	2	0	Issue for Construction Extensive changes to text were made throughout the document to enhance, clarify, and facilitate the practicability and functionality of the construction and submittal process. This revision includes changes based on incorporation of a revision to the Material Dedication Analysis DI: BABEAB000-01717-0200-00003 REV 03 Added Paragraphs 1.03A2 and 1.03A3 Added Paragraphs 1.03B6, 1.03B8, 1.03B9, and 1.03B10 Added Paragraphs 1.03C3 and 1.03C4 Article 1.04 edited for clarification Added Paragraphs 1.05A and 1.05B Added Paragraph 1.06A Paragraph 2.01: Added listing of permanent components Paragraphs 2.01B, 2.01C, and 2.01D edited for clarification Paragraphs 2.02D1 and 2.02D2 added Paragraphs 3.01A and 3.01B expanded for clarification Added Paragraphs 3.03A1, 3.03A4, 3.03A6, 3.03B1, 3.03B2, 3.03D, and 3.03E Paragraphs 4.01A, 4.01B, and 4.01C expanded for clarification Deleted AISC S329-85, Added AISC M016-89, AISC M017-92, ASTM A 6/A 6M-916, ASTM A 53-93, ASTM F 606-90, AW A5.1-91, AWS A5.20-79, and YAP-15.1Q. Deleted Paragraphs 4.01D and 4.01E. Editorial revision change made throughout.

SECTION 02341

STEEL SETS AND ACCESSORIES SUBSURFACE

PART 1 GENERAL

1.01 SECTION INCLUDES

The work covered by this Specification Section includes the furnishing of all labor, materials and tools for fabrication, testing and inspection and delivery, as required, for the erection of steel set support systems in the Topopah Springs (TS) North Ramp as specified herein and as indicated on the Drawings.

1.02 RELATED SECTIONS

A. Division 1 General Requirements

B. Section 05121 Structural Steel and Miscellaneous Metal

1.03 REFERENCES

A. American Institute of Steel Construction, Inc. (AISC):

1.	AISC M016-89	Manual of Steel Construction, Allowable Stress Design, Ninth Edition
2.	AISC M017-92	Manual of Steel Construction, Volume II, Connections, ASD 9th Edition/LRFD 1st Edition.

B. American Society for Testing and Materials (ASTM):

1.	ASTM A36/A36M-91	Standard Specification for Structural Steel
2.	ASTM A307-93a	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
3.	ASTM A325-92a	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
4.	ASTM A370-92	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
5.	ASTM A490-93	Standard Specification for Heat-Treated Steel Structure Bolts, 150 ksi Minimum Tensile Strength
6.	ASTM A563-93	Standard Specification for Carbon and Alloy Steel Nuts

7.	ASTM F436-93	Standard Specification for Hardened Steel Washers
8.	ASTM A 6/A 6M-91b	Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
9.	ASTM A53-93	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
10.	ASTM F606-90	Standard Test Methods for Determining the Mechanical Properties of Externally and Internally threaded Fasteners, Washers, and Rivets

C. American Welding Society (AWS):

1.	AWS B2.1-84	Welding Procedure and Performance Qualification
2.	AWS D1.1-92	Structural Welding Code Steel, 13th Edition
3.	AWS A5.1-91	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
4.	AWS A5.20-79	Specification for Carbon Steel Electrodes for Flux Cored Arc Welding

1.04 QUALITY ASSURANCE

A. This Specification Section includes materials and activities classified as QA-1, QA-5, and QA-None. Individual quality assurance (QA) controls are designated "QA Control" and are underlined.

B. QA shall be conducted in accordance with Specification Section 01400 and applicable QA controls from other Specification Sections. QA Control: All inspections and test results shall be documented and made available to the Architect/Engineer (A/E).

C. Acceptance of Product

1. QA Control: Receipt Verification of Items Classified QA-1 and QA-5 that are purchased from a qualified source shall include:

a. Dimensional/visual inspection for conformance with Purchasing Documents which impose the requirements of this Specification Section and applicable steel set Drawings.

b. Verification that Certification Documents required by the Purchasing Documents are received, acceptable, and in accordance with the requirements of this Specification Section.

