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Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

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(Return to WM, 623-SS) sent 5/2/83 cz

Dr. Robert J. Wright
Senior Technical Advisor
High Level Waste Technical
Development Branch
Division of Waste Management
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Dr. Wright:

TRANSMITTAL OF BWIP INFORMATION - EXPLORATORY SHAFT CONSTRUCTION AND SEALING

My letter to you dated April 1, 1983, provided a summary report on BWIP Exploratory Shaft construction and sealing. This report was in response to NRC comments provided with the H. J. Miller to J. H. Anttonen letter dated January 13, 1983. The report also identified project documents which would be used for Exploratory Shaft development and when they would be available for project use. Attachment I is a revision to the summary report which corrects a number of errors in the original report; Attachment II is a listing of the revisions incorporated in this latest edition of Attachment I; Attachment III provides a listing of references from the report and their status; and Attachments IV, V, and VI are copies of project documents as requested.

If you have any questions on this material, please contact D. J. Squires of my staff.

Very truly yours,

R. P. Saget for

O. L. Olson, Project Manager
Basalt Waste Isolation Project Office

BWI:OLO

Attachments
(See following page for
list of attachments)

cc, w/o attach: M. W. Frei, DOE-HQ

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List of Attachments to letter, O. L. Olson to Robert J. Wright, Transmittal of BWIP Information - Exploratory Shaft Construction and Sealing, dated

Attachments:

I. Response to NRC Comments on BWIP Exploratory Shaft Construction and Sealing, Revision 1

II. List of Revisions incorporated in this latest edition of Attachment I

III. Listing of Reference Documents and Status

IV. B-314-C-X28048, Construction Specifications for Casing Cementing

V. B-314-C-X28038, Construction Specifications for Casing Field Welding Services

VI. No number available, DuPont Blasters Manual

ATTACHMENT I
REVISION 1

Enclosure to 4/29/83 ltr. from Olson to Wright

RESPONSE TO NUCLEAR REGULATORY COMMISSION COMMENTS ON BASALT WASTE ISOLATION PROJECT EXPLORATORY SHAFT CONSTRUCTION AND SEALING, H. J. MILLER LETTER TO J. H. ANTTONEN, DATED JANUARY 13, 1983

A. SHAFT CONSTRUCTION AND SEAL DESIGN CONSIDERATIONS

Comment

Provide an analysis of the potential effects of construction of the exploratory shaft on long-term sealing capabilities of the rock mass and identify factors that determine the nature and extent of such effects.

Response

The major effect of shaft construction on long term sealing capabilities of the rock is its creation of a disturbed rock zone (DRZ) around the periphery of the shaft due to redistribution of stresses after completion of the opening. If not properly sealed, the DRZ could provide a pathway for migration of nuclides from the repository. This is eliminated by the installation of seals at several locations along the length of the shaft. These seals will also prevent communication between major aquifers.

The Reference 1 document provides an analysis of the effects on rock mass permeability associated with the excavation of shafts and tunnels in fractured rock. This document relates to the Exploratory Shaft (ES) primarily from the standpoint of redistribution of stresses around the shaft opening resulting in a DRZ. The DRZ resulting from the drilling of the ES is insignificant compared to the effect from redistribution of stresses. Therefore, the controlling features of the shaft that affect long-term sealing are the shaft seal(s) emplaced upon decommissioning and the DRZ. The DRZ will be characterized as a portion of the ES test program and again after the liner is removed for post-closure sealing. These characterizations will consist of measurements of permeability and depth of the zone. Details will be included in the ES Test Plan (Reference 2). Seal performance requirements and design criteria are presented in Reference 3 to be released in July 1983. The performance requirements identified in this document were derived from Nuclear Regulatory Commission (NRC), U.S. Department of Energy (DOE), and Environmental Protection Agency (EPA) regulatory documents. In addition, a test plan (Reference 4) is being prepared to investigate the long term stability of proposed grout materials in the repository environment. This test program will determine the bond strength, permeability, and mechanical properties of various grouts and their degradation, if any, with exposure to temperature, clean basalt rock, mud-contaminated basalt rock, and the liner material.

After completion of the Phase II test program in the ES (Reference 2) and receipt of approval to decommission the facility, the shaft will be backfilled and sealed using the same techniques and procedures currently proposed for sealing the repository.

As currently proposed, a minimum of six (6) seals will be located in the ES; the two (2) primary isolation seals will be located in the competent basalt directly above the tunnel opening and in the entablature of the basalt flow directly above the horizon containing the Phase II tunnel system. The remaining seals will be placed below each of the major aquifers to eliminate communication between aquifers.

The methodology used for seal emplacement is described below:

- The integrity of the shaft seal around the liner is tested via portholes and core drilling prior to initiation of liner removal.
- The liner is removed at each seal location.
- Grout and debris are removed from the shaft wall.
- The shaft wall is characterized as to depth and permeability of the DRZ at the seal location.
- The disturbed zone is then injection grouted or removed, if necessary, to eliminate any major pathways around the seal.
- After seal emplacement (cement with basalt aggregate) the shaft is backfilled with crushed basalt to the level of the next seal.

The above procedure is repeated for each seal location until the shaft backfilling is completed.

References

(1) ONWI-411, Topical Report, Preliminary Evaluation of the Rock Mass Disturbance Resulting from Shaft, Tunnel, or Borehole Excavation, D'Appolonia (7/82)

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

(4) No Number Available, Exploratory Shaft Test Plan for Material Quality Control and Long Term Stability Assessment (7/83*)

Comment

Describe how the selected technique and shaft design accounts for limitations and uncertainties in long-term sealing considerations.

Response

This comment is interpreted as applying to the annulus shaft seals emplaced for long term operation and is addressed accordingly. The

*Expected date when document will be available

ES Test Plan (Reference 2) provides for physical examination of the shaft affected zone through the portholes in the liner. The shaft liner is designed for one and one-half times the hydrostatic head of water from the surface and is inspected to ensure that the fabricated liner meets the design requirements. The liner, grout, and seal ring are designed to last the useful life of the shaft but if problems develop, remedial grouting can be accomplished from inside the shaft. The design of the casing installation and casing cementing (References 5 and 6) ensure an appropriate seal between the casing and the rock formation during the operating phase of the ES. Reference 7 describes the past experience achieved with this type of seal. The blind hole boring technique is the least disruptive method of excavating the shaft. Once the shaft is excavated, the redistribution of stresses around the shaft is the most significant effect on the rock adjacent to the shaft. Therefore, the controlling feature that affects long term sealing during operations is the DRZ. The extent of the DRZ will be determined as a portion of the ES test program.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(5) No Number Available, M-K Procedure for Casing Handling, Aligning, and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(7) No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/ development (published)

Comment

Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.

Response

The potential leak paths which may affect shaft sealing performance are addressed in Reference 12. The design specifications for the ES are described in References 6, 8, 9, and 13. References 5 and 10 deal with emplacement of the shaft liner and grout. The seal test procedures (Reference 11) deal with evaluation of the effectiveness of the shaft seal and Reference 12 documents this

*Expected date when document will be available

evaluation. The documents referenced describe the seal to be placed and utilized during the operating phase of the ES. The performance requirements of the seal to be utilized for terminal isolation are presented in Reference 3.

References

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(9) B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(13) B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)

Comment

Describe the grout and chemical seal design.

Response

The grout and chemical seal design is described in the construction specification for casing cementing (Reference 6). The procedure for cementing (Reference 10) describes the approach used in placing the grout seal.

References

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

*Expected date when document will be available

Comment

Discuss the selected locations of the portholes. Include discussion of data on sealing characteristics to be gathered through the portholes.

Response

The supporting document (Reference 14) describes the selected locations for the portholes. The ES Test Plan (Reference 2) describes the tests to be conducted through portholes. The rationale for porthole locations is provided in Reference 14. The seal test procedures (Reference 11) describe the acquisition of data to be gathered through the portholes and the seal test report (Reference 12) will describe the test program conducted and present the data collected. This report will assess the suitability of the sealing technique utilized at the ES.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(14) SD-BWI-TI-119, Exploratory Shaft Test Porthole Configuration (6/83*)

Comment

Limitations and uncertainties associated with the (porthole) data.

Response

Data obtained through portholes will consist of geologic and geomechanics data based on extracted core, geochemical data based on water samples, and hydrologic data obtained via packer tests.

The next revision of the Exploratory Test Plan (due in 7/83) (Reference 2) will include additional discussion on the limitations and uncertainties of the hydrologic data obtainable through porthole testing.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

*Expected date when document will be available

B. CONSTRUCTION PLANS AND PROCEDURES

Comment

Identify the acceptance criteria for construction of the exploratory shaft.

Response

Specific acceptance criteria are contained in the project construction specifications (References, 5, 6, 8, 9, 13, 15, and 16). System acceptance criteria are contained in Reference 17.

References

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(9) B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)

(13) B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)

(15) B-314-P-S28004, Procurement Specification for 112" ID Steel Casing (published)

(16) B-314-B-X28028, Procurement Specification for Drilling Mud (published)

(17) No Number Available, ES Acceptance Test Procedure (10/83*)

Comment

Identify procedures used to minimize damage to the rock penetrated.

Response

The blind boring technique has been selected for shaft drilling (References 8 and 18) as the least damaging of the available methods. The cutters, mounted on the bit body, crush and grind the solid rock as the hole is deepened while exerting minimal pressure on the wall of the hole as drilling advances. Alternate methods of

*Expected date when document will be available

shaft sinking all employ explosives to dislodge and break up the solid rock. Blasting damage, even under controlled conditions, extends below and beyond the shaft perimeter. Irregardless of how the shaft is constructed, stress redistribution around the opening results in a DRZ (Reference 1). This DRZ is a function of the in situ state of stress and the shaft diameter. For construction of the shaft station (breakout), the engineering judgment of personnel experienced in underground mining operations will be employed using established (Reference 19) controlled blasting procedures. Detail procedures covering shaft station breakout requirements will be provided prior to breakout. These procedures will cover requirements for pilot boreholes, blasting technique, amount and depth of explosives, hole spacing, shooting sequence, and monitoring during blasting.

References

(1) ONWI-411, Topical Report, Preliminary Evaluation of the Rock Mass Disturbance Resulting from Shaft, Tunnel, or Borehole Excavation, D'Appolonia (7/82)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(19) No Number Available, DuPont Blasters Manual (published)

Comment

Identify liner construction and placement technique. Include information on topics such as: liner type, liner material testing, welding of liner, placement of liner. This information needs to be fully considered in application of any permanent sealing program.

Response

It is assumed that this comment refers to the operational ES liner system and is addressed accordingly.

The liner design and materials specifications, shop welding specifications, and shop inspection and testing procedures are detailed in References 13 and 15. Casing handling, field welding and inspecting, aligning, and installation procedures are documented in References 5, 8, and 9.

References

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

*Expected date when document will be available

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(9) B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)

(13) B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)

(15) B-314-P-S28004, Procurement Specification for 112" ID Steel Casing (published)

C. SEAL OR GROUTING PLAN AND PROCEDURES

Comment

Describe how the grouts and chemical seal are expected to perform in sealing the exploratory shaft. Describe tests done, both laboratory and field, to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment.

Response

The long term durability of the grout will be assessed as described in Reference 4.

Expanding cement (regulated fill cement) in conjunction with a chemical seal ring, a proprietary product of Dow Chemical, will be used to seal the ES from overlying aquifers during the operating phase. The low permeability expanding cement will provide the major barrier to water movement. The chemical seal ring which is activated by water will be used both above and below the shaft station to provide a gasket-like seal to minimize water in-leakage. The sealing subcontractor, Dowell, has provided a letter report discussing past laboratory testing and actual field experience in sealing boreholes and large diameter shafts (Reference 7). The specification for casing cement is described in Reference 6. The seal described for the ES is planned to be used only during the operating phase. If during the operating phase remedial grouting or repairs are required, then these will be performed from inside the shaft. During the isolation phase another seal will be emplaced which may involve removal of portions of the liner and grout. The seal for terminal isolation has not been designed at this time. Refer to Reference 3 for terminal seal development program.

References

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

*Expected date when document will be available

(4) No Number Available, Exploratory Shaft Test Plan for Material Quality Control and Long Term Stability Assessment (7/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(7) No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/ development (published)

Comment

Describe the placement methods to be used including the limitations and uncertainties of the methods.

Response

The construction specification for casing cementing (Reference 6), the procedure for grout emplacement (Reference 10), and the Dowell report (Reference 7) describe the grout and seal placement. One of the objectives of the ES and associated test programs (Reference 2) is to determine limitations and uncertainties of the grout placement method which would be used for the repository shafts.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(7) No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/ development (published)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

Comment

Describe remedial methods to be used if sealing methods are not adequate.