2. QA Control: Receipt Verification of Items Classified QA-1 and QA-5 that are purchased as commercial grade items shall include:

   a. Dimensional/visual inspection for conformance with Purchasing Documents which impose the requirements of this Specification Section and applicable steel set Drawings.

   b. Verification of received materials in accordance with material dedication requirements stipulated in Paragraph 1.04F.

3. Receipt Verification: Items without QA Classifications

   a. Dimensional/visual inspection for conformance with Purchasing Documents which impose the requirements of this Specification Section and applicable steel set Drawings.

   b. Documentation, as applicable, that the item was received and is in conformance with the Purchasing Documents and the requirements of this Specification Section.

D. QA Control: Field Verification

1. Verify that storage of materials is in accordance with manufacturer's recommendations and applicable paragraphs of Specification Section 01600.

2. Ensure that materials received are controlled to preclude inadvertent use of items prior to receipt verification.

3. Ensure materials that are purchased and accepted for use in QA applications are segregated from those like items purchased and accepted for use in Non-Q applications.

4. Ensure materials that are purchased and accepted for use in QA applications are identified to distinguish them from those like items purchased and accepted for use in Non-Q applications.

E. QA Control: Material dedication shall be conducted in accordance with Paragraphs 1.04C2, 1.04F, 1.04G, 1.04H, 1.04I, and 1.04J.

F. QA Control: For items purchased as commercial grade and accepted by materials dedication in accordance with Paragraphs 1.04C2, 1.04H, 1.04I, and 1.04J: materials test reports and Certificates of Conformance or Certificates of Compliance as required in this Specification Section shall be complete and acceptable (HOLD POINT) and retained as QA records.

G. QA Control: Inspection of Field Welding

1. Testing and inspection of field welding outside the tunnel and field cutting of the structural members of steel sets and accessories shall be performed in accordance with procedures developed by the Constructor that deal specifically with the items mentioned in this paragraph. These procedures shall be submitted for A/E review. (HOLD POINT)

H. QA Control: Mechanical Test of Steel Sets and Accessories

1. Mechanical testing of steel set members (W8 and C8 shapes, and plates) ASTM A36 material shall be in accordance with procedures described in ASTM A370. Tests to be included as a minimum: minimum tensile strength and minimum yield strength in accordance with Section 13 and a bend test in accordance with Section 14.

2. Mechanical testing of ASTM A307, ASTM A325 and ASTM A490 bolts shall be in accordance with the procedures described in ASTM A370 for a tensile strength test. ASTM A563 nuts shall be Proof Load tested in accordance with ASTM A370.

3. Mechanical testing of all- weld-metal material shall be in accordance with AWS A5.1 Section 11 or AWS A5.20 Section 1.4.2.

4. Mechanical testing of washers ASTM F436 shall be in accordance with ASTM F606 Section 5.

I. QA Control: Test Specimens

The following specimens shall be taken for each test specified herein:

1. Two specimens for each fifty tons or each heat lot or fraction thereof for steel sets (W8) and lagging (C8).

2. Two specimens for each five tons or each heat lot or fraction thereof for steel plate attachments to steel sets (W8) and lagging (C8), except for jacking brackets, wedges and shim plating.

3. Two specimens minimum for each 1000 pieces or fraction thereof for each diameter and grade of bolts and nuts and washers used.

4. Two specimens for each heat lot or fraction thereof for carbon steel electrodes.

J. QA Control: Welding shall be inspected by Constructor QC using nondestructive methods as follows:

1. Material to be welded (W8 and C8 shapes and steel plates) shall be visually inspected and shall be in accordance with AWS D1.1 Section 3.2.

2. One hundred percent of all welds shall be visually inspected in accordance with AWS D1.1 Sections 6 and 9.25.

3. Visual inspection of welds shall be performed by personnel who have been certified to perform welding inspections as described in AWS D1.1 Section 6.1.3.

4. A minimum of ten percent of all welds in each steel set shall be magnetic particle inspected in accordance with AWS D1.1 Section 6, Subsection 6.7.6, and Section 9.25. The welds to be randomly tested shall be selected in accordance with a Constructor approved plan. Test results shall be QA records and made available to the A/E.

K. QA Control: Connection for utility brackets to steel sets shall be bolted. Bolt holes in the steel sets shall be field drilled in accordance with Paragraph 3.01B. One Hundred percent of the total number of field drilled holes shall be visually inspected by Constructor QC.