Response

Reference 20 provides guidance for remedial actions which have been effective in other locations and materials similar to those expected to be encountered at the Hanford Site. Reference 21 provides a description of the currently planned remedial actions for those problems most likely to be encountered based upon the information

*Expected date when document will be available

contained in Reference 20. Data obtained during shaft excavation will allow further refinement of current plans.

References

(20) No Number Available, Amchitka Mining History, Fenix and Scisson (1973)

(21) Letter #R83-0283.1, Contingency Plan for Anomaly Detection and Resolution During Exploratory Shaft Construction (1/83)

D. TESTING AND INSPECTION PLANS AND PROCEDURES

Comment

Describe test and inspection procedures to be used during drilling (e.g., plumbness of hole, drill mud loss, drill bit inspection, etc.) to determine acceptability of the shaft as constructed and to obtain adequate information on this construction technique.

Response

The following test and inspection procedures will be used during drilling:

A. Plumbness of Hole

The plumbness of the drilled hole will be checked every 30 feet of drilled hole using a gyroscopic survey. The actual procedure is contained in Morrison-Knudsen Company, Inc. (M-K) Reference 24 submitted to DOE/Rockwell for review on February 24, 1983.

The tolerances of the plumbness of the hole are: The center of the bottom of the hole shall not be displaced from the center of the top of the hole by more than 3 feet in any direction, and no point on the centerline along the length of the hole shall be more than 2.5 feet from a straight line drawn from the center of the top of the hole to the center of the bottom of the hole.

A graph of the hole deviation will be maintained in the M-K site trailer and updated as new surveys are completed.

B. Drill Mud Loss

The mud level in the pits is monitored at each weir by observing the fluid level as indicated on a staff. The mud engineer and drill crew personnel monitor this level at frequent intervals during each shift. A loss of drilling mud would show up as a net drop in level at the final pit.

A float device to monitor the mud level in either the final section of the mixing tank or the last mud pit is in the final design and early procurement stage. This float device will sound an alarm in the drill rig operating floor should the mud level fall below a preset level.

C. Drill Bit Inspection

The drill bits will be inspected each time the drill string is removed from the hole. There is a planned inspection at the end of the first 100 drilling hours as required by Reference 25. The indicated schedule may be revamped following the first inspection if excessive wear conditions are indicated. Additional inspections will be performed whenever the drilling subcontractor or drilling consultant determines that there could be a problem with the bits. Bit problems usually show up as excessive vibration of the drill rig or a substantial decrease in the penetration rate.

The details of the drill bit inspection program (Reference 26) are currently being defined and reviewed in the M-K BWIP organization and will be submitted to DOE/Rockwell by June 1983.

Reference 22 describes the QA procedures for internal M-K activities; included, also, are procedures for exercising control over subcontractors by the CM. M-K has prepared a drilling QA (inspection) plan (Reference 18), which has been submitted to Rockwell for review.

Rockwell QA has prepared surveillance plans for drilling activities (Reference 23). Additional surveillance plans will be available for post-drilling activities by 6/30/83.

QA technical requirements for sealing will be incorporated in Reference 3.

References

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(24) No Number Available, Sperry Sun Survey Procedure (2/83)

(25) SD-BWI-AR-003, M-K/BWIP ES Phase I Drilling Program for 144" Hole (published)

(26) No Number Available, Drill Bit Inspection Program (6/83*)

*Expected date when document will be available

Comment

Describe test and inspection procedures to be used after completion of drilling and during the sealing of the shaft. Include information such as caliper surveys, grout injection rate, grout level sensor, cement bond log, thermal measurements during curing, etc.

Response

The following tests and inspections are planned to be made following the completion of drilling on the 144" surface hole:

1. Caliper surveys

    a. Mechanical survey
    b. Sonic survey each foot (tentative)

2. The grout injection rate will be monitored by the grouting subcontractor, the method will be presented in the grouting procedure (Reference 36) to be submitted by June 1983.

3. The grout level sensing will be performed by a density log performed through one of the grout lines.

4. The grout bond logs will be performed by a sonic survey (tentative).

5. There are no current plans to perform thermal measurements downhole during the grout curing on the 144" surface hole.

The procedures for items 1 through 4 are being prepared for the 144" surface hole (Reference 27) and will be published by June 1983 for the 110" diameter hole (Reference 28).

Caliper surveys/loggings are performed in conjunction with the drilling operation (Reference 8). Additional precision alignments will be required by Reference 5 (during liner installation). The testing requirements for grout installation are provided in Reference 6. The procedure to be used for grout emplacement is described in Reference 10. The procedure to determine the grout effectiveness and lab testing of cores of the grout emplaced is described in Reference 11. The details of grout injection, grout level sensors, cement bond log will be provided in a shaft seal report as defined in Reference 12. There will be no thermal measurements conducted during curing as these are inappropriate since the grout will be injected under water. The construction inspection and testing will be in accordance with QA program plans listed as References 22 and 23.

References

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(27) No Number Available, Post Drilling Inspection Procedure for 144" Hole (6/83*)

(28) No Number Available, Post Drilling Inspection Procedure for 110" Hole (6/83*)

(36) No Number Available, Grouting Procedure (6/83*)

Comment

Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects. Include information such as grout strength tests, visual identification of seal conditions, records of water inflow, assessment of seal bond to host rock, physical logging of drill holes, photo or t.v. camera methods in all portholes.

Response

The ES Test Plan (Reference 2) lists requirements for assessing the shaft seal. The techniques to be utilized for shaft seal verification will be developed in the Near-Surface Test Facility and will result in a shaft seal test procedure (Reference 11). The results of the shaft seal testing will be documented in the shaft seal report (Reference 12). Photo or television camera logging of the holes drilled through the portholes is not planned at this time. Testing will be conducted in accordance with QA plans listed as References 22 and 23.

*Expected date when document will be available

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

E. PLANS AND PROCEDURES FOR GATHERING SPECIFIC INFORMATION RELATED TO SITE CHARACTERIZATION

Comment

Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft.

Response

The revised ES Test Plan (Reference 2) will describe the tests which will be conducted to characterize the proposed repository site. The objectives presented in the plan are directly related to the work elements in the Site Characterization Report (SCR). The revised ES Test Plan will describe in detail how each objective will be attained and relate how the test results will resolve the applicable work elements of the SCR.

The ES Test Plan (Reference 2) describes the requirements for a principal borehole which will be used to characterize the site prior to construction of an ES. The borehole test report documenting the results of the principal borehole is currently available (Reference 29). A matrix in the ES Test Plan will identify the relevant work elements in the Site Characterization Report which will be addressed during the ES construction and testing. Hydrologic and geomechanics data to be utilized for site characterization will be collected as described in the ES Test Plan (Reference 2) and will be reported in test reports at the conclusion of the ES testing program (References 30 and 31).

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(29) SD-BWI-TI-113, Principal Borehole Report, Borehole RRL-2 (1/83)

*Expected date when document will be available

(30) No Number Available, Hydrologic Test Report (1985*)

(31) No Number Available, Geomechanics Test Report (1985*)

Comment

Will hydrologic conditions (heads) in nearby drill holes be measured during shaft construction to help understand bulk hydrologic properties?

Response

The hydrologic conditions in borehole RRL-2 will be monitored as the ES is drilled from the Vantage to total depth. The borehole RRL-2 is cased down to the Vantage and is, therefore, not available for testing above that horizon. The test specification for RRL-2 will be revised (Reference 32) to include monitoring the heads from the Vantage interbed to total depth.

References

(32) SD-BWI-TC-001, Rev. 1-0, Test Procedure for the Principal Borehole RRL-2 (6/83*)

Comment

Will the following be monitored: Sampling of drill cuttings, bit thrust, torque, rate of advance, slurry weight, speed of rotation, pumping pressure, water inflow? This information can be used to detect and/or explain anomalies encountered?

Response

The following parameters will be monitored during drilling:

A. Drill cuttings will be taken from the blooie tube (cuttings discharge line) at selected elevations. Each sample will be about 5 pounds and will be appropriately washed and labeled.

B. Recorded Drill Rig Information

The following information will be continuously recorded on the Tolco recorder unit on the drill rig:

1. Weight of drill assembly hanging from the main hook. From this number, the bit thrust will be calculated and recorded in the Morrison-Knudsen Company, Inc. (M-K) daily log by the shift supervisor each time the thrust changes and each shift in the daily International Association of Drilling Contractors (IADC) report.

2. The rotary table torque.

3. The rate of bit advance.

4. The air pressure.

*Expected date when document will be available

C. Slurry Weight

The slurry weight will be monitored by the mudding subcontractor and recorded in his daily log as required by the Drilling Mud Program - 144" Surface Hole (Reference 34) released February 11, 1983.

D. IADC Log

The IADC log, kept daily by the drilling subcontractor, records the speed of rotation and the compressed air pressure.

The ES Test Plan (Reference 2) specifies that certain parameters be monitored during drilling operations. Additional parameters identified in this information request will be monitored with the exception of water inflow since the hole is already filled with water. Water inflows have been measured in the RRL-2 borehole (Reference 29). The drilling will be conducted in accordance with the specification (Reference 8) and procedure for drilling (Reference 18). The data from the drilling activity will be presented in the drilling test report (Reference 33) at the conclusion of the drilling program and will provide a complete history of the ES drilling activities.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(29) SD-BWI-TI-113, Principal Borehole Report, Borehole RRL-2 (1/83)

(33) No Number Available, Drilling Test Report (1984*)

(34) SD-BWI-AR-002, M-K/BWIP ES Phase I Drilling Mud Program, 144" Hole (published)

Comment

Identify all parameters to be measured and methods of measurement.

Response

The ES Test Plan (Reference 2) will identify the parameters to be measured to meet the objectives of the test plan. Additional parameters such as rotary table torque, bit load, rate of advance, speed of rotation, will be measured as a normal part of drilling

*Expected date when document will be available

activities (Reference 18). The rig to be used for the ES drilling contains all instrumentation necessary to measure these parameters. The drilling test report (Reference 33) will include the results from the drilling program.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(33) No Number Available, Drilling Test Report (1984*)

F. QUALITY ASSURANCE (QA) - ADMINISTRATIVE PROCEDURES

Comment

Identify the line of responsibility for implementing QA procedures down to and including the construction contractor.

Response

Line of responsibility for QA is described in the Project Management Plan for the ES-Phase I (Reference 35) and the DOE QA Plan (Reference 37). The Rockwell QA Program Plan (Reference 23) further identifies the specific QA requirements for the ES. The construction manager's QA program is described in Reference 22.

References

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(35) SD-BWI-PMP-002, Project Management Plan for Exploratory Shaft-Phase I (ES-I) (6/83*)

(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)

Comment

Identify the procedures for monitoring and implementing the QA program by the Quality Assurance organization of exploratory shaft design, construction and testing.

Response

The QA Program Index (Appendix A of Reference 23) identifies the specific BWIP operating procedures which are used for auditing and

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surveillance of the QA program for the ES. The construction manager QA program plan is identified as Reference 22. Specific test/inspection procedures are listed in Appendix A of Reference 23. The DOE overview and auditing of the entire Basalt Waste Isolation Project QA program is detailed in Reference 37.

References

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)

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REVISION 1 TO ATTACHMENTS TO LETTER FROM O. L. OLSON
TO DR. ROBERT J. WRIGHT, DATED APRIL 1, 1983

A. Changes to Attachment I

1) Page 1 - Add the following title: RESPONSE TO NUCLEAR REGULATORY COMMISSION COMMENTS ON BASALT WASTE ISOLATION PROJECT EXPLORATORY SHAFT CONSTRUCTION AND SEALING, H. J. MILLER LETTER TO J. H. ANTTONEN, DATED JANUARY 13, 1983.

2) Page 1 - Under Response, second paragraph, eleventh and twelfth lines - Change "characterization" to "characterizations."

3) Page 2 - Delete the first paragraph and add the following: As currently proposed, a minimum of six (6) seals will be located in the ES: the two (2) primary isolation seals will be located in the competent basalt directly above the tunnel opening and in the entablature of the basalt flow directly above the horizon containing the Phase II tunnel system. The remaining seals will be placed below each of the major aquifers to eliminate communication between aquifers.

4) Page 2 - Reference (2) - Change "(7/83*)" to "(10/83*)."

5) Page 3 - Reference (2) - Change "(7/83*)" to "(10/83*)."

6) Page 4 - Reference (10) (two places) - Change "(published)" to "(5/83*)."