L. QA Control: Wedges, shims, pipe spacers, blocking, clip plates, and all permanent items shall be inspected for the following:

1. Dimensional/visual inspection of received items shall be in accordance with the referenced Specification Sections or approved shop Drawings.

M. QA Control: Bolted Connections

1. QA Control: A minimum of 2 bolts or ten percent of the bolts in a connection, whichever is greater, for all bolted connections using ASTM A307 or ASTM A325 bolts shall be visually inspected as snug tightness during construction (snug tightness shall be in accordance with AISC).

2. The Constructor may use ASTM A490 bolts in lieu of ASTM A307 or ASTM A325 with the approval of the A/E.

3. QA Control: All bolted connections using ASTM A490 bolts shall be tightened to a bolt pretension not less than the following:

Bolt Size	A490 Bolts
3/4"	35,000 lbs.
7/8"	49,000 lbs.
1"	64,000 lbs.
1-1/8"	80,000 lbs.

4. QA Control: A minimum of 2 bolts or ten percent of the bolts in a connection, whichever is greater, for all bolted connections using ASTM A490 bolts, shall be inspected for proper tightening by a direct tension indicator. A calibrated tension measuring device shall be required at the job site. Inspection results shall be documented and records made available to the A/E.

N. QA Control: Jack mounting and jacking 25 tons maximum capacity

1. One hundred percent of the jack mounting shall be dimensionally inspected to ensure that the center of the jack cylinder shall be within 6 inches from X-axis and in line with

Y-axis of W8X31 steel set (X and Y axes shall be in accordance with Paragraph 1.03A2).

2. The jacking capacity shall be tested and limited by the Constructor so that 25 tons is the ultimate maximum force that shall not be exceeded during jacking operation.

1.05 DEFINITIONS

A. Perpendicular steel set alignment: Alignment of steel set system perpendicular to the designed tunnel grade.

B. The following components of steel sets are permanent.

1. Steel Set
2. Steel lagging
3. Tie rod and pipe spacer
4. Steel set foot plate
5. Steel set connection to insert
6. Connection to steel set segment
7. Insert
8. Steel set foot segment
9. Shim plate
10. Steel wedges.

C. The following components of steel sets are temporary:

1. Jacking brackets assembly and bolted connection to steel set
2. Anchor bolt to precast concrete.

1.06 SYSTEM DESCRIPTION

A. The steel set system, including permanent and temporary items, provides immediate support for personnel safety after installation. The permanent function steel set system provides maintainable, long-term ground support in the TS North Ramp for up to 100 years (TBV-192).

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL AND OTHER PERMANENT COMPONENTS

A. QA Control: Structural Steel Sets and Associated Permanent Components shall be of the following materials:

1. Steel Set - W8 Shape - ASTM A36
2. Steel lagging - C8 Shape - ASTM A36
3. Tie rod and pipe spacer - Tie Rod ASTM A307, Pipe ASTM A53 Gr B
4. Steel set foot plate - ASTM A36

5. Steel set connection to insert - ASTM A36
6. Connection to steel set segment - ASTM A36
7. Insert - ASTM A36
8. Steel set foot segment - ASTM A36
9. Shim plate - ASTM A36
10. Steel wedges - ASTM A36.

B. QA Control: All bolts and tie rods shall be ASTM A307 or A325 with heavy hex, grade DH ASTM A563 nuts and Type-1 washers in accordance with ASTM F436 unless indicated otherwise on the Drawings.

1. High strength bolts at Constructor's option shall be in accordance with the requirements of ASTM A490.

2. All bolts, nuts and washers shall be new.

C. QA Control: Welding materials shall conform to AWS A5.1 or A5.20 Series electrodes unless otherwise noted on the Drawings. Welding electrodes shall be E70XX.

D. Steel Sets and Associated Temporary Components:

1. Jacking Bracket - ASTM A36
2. Bolts - ASTM A307
3. Nuts - ASTM A563
4. Welding electrodes - E70XX.

2.02 FABRICATION

A. QA Control: Fabricate structural steel sets, shim plates, clip plates, insert assembly, lagging, tie rods, and end plates in accordance with the Drawings. Steel set shape shall be cold rolled.

B. QA Control: Bending Tolerances for Structural Steel Members

1. Rib segment assembly shall conform to true template at ends within tolerances stated herein. Ribs between end plates may depart from true template plus or minus 3/8 inch provided no point departs more than 1/8 inch in any 3 feet template length. The rib segment shall be of uniform contour.

2. Flanges shall be true to shape within established mill rolling tolerances except that after bending, the outer flange will be permitted to droop 1/8 inch maximum toward the inner flange. Flange droop will be in addition to any flange deviation allowed within mill rolling tolerances.

3. The web shall be true within established mill rolling tolerances, and free of cracks and wrinkles. Where radii of bends are 14 or more times the beam depth, buckling of the web for a distance of 1/2 the beam depth from each end will be permitted where deviation from flat does not exceed plus or minus 1/8 inch.

4. Depth of beam at web after bending can be a maximum of 1/4 inch less than the nominal depth.

5. Sweep in beams between end plates will be permitted within established mill rolling tolerances.

C. QA Control: Shop Fabrication Tolerances

1. The butt or foot plate after welding shall be within plus or minus 1/16 inch of square with respect to the Y-Y axis of the W8 members.

2. Tie rod holes in web of rib segment holes shall lie within plus or minus 3/8 inch of location shown on Drawings.

3. Mill rolling tolerances shall apply to the width of plates with milled edges in accordance with reference 1.03A.1, page 1-158. Width or length of sheared plates to be within plus or minus 1/8 inch of theoretical dimensions.

4. Groups of holes in joint plates after assembly shall lie within 1/8 inch of correct location irrespective of the variations which may exist in the beam as a result of allowable tolerances.

D. QA Control: Connections

1. QA Control: Welding shall be in accordance with Paragraph 1.03C.2. The Constructor shall maintain as QA records, documentation of welders' qualifications.

2. As verified and recorded per AWS B2.1, AWS D1.1 Part A5.1 and Part B C5.5. Records shall be made available to A/E.

E. Fabrication of temporary components shall conform to AISC standard practices, tolerance and Specification 05121.

2.03 FINISH

After fabrication, clean all structural steel of all weld slag, flux deposit, dirt, or other foreign matter. ASTM A53 pipe shall not be Hot-Dipped Zinc Coated.

PART 3 EXECUTION

3.01 FIELD CONNECTIONS

A. QA Control: Field connections in the TS North Ramp including mounting brackets for subsurface utilities, shall be bolted as indicated on the Drawings. Field welding to steel set is not permitted after installation. Field welding to steel sets outside the tunnel shall be considered a special process in accordance with Specification Section 01501.

B. QA Control: Field drilled holes in steel sets shall be located in accordance with the standard gage for W8X31, and nominal hole dimensions shall be in accordance with Table J3.1 of Reference in Paragraph 1.03A2 unless otherwise noted on the Drawings.

3.02 HIGH-STRENGTH BOLT INSTALLATION AND INSPECTION

A. QA Control: General: Installation and inspection of all high strength bolts, nuts, and washers shall be in accordance with the requirements of 1.03A1 and the requirements of Paragraphs 1.04M1 and 1.04M4.

B. QA Control: Fastener handling and storage shall be in accordance with Paragraph 1.04D1.

3.03 ERECTION

A. All steel sets shall be installed in accordance with the following criteria:

1. Once assembled and clear of the tunnel boring machine shield, the set shall be expanded against rock surfaces through jacking and the insertion of structural inserts and/or shims in each wall member as shown on the Drawings.

   QA Control: The steel sets shall be installed nominally to a perpendicular alignment (Paragraph 1.05A). The horizontal offset from plumb for a steel set shall not exceed 8 1/4 inches measured between the crown and base of the steel set . The Constructor shall submit for A/E review and approval an inspection plan to address the measurement of these tolerances (HOLD POINT)

2. The expansion of the sets shall be done so that the outside surface of the set system is forced to make positive contact with rock in the crown and walls to the extent practical.

3. QA Control: The Constructor shall submit a jacking/expansion process procedure to the A/E for review and acceptance to ensure controls in Paragraphs 1.04N1 and 1.04N2 shall be met and documented. (HOLD POINT)

4. During the steel set assembly, lagging shall be installed to control sloughing, spalling, or fallout of rocks in the crown and walls.