7) Page 5 - Under Response, top of page, third line - Change "rational" to "rationale."

8) Page 5 - Reference (2) (two places) - Change "(7/83*)" to "(10/83*)."

9) Page 6 - Under References - Change "(14)" to "(13)."

10) Page 7 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

11) Page 9 - Reference (2) - Change "(7/83*)" to "(10/83*)."

12) Page 9 - Reference (10) - Change "(published)" to "(5/83*)."

13) Page 11 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

14) Page 11 - Under Item C, Drill Bit Inspection, third paragraph - Delete the sentence "This document has been submitted to DOE-RL for approval."

15) Page 11 - Reference (22) - Change "(4/83*)" to "(4/83)."

16) Page 11 - Reference (23) - Change "(4/83*)" to "(4/83)."

17) Page 11 - Reference (25) - Add "(published)."

18) Page 11 - Reference (26) - Change "(6/83)" to "(6/83*)."

19) Page 12 - Under Response, Item 2 - Change "(Reference 31)" to "(Reference 36)."

20) Page 13 - Reference (10) - Change "(published)" to "(5/83*)."

21) Page 13 - Reference (22) - Change "(4/83*)" to "(4/83)."

22) Page 13 - Reference (23) - Change "(4/83*)" to "(4/83)."

23) Page 13 - Under References - Add "(36) No Number Available, Grouting Procedure (6/83*)."

24) Page 14 - Reference (2) (two places) - Change "(7/83*)" to "(10/83*)."

25) Page 14 - Reference (22) - Change "(4/83*)" to "(4/83)."

26) Page 14 - Reference (23) - Change "(4/83*)" to "(4/83)."

27) Page 15 - Reference (32) - Change "Test Specification for RRL-2" to "Test Procedure for the Principal Borehole RRL-2."

28) Page 16 - Reference (2) - Change "(7/83*)" to "(10/83*)."

29) Page 16 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

30) Page 16 - Reference (34) - Add "(published)."

31) Page 17 - Under Response, top of page, first sentence - Change "....for the ES-Phase I (Reference 35)" to "....for the ES-Phase I (Reference 35) and the DOE QA Plan (Reference 37)."

32) Page 17 - Under Response, top of page, second sentence - Change "The QA Program Plan (Reference 23)...." to "The Rockwell QA Program Plan (Reference 23)...."

33) Page 17 - Reference (2) - Change "(7/83*)" to "(10/83*)."

34) Page 17 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

35) Page 17 - Reference (22) - Change "(4/83*)" to "(4/83)."

36) Page 17 - Reference (23) - Change "(4/83*)" to "(4/83)."

37) Page 17 - Reference (35) - Change "Project Management Plan for Exploratory Shaft (6/83*)" to "Project Management Plan for Exploratory Shaft - Phase I (ES-I) (6/83*)."

38) Page 17 - Under References, bottom of page - Add "(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)."

39) Page 18 - Add the following sentence to the end of the first paragraph: The DOE overview and auditing of the entire Basalt Waste Isolation Project Quality Assurance Program is detailed in Reference (37).

40) Page 18 - Reference (22) - Change "(4/83*)" to "(4/83)."

41) Page 18 - Reference (23) - Change "(4/83*)" to "(4/83)."

42) Page 18 - Under References - Add "(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)."

B. Changes to Attachment II

The changes which have been incorporated into Attachment I, Revision 1, also affect Attachment II which has been rewritten and is provided as Attachment III.

REFERENCE DOCUMENTS

The following reference documents were transmitted to the Nuclear Regulatory Commission (NRC) on February 25, 1983 by U.S. Department of Energy-Richland Operations Office (DOE-RL):

Reference No.	Title
1	ONWI-411, Topical Report, Preliminary Evaluation of Rock Mass Disturbance Resulting from Shaft, Tunnel, or Borehole Excavation, D'Appolonia (7/82)
7	No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/development (published)
8	B-314-C-X28018, Construction Specification for Shaft Boring (published)
13	B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)
15	B-314-P-S28004, Procurement Specification for 112" ID Steel Casing (published)
16	B-314-B-X28028, Procurement Specification for Drilling Mud (published)
20	No Number Available, Amchitka Mining History, Fenix and Scisson (1973)
21	Letter #R83-0283.1, Contingency Plan for Anomaly Detection and Resolution During Exploratory Shaft Construction (1/83)
24	No Number Available, Sperry Sun Survey Procedure (2/83)
25	SD-BWI-AR-003, M-K/BWIP ES Phase I Drilling Program for 144" Hole (published)
29	SD-BWI-TI-113, Principal Borehole Report, Borehole RRL-2 (1/83)
34	SD-BWI-AR-002, M-K/BWIP ES Phase I Drilling Mud Program, 144" Hole (published)

The following reference documents were transmitted to the NRC April 1, 1983 by DOE-RL:

Reference No.	Title
22	No Number Available, M-K QA Plan (4/83)
23	RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

The following reference documents are submitted with this transmittal:

Reference No.	Title
6	B-314-C-X28048, Construction Specification for Casing Cementing (published)
9	B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)
19	No Number Available, DuPont Blasters Manual (published)

The following documents will not be available until later in the program as indicated by the dates after each reference:

Reference No.	Title
2	SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)
3	SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)
4	No Number Available, Exploratory Shaft Test Plan for Material Quality Control and Long Term Stability Assessment (7/83*)
5	No Number Available, M-K Procedure for Casing Handling, Aligning, and Running (Note: This procedure will be prepared for the 112" casing intially. A separate procedure will then be developed for the 72" casing.) (6/83*)
10	No Number Available, M-K Procedure for Cementing (5/83*)
11	No Number Available, Seal Test Procedure (9/83*)
12	No Number Available, Shaft Seal Report (1985*)

*Expected date when document will be available

Reference No.	Title
14	SD-BWI-TI-119, Exploratory Shaft Test Porthole Configuration (6/83*)
17	No Number Available, ES Acceptance Test Procedure (10/83*)
18	No Number Available, M-K Drilling Program, 110" Hole (6/83*)
26	No Number Available, Drill Bit Inspection Program (6/83*)
27	No Number Available, Post Drilling Inspection Procedure for 144" Hole (6/83*)
28	No Number Available, Post Drilling Inspection Procedure for 110" Hole (6/83*)
30	No Number Available, Hydrologic Test Report (1985*)
31	No Number Available, Geomechanics Test Report (1985*)
32	SD-BWI-TC-001, Rev. 1-0, Test Procedure for the Principal Borehole RRL-2 (6/83*)
33	No Number Available, Drilling Test Report (1984*)
35	SD-BWI-PMP-002, Project Management Plan for Exploratory Shaft-Phase I (ES-I) (6/83*)
36	No Number Available, Grouting Procedure (6/83*)
37	No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)

*Expected date when document will be available

RESPONSE TO NUCLEAR REGULATORY COMMISSION COMMENTS ON BASALT WASTE ISOLATION PROJECT EXPLORATORY SHAFT CONSTRUCTION AND SEALING, H. J. MILLER LETTER TO J. H. ANTTONEN, DATED JANUARY 13, 1983

A. SHAFT CONSTRUCTION AND SEAL DESIGN CONSIDERATIONS

Comment

Provide an analysis of the potential effects of construction of the exploratory shaft on long-term sealing capabilities of the rock mass and identify factors that determine the nature and extent of such effects.

Response

The major effect of shaft construction on long term sealing capabilities of the rock is its creation of a disturbed rock zone (DRZ) around the periphery of the shaft due to redistribution of stresses after completion of the opening. If not properly sealed, the DRZ could provide a pathway for migration of nuclides from the repository. This is eliminated by the installation of seals at several locations along the length of the shaft. These seals will also prevent communication between major aquifers.

The Reference 1 document provides an analysis of the effects on rock mass permeability associated with the excavation of shafts and tunnels in fractured rock. This document relates to the Exploratory Shaft (ES) primarily from the standpoint of redistribution of stresses around the shaft opening resulting in a DRZ. The DRZ resulting from the drilling of the ES is insignificant compared to the effect from redistribution of stresses. Therefore, the controlling features of the shaft that affect long-term sealing are the shaft seal(s) emplaced upon decommissioning and the DRZ. The DRZ will be characterized as a portion of the ES test program and again after the liner is removed for post-closure sealing. These characterizations will consist of measurements of permeability and depth of the zone. Details will be included in the ES Test Plan (Reference 2). Seal performance requirements and design criteria are presented in Reference 3 to be released in July 1983. The performance requirements identified in this document were derived from Nuclear Regulatory Commission (NRC), U.S. Department of Energy (DOE), and Environmental Protection Agency (EPA) regulatory documents. In addition, a test plan (Reference 4) is being prepared to investigate the long term stability of proposed grout materials in the repository environment. This test program will determine the bond strength, permeability, and mechanical properties of various grouts and their degradation, if any, with exposure to temperature, clean basalt rock, mud-contaminated basalt rock, and the liner material.

After completion of the Phase II test program in the ES (Reference 2) and receipt of approval to decommission the facility, the shaft will be backfilled and sealed using the same techniques and procedures currently proposed for sealing the repository.

As currently proposed, a minimum of six (6) seals will be located in the ES; the two (2) primary isolation seals will be located in the competent basalt directly above the tunnel opening and in the entablature of the basalt flow directly above the horizon containing the Phase II tunnel system. The remaining seals will be placed below each of the major aquifers to eliminate communication between aquifers.

The methodology used for seal emplacement is described below:

- The integrity of the shaft seal around the liner is tested via portholes and core drilling prior to initiation of liner removal.
- The liner is removed at each seal location.
- Grout and debris are removed from the shaft wall.
- The shaft wall is characterized as to depth and permeability of the DRZ at the seal location.
- The disturbed zone is then injection grouted or removed, if necessary, to eliminate any major pathways around the seal.
- After seal emplacement (cement with basalt aggregate) the shaft is backfilled with crushed basalt to the level of the next seal.

The above procedure is repeated for each seal location until the shaft backfilling is completed.

References

(1) ONWI-411, Topical Report, Preliminary Evaluation of the Rock Mass Disturbance Resulting from Shaft, Tunnel, or Borehole Excavation, D'Appolonia (7/82)

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

(4) No Number Available, Exploratory Shaft Test Plan for Material Quality Control and Long Term Stability Assessment (7/83*)

Comment

Describe how the selected technique and shaft design accounts for limitations and uncertainties in long-term sealing considerations.

Response

This comment is interpreted as applying to the annulus shaft seals emplaced for long term operation and is addressed accordingly. The

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ES Test Plan (Reference 2) provides for physical examination of the shaft affected zone through the portholes in the liner. The shaft liner is designed for one and one-half times the hydrostatic head of water from the surface and is inspected to ensure that the fabricated liner meets the design requirements. The liner, grout, and seal ring are designed to last the useful life of the shaft but if problems develop, remedial grouting can be accomplished from inside the shaft. The design of the casing installation and casing cementing (References 5 and 6) ensure an appropriate seal between the casing and the rock formation during the operating phase of the ES. Reference 7 describes the past experience achieved with this type of seal. The blind hole boring technique is the least disruptive method of excavating the shaft. Once the shaft is excavated, the redistribution of stresses around the shaft is the most significant effect on the rock adjacent to the shaft. Therefore, the controlling feature that affects long term sealing during operations is the DRZ. The extent of the DRZ will be determined as a portion of the ES test program.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(5) No Number Available, M-K Procedure for Casing Handling, Aligning, and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(7) No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/ development (published)

Comment

Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.

Response

The potential leak paths which may affect shaft sealing performance are addressed in Reference 12. The design specifications for the ES are described in References 6, 8, 9, and 13. References 5 and 10 deal with emplacement of the shaft liner and grout. The seal test procedures (Reference 11) deal with evaluation of the effectiveness of the shaft seal and Reference 12 documents this

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evaluation. The documents referenced describe the seal to be placed and utilized during the operating phase of the ES. The performance requirements of the seal to be utilized for terminal isolation are presented in Reference 3.

References

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(9) B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(13) B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)

Comment

Describe the grout and chemical seal design.

Response

The grout and chemical seal design is described in the construction specification for casing cementing (Reference 6). The procedure for cementing (Reference 10) describes the approach used in placing the grout seal.

References

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

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Comment

Discuss the selected locations of the portholes. Include discussion of data on sealing characteristics to be gathered through the portholes.

Response

The supporting document (Reference 14) describes the selected locations for the portholes. The ES Test Plan (Reference 2) describes the tests to be conducted through portholes. The rationale for porthole locations is provided in Reference 14. The seal test procedures (Reference 11) describe the acquisition of data to be gathered through the portholes and the seal test report (Reference 12) will describe the test program conducted and present the data collected. This report will assess the suitability of the sealing technique utilized at the ES.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(14) SD-BWI-TI-119, Exploratory Shaft Test Porthole Configuration (6/83*)

Comment

Limitations and uncertainties associated with the (porthole) data.

Response

Data obtained through portholes will consist of geologic and geomechanics data based on extracted core, geochemical data based on water samples, and hydrologic data obtained via packer tests.

The next revision of the Exploratory Test Plan (due in 7/83) (Reference 2) will include additional discussion on the limitations and uncertainties of the hydrologic data obtainable through porthole testing.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

*Expected date when document will be available

B. CONSTRUCTION PLANS AND PROCEDURES

Comment

Identify the acceptance criteria for construction of the exploratory shaft.

Response

Specific acceptance criteria are contained in the project construction specifications (References, 5, 6, 8, 9, 13, 15, and 16). System acceptance criteria are contained in Reference 17.

References

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(9) B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)

(13) B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)

(15) B-314-P-S28004, Procurement Specification for 112" ID Steel Casing (published)

(16) B-314-B-X28028, Procurement Specification for Drilling Mud (published)

(17) No Number Available, ES Acceptance Test Procedure (10/83*)

Comment

Identify procedures used to minimize damage to the rock penetrated.

Response

The blind boring technique has been selected for shaft drilling (References 8 and 18) as the least damaging of the available methods. The cutters, mounted on the bit body, crush and grind the solid rock as the hole is deepened while exerting minimal pressure on the wall of the hole as drilling advances. Alternate methods of

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shaft sinking all employ explosives to dislodge and break up the solid rock. Blasting damage, even under controlled conditions, extends below and beyond the shaft perimeter. Irregardless of how the shaft is constructed, stress redistribution around the opening results in a DRZ (Reference 1). This DRZ is a function of the in situ state of stress and the shaft diameter. For construction of the shaft station (breakout), the engineering judgment of personnel experienced in underground mining operations will be employed using established (Reference 19) controlled blasting procedures. Detail procedures covering shaft station breakout requirements will be provided prior to breakout. These procedures will cover requirements for pilot boreholes, blasting technique, amount and depth of explosives, hole spacing, shooting sequence, and monitoring during blasting.

References

(1) ONWI-411, Topical Report, Preliminary Evaluation of the Rock Mass Disturbance Resulting from Shaft, Tunnel, or Borehole Excavation, D'Appolonia (7/82)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(19) No Number Available, DuPont Blasters Manual (published)

Comment

Identify liner construction and placement technique. Include information on topics such as: liner type, liner material testing, welding of liner, placement of liner. This information needs to be fully considered in application of any permanent sealing program.

Response

It is assumed that this comment refers to the operational ES liner system and is addressed accordingly.

The liner design and materials specifications, shop welding specifications, and shop inspection and testing procedures are detailed in References 13 and 15. Casing handling, field welding and inspecting, aligning, and installation procedures are documented in References 5, 8, and 9.

References

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

*Expected date when document will be available

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(9) B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)

(13) B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)

(15) B-314-P-S28004, Procurement Specification for 112" ID Steel Casing (published)

C. SEAL OR GROUTING PLAN AND PROCEDURES

Comment

Describe how the grouts and chemical seal are expected to perform in sealing the exploratory shaft. Describe tests done, both laboratory and field, to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment.

Response

The long term durability of the grout will be assessed as described in Reference 4.

Expanding cement (regulated fill cement) in conjunction with a chemical seal ring, a proprietary product of Dow Chemical, will be used to seal the ES from overlying aquifers during the operating phase. The low permeability expanding cement will provide the major barrier to water movement. The chemical seal ring which is activated by water will be used both above and below the shaft station to provide a gasket-like seal to minimize water in-leakage. The sealing subcontractor, Dowell, has provided a letter report discussing past laboratory testing and actual field experience in sealing boreholes and large diameter shafts (Reference 7). The specification for casing cement is described in Reference 6. The seal described for the ES is planned to be used only during the operating phase. If during the operating phase remedial grouting or repairs are required, then these will be performed from inside the shaft. During the isolation phase another seal will be emplaced which may involve removal of portions of the liner and grout. The seal for terminal isolation has not been designed at this time. Refer to Reference 3 for terminal seal development program.

References

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

*Expected date when document will be available

(4) No Number Available, Exploratory Shaft Test Plan for Material Quality Control and Long Term Stability Assessment (7/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(7) No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/ development (published)

Comment

Describe the placement methods to be used including the limitations and uncertainties of the methods.

Response

The construction specification for casing cementing (Reference 6), the procedure for grout emplacement (Reference 10), and the Dowell report (Reference 7) describe the grout and seal placement. One of the objectives of the ES and associated test programs (Reference 2) is to determine limitations and uncertainties of the grout placement method which would be used for the repository shafts.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(7) No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/ development (published)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

Comment

Describe remedial methods to be used if sealing methods are not adequate.

Response

Reference 20 provides guidance for remedial actions which have been effective in other locations and materials similar to those expected to be encountered at the Hanford Site. Reference 21 provides a description of the currently planned remedial actions for those problems most likely to be encountered based upon the information

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contained in Reference 20. Data obtained during shaft excavation will allow further refinement of current plans.

References

(20) No Number Available, Amchitka Mining History, Fenix and Scisson (1973)

(21) Letter #R83-0283.1, Contingency Plan for Anomaly Detection and Resolution During Exploratory Shaft Construction (1/83)

D. TESTING AND INSPECTION PLANS AND PROCEDURES

Comment

Describe test and inspection procedures to be used during drilling (e.g., plumbness of hole, drill mud loss, drill bit inspection, etc.) to determine acceptability of the shaft as constructed and to obtain adequate information on this construction technique.

Response

The following test and inspection procedures will be used during drilling:

A. Plumbness of Hole

The plumbness of the drilled hole will be checked every 30 feet of drilled hole using a gyroscopic survey. The actual procedure is contained in Morrison-Knudsen Company, Inc. (M-K) Reference 24 submitted to DOE/Rockwell for review on February 24, 1983.

The tolerances of the plumbness of the hole are: The center of the bottom of the hole shall not be displaced from the center of the top of the hole by more than 3 feet in any direction, and no point on the centerline along the length of the hole shall be more than 2.5 feet from a straight line drawn from the center of the top of the hole to the center of the bottom of the hole.

A graph of the hole deviation will be maintained in the M-K site trailer and updated as new surveys are completed.

B. Drill Mud Loss

The mud level in the pits is monitored at each weir by observing the fluid level as indicated on a staff. The mud engineer and drill crew personnel monitor this level at frequent intervals during each shift. A loss of drilling mud would show up as a net drop in level at the final pit.

A float device to monitor the mud level in either the final section of the mixing tank or the last mud pit is in the final design and early procurement stage. This float device will sound an alarm in the drill rig operating floor should the mud level fall below a preset level.

C. Drill Bit Inspection

The drill bits will be inspected each time the drill string is removed from the hole. There is a planned inspection at the end of the first 100 drilling hours as required by Reference 25. The indicated schedule may be revamped following the first inspection if excessive wear conditions are indicated. Additional inspections will be performed whenever the drilling subcontractor or drilling consultant determines that there could be a problem with the bits. Bit problems usually show up as excessive vibration of the drill rig or a substantial decrease in the penetration rate.

The details of the drill bit inspection program (Reference 26) are currently being defined and reviewed in the M-K BWIP organization and will be submitted to DOE/Rockwell by June 1983.

Reference 22 describes the QA procedures for internal M-K activities; included, also, are procedures for exercising control over subcontractors by the CM. M-K has prepared a drilling QA (inspection) plan (Reference 18), which has been submitted to Rockwell for review.

Rockwell QA has prepared surveillance plans for drilling activities (Reference 23). Additional surveillance plans will be available for post-drilling activities by 6/30/83.

QA technical requirements for sealing will be incorporated in Reference 3.

References

(3) SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(24) No Number Available, Sperry Sun Survey Procedure (2/83)

(25) SD-BWI-AR-003, M-K/BWIP ES Phase I Drilling Program for 144" Hole (published)

(26) No Number Available, Drill Bit Inspection Program (6/83*)

*Expected date when document will be available

Comment

Describe test and inspection procedures to be used after completion of drilling and during the sealing of the shaft. Include information such as caliper surveys, grout injection rate, grout level sensor, cement bond log, thermal measurements during curing, etc.

Response

The following tests and inspections are planned to be made following the completion of drilling on the 144" surface hole:

1. Caliper surveys

   a. Mechanical survey
   b. Sonic survey each foot (tentative)

2. The grout injection rate will be monitored by the grouting subcontractor, the method will be presented in the grouting procedure (Reference 36) to be submitted by June 1983.

3. The grout level sensing will be performed by a density log performed through one of the grout lines.

4. The grout bond logs will be performed by a sonic survey (tentative).

5. There are no current plans to perform thermal measurements downhole during the grout curing on the 144" surface hole.

The procedures for items 1 through 4 are being prepared for the 144" surface hole (Reference 27) and will be published by June 1983 for the 110" diameter hole (Reference 28).

Caliper surveys/loggings are performed in conjunction with the drilling operation (Reference 8). Additional precision alignments will be required by Reference 5 (during liner installation). The testing requirements for grout installation are provided in Reference 6. The procedure to be used for grout emplacement is described in Reference 10. The procedure to determine the grout effectiveness and lab testing of cores of the grout emplaced is described in Reference 11. The details of grout injection, grout level sensors, cement bond log will be provided in a shaft seal report as defined in Reference 12. There will be no thermal measurements conducted during curing as these are inappropriate since the grout will be injected under water. The construction inspection and testing will be in accordance with QA program plans listed as References 22 and 23.

References

(5) No Number Available, M-K Procedure for Casing Handling, Aligning and Running (Note: This procedure will be prepared for the 112" casing initially. A separate procedure will then be developed for the 72" casing.) (6/83*)

(6) B-314-C-X28048, Construction Specification for Casing Cementing (published)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(10) No Number Available, M-K Procedure for Cementing (5/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(27) No Number Available, Post Drilling Inspection Procedure for 144" Hole (6/83*)

(28) No Number Available, Post Drilling Inspection Procedure for 110" Hole (6/83*)

(36) No Number Available, Grouting Procedure (6/83*)

Comment

Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects. Include information such as grout strength tests, visual identification of seal conditions, records of water inflow, assessment of seal bond to host rock, physical logging of drill holes, photo or t.v. camera methods in all portholes.

Response

The ES Test Plan (Reference 2) lists requirements for assessing the shaft seal. The techniques to be utilized for shaft seal verification will be developed in the Near-Surface Test Facility and will result in a shaft seal test procedure (Reference 11). The results of the shaft seal testing will be documented in the shaft seal report (Reference 12). Photo or television camera logging of the holes drilled through the portholes is not planned at this time. Testing will be conducted in accordance with QA plans listed as References 22 and 23.

*Expected date when document will be available

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(11) No Number Available, Seal Test Procedure (9/83*)

(12) No Number Available, Shaft Seal Report (1985*)

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

E. PLANS AND PROCEDURES FOR GATHERING SPECIFIC INFORMATION RELATED TO SITE CHARACTERIZATION

Comment

Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft.

Response

The revised ES Test Plan (Reference 2) will describe the tests which will be conducted to characterize the proposed repository site. The objectives presented in the plan are directly related to the work elements in the Site Characterization Report (SCR). The revised ES Test Plan will describe in detail how each objective will be attained and relate how the test results will resolve the applicable work elements of the SCR.

The ES Test Plan (Reference 2) describes the requirements for a principal borehole which will be used to characterize the site prior to construction of an ES. The borehole test report documenting the results of the principal borehole is currently available (Reference 29). A matrix in the ES Test Plan will identify the relevant work elements in the Site Characterization Report which will be addressed during the ES construction and testing. Hydrologic and geomechanics data to be utilized for site characterization will be collected as described in the ES Test Plan (Reference 2) and will be reported in test reports at the conclusion of the ES testing program (References 30 and 31).

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(29) SD-BWI-TI-113, Principal Borehole Report, Borehole RRL-2 (1/83)

*Expected date when document will be available

(30) No Number Available, Hydrologic Test Report (1985*)

(31) No Number Available, Geomechanics Test Report (1985*)

Comment

Will hydrologic conditions (heads) in nearby drill holes be measured during shaft construction to help understand bulk hydrologic properties?

Response

The hydrologic conditions in borehole RRL-2 will be monitored as the ES is drilled from the Vantage to total depth. The borehole RRL-2 is cased down to the Vantage and is, therefore, not available for testing above that horizon. The test specification for RRL-2 will be revised (Reference 32) to include monitoring the heads from the Vantage interbed to total depth.