5. If at any time the steel set and lagging system fails to control rock sloughing, spalling or fallout in the tunnel crown and walls and a loosening of that system occurs, blocking and/or possibly additional lagging, shall be installed between the sets and rock and between the lagging and rock as required to ensure that the system is tightly in place.

6. The use of temporary wood blocking or wood wedges shall be minimized to the extent practical. Temporary wood block or wedges shall be untreated wood. QA Control: Any unrecovered wood blocking or wood wedges shall be recorded in accordance with the Tracer, Fluids, and Materials Plan.

7. QA Control: For each set, two expansion inserts shall be installed, one on the left rib and one on the right rib as shown on the Drawings. The inserts shall be installed so that the length of one insert plus shim plates does not exceed the length of the other insert and shim plates by more than 2 inches.

B. QA Control: Erection shall be in accordance with the following longitudinal tolerances along the tunnel axis:

1. Sets shall be placed on nominal 4 ft centers +/- 2 inches, or 2 ft centers +/- 2 inches.

2. Steel sets shall be placed so that the edge of the foot plate is no closer than 4 inches clear from invert segment joint. To avoid installation on the segment joint, the steel set can be spaced to avoid encroachment within 4 inches clear from the joint.

C. QA Control: Do not field cut or alter any structural members without A/E approval.

D. QA Control: The Constructor shall submit as-built information detailing the location of each steel set installed and a listing of all permanent components installed at each steel set to the A/E for information. The as-built records shall include the location and spacing of the steel sets along the tunnel, the areas fully or partially lagged, size and type of optional details and miscellaneous optional attachments incorporated on the steel set assembly.

E. QA Control: Redrilling the shop drilled holes to the next larger size will not be permitted without prior A/E approval.

F. Temporary erection bracing, clips, and other temporary blocking shall be removed after installation of steel sets.

PART 4 SUBMITTALS AND NOTIFICATION

4.01 SUBMITTALS

A. Submittals shall be in accordance with Specification Section 01300 and the attached Submittal and Notification Requirements sheet.

B. Any revision to submittals prepared in accordance with this Specification Section shall be forwarded for A/E review as specified in the original submittal.

C. The Constructor shall submit checked steel set shop drawings to the A/E for review. (HOLD POINT)

1. Indicate the profiles and sizes of all structural members. Indicate all hole sizes, spacings, and locations. Indicate all connections, attachments, anchorages, sizes, and types of fasteners.

2. Indicate all welded connections using standard AWS welding symbols. Indicate the net weld lengths, types, and sizes.

3. Identify bolted connections, clearly indicating the type, number, size, and location of all bolts. Clearly specify and label connections.

4. Submit for A/E review any materials or accessories to be considered an "or equal" commercial grade replacement for the specified product. The product submitted for evaluation will be reviewed for its equivalent minimum conformance to the specified product.

4.02 NOTIFICATION

Should any change in this Specification Section be required to comply with these requirements, the Constructor shall notify the A/E in writing for review.

SUBMITTAL AND NOTIFICATION REQUIREMENTS

ONLY APPLICABLE ITEMS ARE TO BE COMPLETED

SECTION NO. 02341

TITLE: Steel Sets and Accessories Subsurface

Requirements	Paragraph	STATUS: INFORMATION	STATUS: REVIEW	STATUS: CERTIFICATION	STATUS: RECORD	STATUS:	STATUS:	TIMING: PRIOR TO TESTING	TIMING: DAYS AFTER AWARD	TIMING: PRIOR TO FABRICATION	TIMING: PRIOR TO SHIPMENT	TIMING: WITH SHIPMENT	TIMING: PRIOR TO INSTALLATION	TIMING: DAILY REPORT	TIMING: AS DIRECTED	TIMING: PRIOR TO FINAL ACCEPTANCE	TIMING:	TIMING:	NOTIFICATION: WITNESS (DAYS)	NOTIFICATION: HOLD (DAYS)	NOTIFICATION:	NOTIFICATION:
C of C, C of C & MTR	1.04F				X						X	X							5		
Testing Inspection Procedure	1.04G		X		X			X		X								X	5		
Inspection Plan	3.03A.1		X		X								X						10		
Jacking Procedure	3.03A.3		X		X								X						10		
As-Built Info	3.03D	X			X										X						
Shop Drawings	4.01C		X		X					X								X	5		