References

(32) SD-BWI-TC-001, Rev. 1-0, Test Procedure for the Principal Borehole RRL-2 (6/83*)

Comment

Will the following be monitored: Sampling of drill cuttings, bit thrust, torque, rate of advance, slurry weight, speed of rotation, pumping pressure, water inflow? This information can be used to detect and/or explain anomalies encountered?

Response

The following parameters will be monitored during drilling:

A. Drill cuttings will be taken from the blooie tube (cuttings discharge line) at selected elevations. Each sample will be about 5 pounds and will be appropriately washed and labeled.

B. Recorded Drill Rig Information

The following information will be continuously recorded on the Tolco recorder unit on the drill rig:

1. Weight of drill assembly hanging from the main hook. From this number, the bit thrust will be calculated and recorded in the Morrison-Knudsen Company, Inc. (M-K) daily log by the shift supervisor each time the thrust changes and each shift in the daily International Association of Drilling Contractors (IADC) report.

2. The rotary table torque.

3. The rate of bit advance.

4. The air pressure.

*Expected date when document will be available

C. Slurry Weight

The slurry weight will be monitored by the mudding subcontractor and recorded in his daily log as required by the Drilling Mud Program - 144" Surface Hole (Reference 34) released February 11, 1983.

D. IADC Log

The IADC log, kept daily by the drilling subcontractor, records the speed of rotation and the compressed air pressure.

The ES Test Plan (Reference 2) specifies that certain parameters be monitored during drilling operations. Additional parameters identified in this information request will be monitored with the exception of water inflow since the hole is already filled with water. Water inflows have been measured in the RRL-2 borehole (Reference 29). The drilling will be conducted in accordance with the specification (Reference 8) and procedure for drilling (Reference 18). The data from the drilling activity will be presented in the drilling test report (Reference 33) at the conclusion of the drilling program and will provide a complete history of the ES drilling activities.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(8) B-314-C-X28018, Construction Specification for Shaft Boring (published)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(29) SD-BWI-TI-113, Principal Borehole Report, Borehole RRL-2 (1/83)

(33) No Number Available, Drilling Test Report (1984*)

(34) SD-BWI-AR-002, M-K/BWIP ES Phase I Drilling Mud Program, 144" Hole (published)

Comment

Identify all parameters to be measured and methods of measurement.

Response

The ES Test Plan (Reference 2) will identify the parameters to be measured to meet the objectives of the test plan. Additional parameters such as rotary table torque, bit load, rate of advance, speed of rotation, will be measured as a normal part of drilling

*Expected date when document will be available

activities (Reference 18). The rig to be used for the ES drilling contains all instrumentation necessary to measure these parameters. The drilling test report (Reference 33) will include the results from the drilling program.

References

(2) SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)

(18) No Number Available, M-K Drilling Program, 110" Hole (6/83*)

(33) No Number Available, Drilling Test Report (1984*)

F. QUALITY ASSURANCE (QA) - ADMINISTRATIVE PROCEDURES

Comment

Identify the line of responsibility for implementing QA procedures down to and including the construction contractor.

Response

Line of responsibility for QA is described in the Project Management Plan for the ES-Phase I (Reference 35) and the DOE QA Plan (Reference 37). The Rockwell QA Program Plan (Reference 23) further identifies the specific QA requirements for the ES. The construction manager's QA program is described in Reference 22.

References

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(35) SD-BWI-PMP-002, Project Management Plan for Exploratory Shaft-Phase I (ES-I) (6/83*)

(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)

Comment

Identify the procedures for monitoring and implementing the QA program by the Quality Assurance organization of exploratory shaft design, construction and testing.

Response

The QA Program Index (Appendix A of Reference 23) identifies the specific BWIP operating procedures which are used for auditing and

*Expected date when document will be available

surveillance of the QA program for the ES. The construction manager QA program plan is identified as Reference 22. Specific test/inspection procedures are listed in Appendix A of Reference 23. The DOE overview and auditing of the entire Basalt Waste Isolation Project QA program is detailed in Reference 37.

References

(22) No Number Available, M-K QA Plan (4/83)

(23) RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)

*Expected date when document will be available

REVISION 1 TO ATTACHMENTS TO LETTER FROM O. L. OLSON TO DR. ROBERT J. WRIGHT, DATED APRIL 1, 1983

A. Changes to Attachment I

1) Page 1 - Add the following title: RESPONSE TO NUCLEAR REGULATORY COMMISSION COMMENTS ON BASALT WASTE ISOLATION PROJECT EXPLORATORY SHAFT CONSTRUCTION AND SEALING, H. J. MILLER LETTER TO J. H. ANTTONEN, DATED JANUARY 13, 1983.

2) Page 1 - Under Response, second paragraph, eleventh and twelfth lines - Change "characterization" to "characterizations."

3) Page 2 - Delete the first paragraph and add the following: As currently proposed, a minimum of six (6) seals will be located in the ES: the two (2) primary isolation seals will be located in the competent basalt directly above the tunnel opening and in the entablature of the basalt flow directly above the horizon containing the Phase II tunnel system. The remaining seals will be placed below each of the major aquifers to eliminate communication between aquifers.

4) Page 2 - Reference (2) - Change "(7/83*)" to "(10/83*)."

5) Page 3 - Reference (2) - Change "(7/83*)" to "(10/83*)."

6) Page 4 - Reference (10) (two places) - Change "(published)" to "(5/83*)."

7) Page 5 - Under Response, top of page, third line - Change "rational" to "rationale."

8) Page 5 - Reference (2) (two places) - Change "(7/83*)" to "(10/83*)."

9) Page 6 - Under References - Change "(14)" to "(13)."

10) Page 7 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

11) Page 9 - Reference (2) - Change "(7/83*)" to "(10/83*)."

12) Page 9 - Reference (10) - Change "(published)" to "(5/83*)."

13) Page 11 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

14) Page 11 - Under Item C, Drill Bit Inspection, third paragraph - Delete the sentence "This document has been submitted to DOE-RL for approval."

15) Page 11 - Reference (22) - Change "(4/83*)" to "(4/83)."

16) Page 11 - Reference (23) - Change "(4/83*)" to "(4/83)."

17) Page 11 - Reference (25) - Add "(published)."

18) Page 11 - Reference (26) - Change "(6/83)" to "(6/83*)."

19) Page 12 - Under Response, Item 2 - Change "(Reference 31)" to "(Reference 36)."

20) Page 13 - Reference (10) - Change "(published)" to "(5/83*)."

21) Page 13 - Reference (22) - Change "(4/83*)" to "(4/83)."

22) Page 13 - Reference (23) - Change "(4/83*)" to "(4/83)."

23) Page 13 - Under References - Add "(36) No Number Available, Grouting Procedure (6/83*)."

24) Page 14 - Reference (2) (two places) - Change "(7/83*)" to "(10/83*)."

25) Page 14 - Reference (22) - Change "(4/83*)" to "(4/83)."

26) Page 14 - Reference (23) - Change "(4/83*)" to "(4/83)."

27) Page 15 - Reference (32) - Change "Test Specification for RRL-2" to "Test Procedure for the Principal Borehole RRL-2."

28) Page 16 - Reference (2) - Change "(7/83*)" to "(10/83*)."

29) Page 16 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

30) Page 16 - Reference (34) - Add "(published)."

31) Page 17 - Under Response, top of page, first sentence - Change "....for the ES-Phase I (Reference 35)" to "....for the ES-Phase I (Reference 35) and the DOE QA Plan (Reference 37)."

32) Page 17 - Under Response, top of page, second sentence - Change "The QA Program Plan (Reference 23)...." to "The Rockwell QA Program Plan (Reference 23)...."

33) Page 17 - Reference (2) - Change "(7/83*)" to "(10/83*)."

34) Page 17 - Reference (18) - Change "M-K Drilling Program (6/83*)" to "M-K Drilling Program, 110" Hole (6/83*)."

35) Page 17 - Reference (22) - Change "(4/83*)" to "(4/83)."

36) Page 17 - Reference (23) - Change "(4/83*)" to "(4/83)."

37) Page 17 - Reference (35) - Change "Project Management Plan for Exploratory Shaft (6/83*)" to "Project Management Plan for Exploratory Shaft - Phase I (ES-I) (6/83*)."

38) Page 17 - Under References, bottom of page - Add "(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)."

39) Page 18 - Add the following sentence to the end of the first paragraph: The DOE overview and auditing of the entire Basalt Waste Isolation Project Quality Assurance Program is detailed in Reference (37).

40) Page 18 - Reference (22) - Change "(4/83*)" to "(4/83)."

41) Page 18 - Reference (23) - Change "(4/83*)" to "(4/83)."

42) Page 18 - Under References - Add "(37) No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)."

B. Changes to Attachment II

The changes which have been incorporated into Attachment I, Revision 1, also affect Attachment II which has been rewritten and is provided as Attachment III.

REFERENCE DOCUMENTS

The following reference documents were transmitted to the Nuclear Regulatory Commission (NRC) on February 25, 1983 by U.S. Department of Energy-Richland Operations Office (DOE-RL):

Reference No.	Title
1	ONWI-411, Topical Report, Preliminary Evaluation of Rock Mass Disturbance Resulting from Shaft, Tunnel, or Borehole Excavation, D'Appolonia (7/82)
7	No Number Available, Dowell letter report on their chemical seal describing available laboratory test data, performance experience in past applications, and recommendations for further testing/development (published)
8	B-314-C-X28018, Construction Specification for Shaft Boring (published)
13	B-314-P-S28005, Procurement Specification for 72" ID Steel Casing (published)
15	B-314-P-S28004, Procurement Specification for 112" ID Steel Casing (published)
16	B-314-B-X28028, Procurement Specification for Drilling Mud (published)
20	No Number Available, Amchitka Mining History, Fenix and Scisson (1973)
21	Letter #R83-0283.1, Contingency Plan for Anomaly Detection and Resolution During Exploratory Shaft Construction (1/83)
24	No Number Available, Sperry Sun Survey Procedure (2/83)
25	SD-BWI-AR-003, M-K/BWIP ES Phase I Drilling Program for 144" Hole (published)
29	SD-BWI-TI-113, Principal Borehole Report, Borehole RRL-2 (1/83)
34	SD-BWI-AR-002, M-K/BWIP ES Phase I Drilling Mud Program, 144" Hole (published)

The following reference documents were transmitted to the NRC April 1, 1983 by DOE-RL:

Reference No.	Title
22	No Number Available, M-K QA Plan (4/83)
23	RHO-QA-PL-3, Rev. 1 L, Basalt Waste Isolation Project - QA Program Plan (4/83)

The following reference documents are submitted with this transmittal:

Reference No.	Title
6	B-314-C-X28048, Construction Specification for Casing Cementing (published)
9	B-314-C-X28038, Construction Specification for Casing Field Welding Services (12/82)
19	No Number Available, DuPont Blasters Manual (published)

The following documents will not be available until later in the program as indicated by the dates after each reference:

Reference No.	Title
2	SD-BWI-TP-007, Rev. 1-0, Test Plan for Exploratory Shaft in Basalt, Phase I and Phase II (10/83*)
3	SD-BWI-CR-015, Repository Seal Performance Requirements and Preliminary Seal Design Criteria for a NWRB (7/83*)
4	No Number Available, Exploratory Shaft Test Plan for Material Quality Control and Long Term Stability Assessment (7/83*)
5	No Number Available, M-K Procedure for Casing Handling, Aligning, and Running (Note: This procedure will be prepared for the 112" casing intially. A separate procedure will then be developed for the 72" casing.) (6/83*)
10	No Number Available, M-K Procedure for Cementing (5/83*)
11	No Number Available, Seal Test Procedure (9/83*)
12	No Number Available, Shaft Seal Report (1985*)

*Expected date when document will be available

Reference No.	Title
14	SD-BWI-TI-119, Exploratory Shaft Test Porthole Configuration (6/83*)
17	No Number Available, ES Acceptance Test Procedure (10/83*)
18	No Number Available, M-K Drilling Program, 110" Hole (6/83*)
26	No Number Available, Drill Bit Inspection Program (6/83*)
27	No Number Available, Post Drilling Inspection Procedure for 144" Hole (6/83*)
28	No Number Available, Post Drilling Inspection Procedure for 110" Hole (6/83*)
30	No Number Available, Hydrologic Test Report (1985*)
31	No Number Available, Geomechanics Test Report (1985*)
32	SD-BWI-TC-001, Rev. 1-0, Test Procedure for the Principal Borehole RRL-2 (6/83*)
33	No Number Available, Drilling Test Report (1984*)
35	SD-BWI-PMP-002, Project Management Plan for Exploratory Shaft-Phase I (ES-I) (6/83*)
36	No Number Available, Grouting Procedure (6/83*)
37	No Number Available, DOE Basalt Waste Isolation Project Quality Assurance Plan (9/83*)

*Expected date when document will be available

(6)

SPECIFICATION TITLE PAGE

SPECIFICATION NO. B-314-C-X28048

QA LEVEL I

CONSTRUCTION SPECIFICATION FOR

CASING CEMENTING

BWIP EXPLORATORY SHAFT

PROJECT B-314

Prepared By:

Kaiser Engineers, Inc./Parsons Brinckerhoff Quade & Douglas, Inc.

For the U.S. Department of Energy

Contract No. DE-AC06-80RL10000

B H Kilduff Specifications Engineer	12-22-82 Date	Jno Koppe Jr Job Engineer	12-22-82 Date
O Hoeck By PGB Design Manager	12-22-82 Date	D.L. WATSON by JE Project Engineer	12-22-82 Date
H. Thayer by R.S. Thomas QC Engineer/Constr. Engr.	12-22-82 Date	L.S. Thomas Quality Assurance Engineer	12-22-82 Date
P G Boothe Deputy Project Manager	12-22-82 Date	J S Ritchie By PGB Project Manager	12-22-82 Date

ROCKWELL HANFORD OPERATIONS:

_____ _____
Date

TABLE OF CONTENTS

BWIP1ON: 12/21/82

1.2.11 Site

"Site" shall mean the immediate vicinity of the BWIP Exploratory Shaft at Hanford, Washington, as shown on the Drawings.

1.2.12 Stage/Staging

"Stage" shall mean one continuous emplacement or increment of grout or seal.

1.2.13 Supervisor

"Supervisor" shall mean the Contractor's qualified, appointed, and Owner/Engineer approved representative.

1.2.14 Ventilation Line

"Ventilation line" shall mean the vertical piping that is to be attached to the outside of the casing for supplying ventilation air to the bottom of the casing after installation of the casing.

1.2.15 Witness Point

"Witness point" shall mean that activity in the production sequence scheduled for surveillance by the Inspector where work may proceed upon verbal release by the Inspector or upon the expiration of a one hour wait for inspection from the scheduled time.

1.2.16 The applicable definitions contained in the following publications shall also pertain:

a. ANSI NQA-1, Supplement S-1
b. API BUL 10C

1.3 CITED REFERENCES

Work performed and materials furnished under this specification shall conform to the requirements of the documents listed below, to the extent specified herein.

ANSI - American National Standards Institute

NQA-1-1979	Quality Assurance Program Requirements for Nuclear Power Plants
N45.2.2-1978,	Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants
N45.2.15-1981	Hoisting, Rigging and Transporting of Items at Nuclear Power Plants

API, American Petroleum Institute

Bulletin 10C, Oil-Well Cement Nomenclature

Bulletin D4, The Effects of Drilling Mud Additives on Oil-Well Cements

Spec 10-1982, Specifications for Materials and Testing Well Cements

Spec 13A: Specification for Oil-Well Drilling Fluid Materials

RP13B, Recommended Practice for Standard Procedure Testing Drilling Fluids

ASTM, American Society for Testing and Materials

A53-79, Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless

A588-79a, High Strength Low Alloy Structural Steel with 50,000 psi Minimum Yield Point to 4 inches Thick

C144-76, Standard Specification for Aggregate for Masonry Mortar

C618-78, Fly Ash And Raw or Calcined Natural Pozzolan For Use As A Mineral Admixture in Portland Cement Concrete

C878-80, Restrained Expansion of Shrinkage Compensating Cement

DOE, U.S. Department of Energy

HS-8002 Supplier Acceptance Data Package

Dowell, Dowell Division of Dow Chemical, USA

TSC-3559, 100162000, 07827.5M, Technical Information Sheet, Dowell Chemical Seal Ring

1.4 QUALITY ASSURANCE

1.4.1 The materials and services furnished hereunder are for components of a structure classified Quality Level I for nuclear safety purposes and are therefore subject to the requirements of a quality assurance program established and implemented in accordance with ANSI NQA-1 and its Supplements, ANSI N45.2.2, and ANSI N45.2.15.

1.4.2 Each bidder shall submit with the proposal two copies of his quality assurance program and quality control manual for review and evaluation as to his acceptability as a qualified vendor of nuclear Quality Level I materials and services.

1.4.3 The Contractor shall be responsible for assuring that his subcontractors' quality-assurance/quality control programs are in compliance with the Specifications. Subcontracting shall conform to the provisions of ANSI NQA-1, Basic Requirements 4 and 7, and Supplements 4S-1 and 7S-1.

1.4.4 Subsequent to the notice to proceed, the Owner will provide the Contractor comments on the quality assurance program and the quality control manual submitted with the bid. Prior to the start of work, the Contractor shall re-submit the program and manual incorporating the Owner's comments. At this time, a joint Owner/Contractor quality assurance coordinating meeting shall be conducted to clarify requirements and acceptance criteria. Upon acceptance by the Owner of the program and manual, as revised, the Contractor shall proceed with the work in accordance with the provisions of the program and accepted procedures.

1.4.5 The minimum information required for the quality control program is contained in the listing attached as Appendix B.

1.5 INSPECTION PROGRAM

1.5.1 The Contractor shall be responsible for the physical performance and documentation of all required in-process inspection, verification, testing, and other quality control functions during the casing cementing operations.

1.5.2 The Inspector shall perform the surveillance inspection of all required documentation and in-process operations to ensure compliance with the requirements herein.

1.5.3 The Owner shall identify to the Contractor the authorized agencies and individuals who perform inspection surveillance and audit functions.

1.5.4 The Work shall be inspected by the Contractor and the Inspector during all stages of the work. The Contractor shall furnish all facilities, tools, gauges, other equipment materials, mobile calibration facilities, and personnel necessary for inspection and testing. Inspection by the Inspector shall not relieve the Contractor of his responsibility to perform work that complies with the requirements of the Specification and the Drawings.

1.5.5 An inspection plan, identifying all activities that affect the quality of services and materials specified, and incorporating hold points and witness points, shall be developed by the Contractor and submitted to the Owner, within four weeks from notice to proceed, for review, comment, and acceptance. The inspection plan shall be subject to the Owner's review for conformance to the accepted quality assurance program and incorporation of hold and witness points. Work shall not commence prior to acceptance of the inspection plan by the Owner. The inspection plan shall identify pertinent activities and operations, and steps critical to quality control. The following shall be included as minimum hold points:

a. Completion of simulation tests prior to use of any proposed mix. (Refer to Section 2.2)

b. Completion of big-hole caliper survey and calculation of theoretical grout volumes for each lift.

c. Completion of each lift and verification that lift is in place and set up to the extent required.

The approved material acceptability tests affecting the quality of the services and materials specified shall be performed by the Contractor. The Owner shall be notified in advance of any such testing so that he may witness the tests. Section 15 of API Spec 10 shall apply.

1.5.6 Daily inspection reports shall be prepared for each shift period while operations are in progress. Inspection reports shall document results of inspections and examinations of quality and characteristics identified on the Contractor's Inspection Plan developed under requirements of Section 1.5.5.

1.6 RECORDS AND SUBMITTALS

1.6.1 The Contractor shall establish and maintain a records system in accordance with ANSI NQA-1, Basic Requirement 17, Supplement 17S-1, and Appendix 17A-1. This system shall be incorporated into the Contractor's quality assurance program and submitted for the Owner's review and acceptance. The records system shall provide complete traceability of all materials, equipment, workmanship, quality controls, and cementing of each stage as required by Contract Documents, the Quality Control Manual, and the Inspection Plan. All documentation shall be clear, legible, and of suitable quality for microfilming and for long term storage.

1.6.2 The Contractor shall submit for the Engineer's approval no later than 60 calendar days before grout placement commences for either the 112-inch or the 72-inch casing his program and procedures for cementing each casing, including but not limited to proposed mixes of grout and seal compounds, proposed staging of the cementing work, quantities of grout or seal for each stage, pressures and rates of pumping, a listing of all required and proposed equipment, storage facilities, instruments and tools, proposed subcontractors if any, drawings showing field layout of all facilities and a schedule for the conduct of the work.

The cementing schedules, shown on sketches attached hereto, show theoretical volumes of grout and seal materials and proposed stages. Contractor shall adapt the scheduling and staging to suit his proposed cementing and sealing operations.

1.6.3 Subsequent to recording the measurements of the hole, grout quantities and other details of the contractor's plans shall be updated as required and submitted for approval before commencing

the cementing operations. Should the casing(s) not be placed to the planned elevations, additional adjustments to the plans may be required.

1.6.4 The Contractor shall obtain, maintain and submit to the Owner the following:

1.6.4.1 Identification of source, and batch number if applicable, of all ingredients used in cementing and sealing.

1.6.4.2 Laboratory test data obtained in association with the cementing and sealing operations.

1.6.4.3 Monitoring and in-situ inspection and test data obtained before, during and after cementing and sealing operations. Where appropriate, use standard API forms. In any case, forms to be used to report data shall be submitted to Owner/Engineer for approval together with the detailed cementing and staging plans.

1.6.4.4 Records that document the training, experience and qualifications of all supervisory personnel, and of all technicians performing work essential to the quality of the cementing operation.

1.6.5 The Supplier shall submit the information listed in Appendix A, "Bidder and Seller Information Requirements".

1.6.6 All Supplier final data shall be submitted in accordance with DOE HS-BP-8002.

1.7 NONCONFORMING CONDITIONS

The Supplier shall identify all nonconforming conditions relative to this specification and related drawings, and shall notify the Owner and Engineer of each such condition. Dispisition to "use as is", "repair", or "reject" for each nonconforming condition shall require approval by the Owner/Engineer as a condition of acceptance or rejection of the Work. (See Item 10, Page B-1, Appendix B).

1.8 QUALIFICATIONS OF CONTRACTOR

The Contractor performing the cementing and sealing work shall be a specialist contractor experienced in this work. All components of the work, including logging, testing, monitoring and execution of the work shall be performed by persons qualified for and experienced in the particular phase or component of the work. The Contractor's supervisor of the work shall have at least five years hands-on experience with similar work. Qualifications of all persons conducting work affecting with quality of the work, and all senior technicians, shall be submitted for the Owner's review and approval. A qualified technical representative of the Contractor shall be present at all times during cementing and sealing operations.

1.9 SITE CONDITIONS

Rockwell Report No. RRL-2 (will be available in January 1983) should be referred to for results of a test bore hole performed at site.

PART 2 - PRODUCTS

2.1 OWNER FURNISHED PRODUCTS

2.1.1 The materials for the grout guides and accessories will be as noted below.

2.1.1.1 Grout guide pipe: ASTM A 53, Schedule 40, black, Type F.

2.1.1.2 Support plates and guide plates: ASTM A 588, Grade optional.

2.1.2 Grout injection pipes: 2 7/8 inches O.D. EVE S or K55 (8.7 lbs/ft) with special clearance couplings.

2.2 CONTRACTOR FURNISHED PRODUCTS

2.2.1 Cement and Admixtures

2.2.1.1 Cement shall be class A, B, or G cement in accordance with API Spec 10. Cement shall be tested (each lot, each 5000 pounds or each 50 sacks) in accordance with API Spec 10 for the following:

a. Soundness
b. Fineness
c. Compressive strength
d. Thickening time
e. Permeability test

2.2.1.2 Bentonite shall be in accordance with API Spec 10 and shall be tested (each lot, each 5000 lbs or each 50 sacks) in accordance with API Spec 10 for the following:

a. Screen analysis, dry and wet
b. Moisture content
c. Viscometer
d. Yield point
e. Filtration properties
f. pH

2.2.1.3 Fly ash shall be in accordance with API Spec 10 and shall be tested (each lot, each 5000 lbs or each 50 sacks) in accordance with API Spec 10 for the following:

a. Activity index
b. Screen analysis, wet
c. Chemical tests

2.2.1.4 Sand shall be in accordance with ASTM C144 with 100% passing a No. 16 sieve.

2.2.1.5 Other admixtures proposed by the Contractor may be used subject to testing, acceptability and approval of the Owner/Engineer.

2.2.2 Chemical seal ring shall be the type specially developed for sealing of drilled shafts. The chemical seal ring shall equal or exceed the specifications for Dowell Chemical Seal Ring in Dowell Technical Information Sheet TSC-3559, 100162000, 07827.5M.