COMMENTS:

END OF SPECIFICATION SECTION

ITEM 4

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8 CAR NO.: YM-95-008
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QA

CORRECTIVE ACTION REQUEST

1 Controlling Document	2 Related Report No.
MCP-4.0, Revision 4, MCP-7.0, Revision 4	YM-SR-95-011
3 Responsible Organization	**4 Discussed With**
REECo and Kiewit/PB	W. Glasser

5 Requirement:

1. MCP-4.0, Revision 4 "Procurement Document Control", Paragraph 3.3 "Review and Approval of Purchase Orders", states in part; "Those reviewers shall include personnel from the Technical and QA Organizations".

2. MCP-7.0, Revision 4, "Control of Purchased Items and Services", Paragraph 1.2 "Scope", states in part; "This procedure is applicable to procurements valued at $25,000 and under. Procurements valued at greater than $25,000 are conducted with established REECo procurement procedures".

6 Adverse Condition:
Contrary to the cited requirements:

1. Purchase Order (Kiewit/PB) 1785-0311 issued 9/26/94 to Commercial Pantex Sika for 21 each Steel Sets has no objective evidence that a Technical Review was performed prior to issuance.

2. Purchase Order 1785-0311 was issued on 9/26/94 by Kiewit/PB. The P.O. is in excess of $25,000.

9 Does a Significant Condition Adverse to Quality exist? Yes___ No X If Yes, Check One: ☐A ☐B ☐C ☐D ☐E	10 Does a stop work condition exist? Yes___ No X ; If Yes - Attach copy of SWO If Yes, Check One: ☐A ☐B ☐C	13 Response Due Date: 20 Days From Issuance

11 Required Actions: ☒ Remedial ☒ Extent of Deficiency ☒ Preclude Recurrence ☐ Root Cause Determination

12 Recommended Actions:

1. Perform those remedial actions necessary to correct the deficiencies identified in Item No. 6 above.

2. Determine the extent of like deficiencies, correct these, and report the results thereof.

7 Initiator Donald J. Harris Donald J. Harris 11/8/94	14 Issuance Approved by: QADD [signature] Date 11-10-94
15 Response Accepted QAR Date	16 Response Accepted QADD Date
17 Amended Response Accepted QAR Date	18 Amended Response Accepted QADD Date
19 Corrective Actions Verified QAR Date	20 Closure Approved by: QADD Date

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WASHINGTON, D.C.

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CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

13 Recommended Action(s) (continued)

3. Determine those actions necessary to preclude recurrence.

ITEM 5

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8 CAR NO.: YM-95-009
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CORRECTIVE ACTION REQUEST

1 Controlling Document	2 Related Report No.
Kiewit/PB Procedure SPP-008, Revision 2	YM-SR-95-011
3 Responsible Organization	**4 Discussed With**
REECo and Kiewit/PB	N. Glasser

5 Requirement:

Kiewit/PB Procedure SPP-008, Revision 2, "Welder/Welding Operator Performance Qualification", paragraph 3.0.2 states "Welder/Welding Operators Performance Qualification tests shall be conducted by the Kiewit/PB Welding Engineer or an approved Independent Testing Agency."

6 Adverse Condition:

Contrary to the above, Kiewit/PB utilized Hayes Testing Laboratory, Inc. to qualify welders from Commercial Pantex Sika who performed welding on the Steel Sets during the fabrication process.

Hayes Testing Laboratory has not been qualified for supplying these services in accordance with Kiewit/PB MCP 7.0, Revision 4, "Control of Purchases and Services."

9 Does a Significant Condition Adverse to Quality exist? Yes X No ___ If Yes, Check One: ☐A ☒B ☐C ☐D ☐E	10 Does a stop work condition exist? Yes ___ No X ; If Yes - Attach copy of SWO If Yes, Check One: ☐A ☐B ☐C	13 Response Due Date: 20 Days From Issuance

11 Required Actions: ☒ Remedial ☒ Extent of Deficiency ☒ Preclude Recurrence ☒ Root Cause Determination

12 Recommended Actions:

1. Perform those actions necessary to qualify the welders who performed welding on the Steel Sets. This could include the post qualification of Hayes Testing Laboratory or post qualifying the welders in accordance with the Kiewit/PB program.