2.2.3 Equipment

Contractor shall supply all equipment required for the conduct of the work, including, but not limited to:

a. Cementing Units

b. Manifold(s)

c. Field Storage Silos

d. Mixing and Blending Equipment and Tanks for Temporary Storage

e. Instrumentation for monitoring and recording grout flows and densities.

Equipment shall be capable of placing grout at the maximum rate of rise in the annulus of 1 ft/min. for the 72-inch casing. Equipment and storage capacity shall be sufficient to sustain a maximum lift of 350 ft. for the 72-inch casing. Storage shall be supplied for a minimum of three lifts or three days work.

PART 3 - EXECUTION

3.1 GROUT AND SEAL MIXTURES

3.1.1 General

It shall be the Contractor's responsibility to perform the detailed design of all grout and chemical seal mixes, and he shall give full consideration to the following:

a. Ambient temperature existing at the placement depth and to all its effects, which may affect grout performance.

b. Proposed mixing, pumping and piping equipment and placement method, sequence and timing to meet requirements of Section 2.2.3.

c. Testing to assure compliance with provisions of Sections 2.2.1, and 2.2.2. Recording of test results in accordance with Section 1.6.

d. Functional requirements as specified in Sections 3.1.2, 3.1.3, 3.1.4, and 3.1.5.

e. Compatibility with water available at the site

f. Compatibility with drilling mud in the hole. (Reference: API Spec 13A, and API Bul D4)

Tests shall be made to demonstrate the compatibility of water, cement, additives or admixtures, to the satisfaction of the Engineer.

3.1.2 Expanding Grout

Expanding grout shall be placed from the bottom of the hole to the elevations shown on the drawings in Appendix C, except where chemical seal is shown. The elevations indicated on the drawings are subject to revision after the hole is drilled.

Expanding grout shall produce minimum shrinkage, as defined by the approved design mix, upon curing and shall have the following minimum compressive strength:

Time of Testing (Hours)	Compressive Strength (psi)
8	200
24	1500
72	3000
28 Days	3500

The expanding grout design formulation proposed for use in the shaft shall have a performance record satisfactory to the Engineer. The use of products such as regulated fill-up cement (RFC) or check comp or products having similiar characteristics may be proposed for approval of the Engineer.

Expansion of the approved design and as placed mix shall be varified in accordance with ASTM C878. Curing time shall be a minimum of 28 days, and the expansion curve shall show continuous volume increase. Minimum linear expansion at 7 days curing time shall exceed 0.05%.

3.1.3 Chemical Seal

At the elevations indicated on the cementing schedules, Appendix C, impermeable annular seals having minimum vertical thicknesses of 15 feet at all points shall be installed.

3.1.4 Standard Filler Grout

Standard filler cement grout shall be placed between the elevations indicated on the cementing schedules, Appendix C. This grout shall contain Grade A, B or G cement (API STD. 10A) and may contain pozzolanic materials (fly ash) (ASTM C618), bentonite (API STD. 10A), sand (ASTM C144), or other admixtures or additives as appropriate and in accordance with API Spec 10. In accordance with API Spec 10, strength requirements shall be determined as a function of the design strength set-up waiting-period desired.

3.1.5 Operating Strength and Thickening Time Tests

For each proposed mix, simulation tests for operating strength and thickening time shall be performed in accordance with API Spec 10, Appendix D and E, using actual site temperature, mud density, and operating data and conditions. Such testing shall be completed and the resulting data confirmed to be satisfactory before cementing with the proposed mix may proceed.

3.2 SPARES, STANDBY EQUIPMENT, AND MATERIALS

The Contractor shall maintain sufficient tools, materials and facilities to sustain the placement of the maximum lift or stage specified without interruption.

3.3 CEMENTING

A detailed cementing program shall be prepared by the Contractor and approved by the Owner/Engineer before commencing cementing operations, to include all operations, details, mixes, tests, check points and verifications. The following shall be included and observed:

3.3.1 Theoretical grout volumes and suggested cementing stages are shown on the schedule. These volumes are based on theoretical bored hole diameters. New theoretical volumes shall be calculated by the Contractor based on results of caliper logging carried out before placing the casing. The staging of the cementing sequence may be changed by the Contractor subject to the Engineer's approval, except that the chemical seal rings shall be placed where shown on cementing drawings, Appendix C, and shall have the minimum height shown. Expanding cement grout shall be placed to the elevation shown. No stage shall exceed 350 ft.

3.3.2 Actual grout or seal volumes placed shall be measured by flow-meter and reported to the Engineer immediately after completion of each stage.

3.3.3 Flow of grout into the annulus shall be maintained in a manner assuring a uniform rate of rise of the grout level around the casing.

3.3.4 The space below the casing bottoms and the annular space around the casings to the elevations indicated on the drawings, in Appendix C shall be placed in continuous operations respectively.

3.3.5 The bottom stage of the cementing of the 112-inch casing shall be accomplished by grout placement through the outside grout guides. Careful measurement of the annulus between the casing and drill hole wall shall be done in at least three grout guides prior to cementing to ascertain proper location of the casing before cementing.

3.3.6 No stage shall be placed before tests, in accordance with approved program, show that the grout has hardened sufficiently that no additional pressure is exerted on the previously grouted sections of casing by the placing of new grout.

3.3.7 Grout pipes shall be placed immediately above the logged surface of firm grout of the previous stage (or bottom of hole) at the beginning of each grout stage but shall be withdrawn during the grouting operation in accordance with thickening time tests but such that the bottom of the pipe is at least 30 ft. below the theoretical top of grout in the annulus at any time. After completing a stage the pipes shall be withdrawn to at least 60 ft above the theoretical top of grout and thoroughly flushed clean with water or with mud equivalent to the hole mud.

3.3.8 Before commencing, each grouting stage, fluid circulation shall be established.

3.3.9 The chemical seal rings shall be installed in strict accordance with the recommendations of the Supplier.

3.4 TESTING AND MONITORING

3.4.1 Prior to commencement of each grout and stage, field tests shall be performed to verify that field mix complies with approved design mix.

3.4.2 During grouting stages, liquid grout samples shall be taken every 30 minutes and test specimens formed. A select number of these test specimens shall be cured at the temperature prevailing at the depth of the particular stage. At least 1/2 of these specimans shall be kept for future testing. Specimens shall be tested in compression prior to commencing a new stage to ascertain that the grout in-situ has cured properly.

3.4.3 Measurement devices shall be placed and monitored continuously to produce a permanent record of flow rate into each of the manifolded pipes, and of grout density and discharge pressure of each grout pipe.

3.4.4 At regular intervals during each grout stage placement, a log shall be run to determine grout surface elevations.

BWIP10D: 12/21/82

BIDDER AND SELLER INFORMATION REQUIREMENTS

TYPE OF INFORMATION	BY BIDDER	BY SELLER						
		NOTE - LAST COLUMN TO BE COMPLETED BY SELLER						
	COPIES WITH EACH BID	REPRODUCIBLE* TO BE SUBMITTED FOR REVIEW	CERTIFIED DRAWINGS TO BE SUBMITTED AFTER REVIEW			COPIES REQUIRED WITHOUT REVIEW	POST AWARD	
			PAPER PRINTS	REPRODUCIBLE * PAPER	REPRODUCIBLE * PERMANENT		REVIEW DATA REQUIRED (WEEKS AFTER AWARD)	SELLER PROMISE SUBMITTAL (WEEKS AFTER AWARD)
1. DRAWING LIST AND SCHEDULE								
2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION								
3. SCHEMATIC PIPING DIAGRAMS								
4. ELECTRICAL AND INSTRUMENTATION INFORMATION								
5. SHOP DETAIL DRAWINGS								
6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS								
7. LOAD DIAGRAMS								
8. DATA SHEETS, AS NOTED THEREON								
9. PERFORMANCE DATA AND CURVES		**	6	1		3		
10. CERTIFIED TEST AND INSPECTION REPORTS								
11. BILLS OF MATERIAL								
12. INSTALLATION INSTRUCTIONS								
13. MAINTENANCE AND OPERATING								
14. NAMEPLATE DATA, AND MOTOR LIST								
15. CALCULATIONS								
16. PRELIMINARY DESIGN DRAWINGS								
17. FINAL DESIGN DRAWINGS								
18. Quality Control Manual		**	6	1				
19. Inspection Plan		**	6	1				
20. Inspection & Test Personnel Certification						3		
21. Factory Test Results & Computation						3		
22. Field Test Procedure		**	6	1				
23. Field Test Results & Computations						3		
24. Certificate of Conformance						3		
25.								
26.								
27.								
28.								
29.								
30.								
31. * Reproducible required only for data larger than 11" x 17".								
32.								
33. ** 1 reproducible plus 6 copies.								
34.								

See Next Page for Definitions and Instructions

APPENDIX A (Sheet 2 of 2)

DEFINITIONS

1. DRAWING LIST AND SCHEDULE A complete list of all drawings and data by title that the bidder expects to furnish on this order. Schedule to show, in weeks after award, submittal of each type of review and certified drawings.

2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION Drawings to scale showing the relative size, configuration, and location of all material to be furnished. Show two or more views of unit, clearances and area required for operation and maintenance. Show unit in relation to nearby structures and other equipment or operating floor, location of utility connections and direction of rotation, if applicable. When submitting data for "off the shelf" equipment/materials, catalog cuts and information are acceptable provided they are submitted in ample detail.

3. SCHEMATIC PIPING DIAGRAMS Show equipment to be interconnected, flow quantities, pipe sizes, valves and instruments.

4. ELECTRICAL AND INSTRUMENTATION INFORMATION Show all data pertaining to instrumentation, control and power electrical equipment. Include "one-line", "elementary" wiring, panel interior wiring and exterior interconnection wiring, dimensioned outlines of enclosures with raceway entries shown.

5. SHOP DETAIL DRAWINGS Show all necessary details and data required for fabrication and maintenance. For structural details show all connections and member sizes.

6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS Show all data required for foundation design including location, blockouts, embedded items, grout required, and size, type and projection of anchor bolts.

7. LOAD DIAGRAMS Show total static and dynamic loads and load centers.

8. DATA SHEETS Sheets shall be completed for the equipment proposed with all information noted thereon.

9. PERFORMANCE DATA AND CURVES

10. CERTIFIED TEST AND INSPECTION REPORTS Reports by recognized commercial laboratories of indicated chemical and physical tests of materials as required by the specifications. In addition where applicable, weld inspection and stress relieving records and code nameplate rubbings shall be furnished.

11. BILLS OF MATERIAL Show for each unit: item no., shop order no., mark or name, part no., or pattern no., and drawing reference.

12. INSTALLATION INSTRUCTIONS Complete, detailed and sequenced instructions for original installation and for removals and replacements as well as erection information.

13. MAINTENANCE AND OPERATING MANUALS Complete installation, starting and operating instructions. Complete descriptions of preventive and repair maintenance, including detailed lubrication chart showing every lubrication point, grade of lubricant, lubrication schedule and amount of oil or grease required for refill after drainage. Manuals include parts list with recommended spares.

14. NAMEPLATE DATA AND MOTOR LIST

15. CALCULATIONS Shall be checked and stamped by a registered professional engineer, licensed to practice in the state where installation occurs.

16. PRELIMINARY DESIGN DRAWINGS Seller provided design services such as pre-engineered buildings, silos and other structures, conveyor systems, bins and chute design, large ductwork and supports.

17. FINAL DESIGN DRAWINGS Same as Item No. 16.

INSTRUCTIONS

1. DIMENSIONS Shown on all but schematic drawings and diagrams shall be in feet and inches, unless noted otherwise.

2. CERTIFIED DRAWINGS Shall be so marked by Seller. They shall conform to Seller's drawings as finally accepted by the Purchaser and shall be forwarded at commencement of manufacture. The drawings shall be revised and resubmitted to reflect any changes approved during the manufacturing period.

3. REPRODUCIBLE - PERMANENT PRINTS Shall be cloth, "Chronaflex", or "Mylar". They shall depict the material as shipped and shall be forwarded upon completion of shipment.

APPENDIX B

INFORMATION REQUIRED FOR QUALITY CONTROL PROGRAM

1. Identification of organizations/personnel responsible for the performance and verification of activities affecting the quality of the work and its conformance to Specification and Drawing requirements.

2. Material storage facilities and weather protection.

3. Methods of controlling and measuring material dimensions.

4. Material records and marking system.

5. Non-destructive examination and quality control personnel qualification and certification program.

6. Identification of organizations/personnel responsible for the control of cementing operations that affect the quality of the water.