7 Initiator	14 Issuance Approved by:
John S. Martin 11/8/94	QADD for Date 11.10.94
15 Response Accepted	16 Response Accepted
QAR Date	QADD Date
17 Amended Response Accepted	18 Amended Response Accepted
QAR Date	QADD Date
19 Corrective Actions Verified	20 Closure Approved by:
QAR Date	QADD Date

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8 CAR NO.: YM-95-009
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CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

13 Recommended Action(s) (continued)

2. Determine the extent of like deficiencies (i.e.; are there any other suppliers who should have been qualified for performing quality affecting services who were not) and report results thereof and planned corrective action.

3. Determine those actions necessary to preclude recurrence,

4. Determine root cause for this deficiency and report the results thereof.

ITEM 6

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8 CAR NO.: YM-95-010
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CORRECTIVE ACTION REQUEST

1 Controlling Document	2 Related Report No.
QARD - DOE/RW-0333P, Revision 1	YM-SR-95-011
3 Responsible Organization	**4 Discussed With**
REECo	W. Glasser

5 Requirement:

DOE/RW-0333P, Revision 1, "Quality Assurance Requirements and Description", Section No. 4 "Procurement Document Control" paragraph 4.2.1 C 3 states "When deemed appropriate, the purchaser shall permit some or all supplier work to be performed under the purchaser's quality assurance program provided the work is adequately addressed. In these cases, procurement documents shall specify that the purchaser's implementing documents are applicable to the supplier and that the purchaser shall provide these applicable documents to them."

REECo attempted to qualify Commercial Pantex Sika (CPS) and rejected them as supplier of quality services. As such, Kiewit/PB stipulated that their program Management Control Procedures (MCPs) be utilized by CPS in the manufacture of steel sets which are to be utilized as part of the ground support system for the Exploratory Studies Facility (ESF). Kiewit/PB stipulated these

6 Adverse Condition:

1. Contrary to the above, CPS did not utilize the Kiewit/PB MCP Procedures in the manufacture of the steel sets as stipulated in P.O. 1785-0311.

2. In addition, in review of the Kiewit/PB quality assurance program documents, it was found that they do not adequately address the manufacture of quality affecting items, and that in actuality CPS performed the manufacture of the steel sets under their normal manufacturing processes and procedures. The Kiewit/PB Quality Assurance program as implemented through their procedures, has been established and accepted by REECo as a constructor and not as a manufacturer.

   For example: Kiewit/PB quality program does not currently describe those programmatic controls necessary for the control of material dedication testing or the forming of Steel Shapes and plates.

9 Does a Significant Condition Adverse to Quality exist? Yes X No ___ If Yes, Check One: ☐A ☒B ☐C ☐D ☐E	10 Does a stop work condition exist? Yes ___ No X ; If Yes - Attach copy of SWO If Yes, Check One: ☐A ☐B ☐C	13 Response Due Date: 20 Days From Issuance

11 Required Actions: ☒ Remedial ☒ Extent of Deficiency ☒ Preclude Recurrence ☒ Root Cause Determination

12 Recommended Actions:

1. a.) Perform those actions necessary to qualify a program under which CPS may perform work.

   b.) Collect all documentation available for the manufacture of the steel sets and determine what actions are necessary to accept these items as "Q".

7 Initiator John S. Martin 11/8/94	14 Issuance Approved by: QADD Date 11.10.94
15 Response Accepted QAR Date	16 Response Accepted QADD Date
17 Amended Response Accepted QAR Date	18 Amended Response Accepted QADD Date
19 Corrective Actions Verified QAR Date	20 Closure Approved by: QADD Date

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QA

CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

5 Requirements (continued)
requirements in purchase Order No. 1785-0311.

13 Recommended Action(s) (continued)

Report results from 1 (a) and (b) above.

2. Determine the extent of like deficiencies and report the results thereof and the planned corrective action.

3. Determine those actions necessary to preclude recurrence.

4. Determine root cause for this deficiency and report results thereof.