7. Quality control manual containing all policies, assignments of responsibility, procedures, forms, and controls.

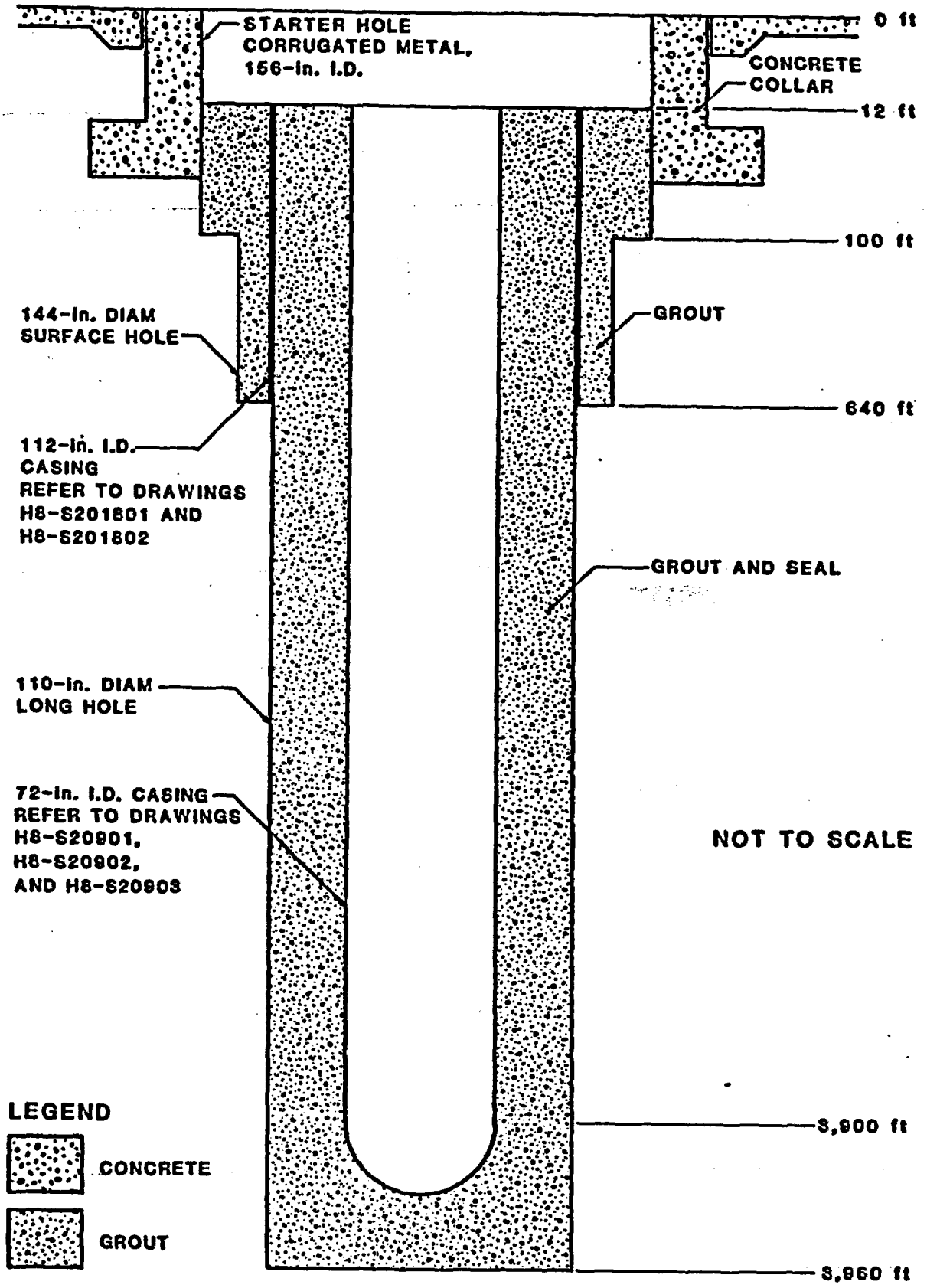
8. In progress and final inspection procedures.

9. Document and record controls.

10. Control of nonconformances.

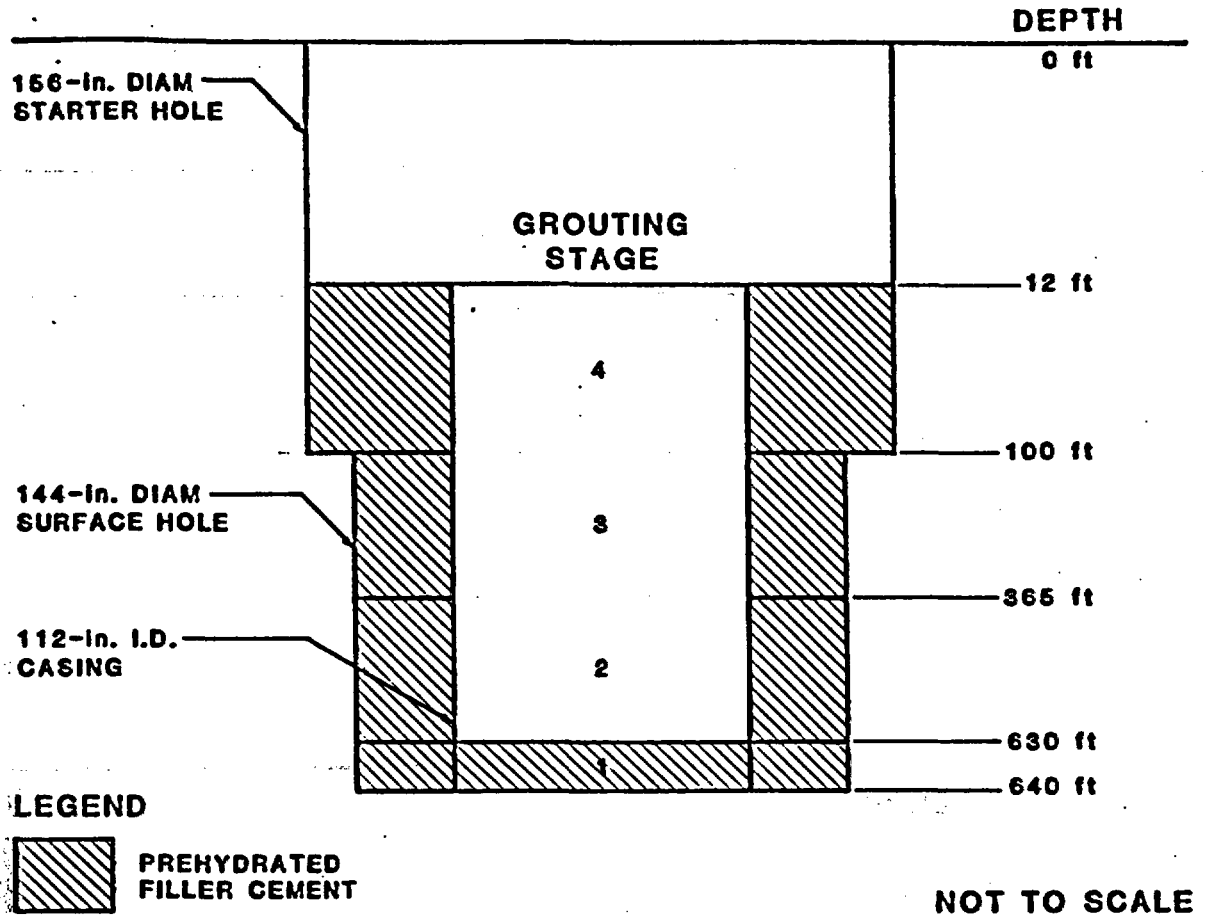
APPENDIX C

GROUT AND CASING SCHEMATIC DIAGRAM



APPENDIX C

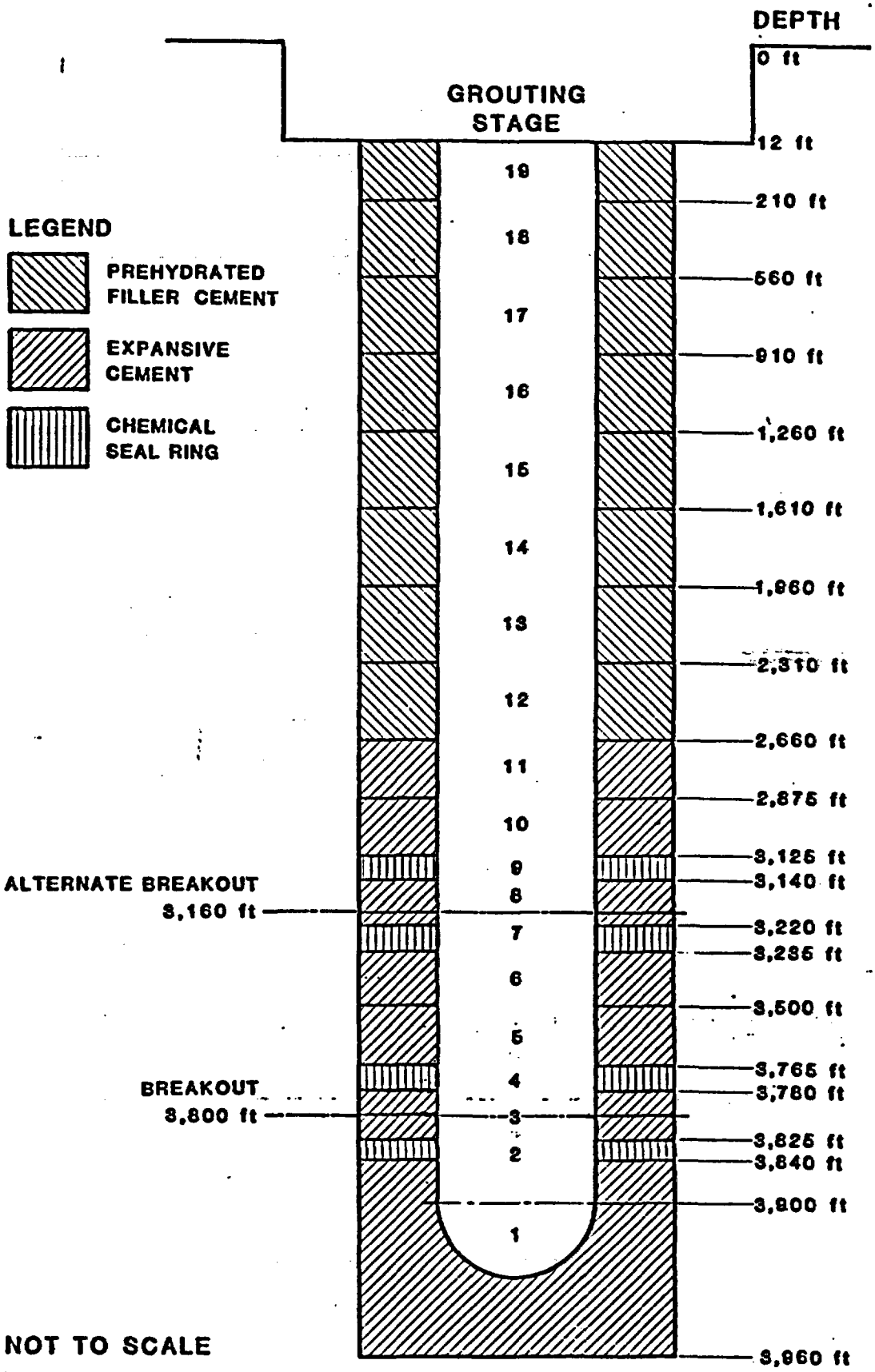
112-in. I.D. CASING CEMENTING SCHEDULE



Grouting Stage	Depth (ft)	Stage Height (ft)	Stage Volume (ft^3)	Average Grout Volume (ft^3/ft)	Cumulative Grout Volume (ft^3)
1	630	10	1,097.84	109.78	1,097.84
2	365	265	11,019.49	41.58	12,117.33
3	100	265	11,267.67	42.52	23,385.00
4	12	88	5,510.43	62.62	28,895.43

NOTE: Volumes are theoretical, based on nominal bored hole dimensions

72-in. I.D. CASING CEMENTING SCHEDULE



72-in. I.D. CEMENTING SCHEDULE

Grouting Stage	Stage Fill Material[a]	Depth (ft)	Stage Height (ft)	Stage Volume (ft^3)	Average Grout Volume (ft^3/ft)	Cumulative Grout Volume (ft^3)
1	E	3,840	120	5,806.48	48.39	5,806.48
2	C	3,825	15	477.6	31.84	6,284.08
3	E	3,780	45	1,432.8	31.84	7,716.88
4	C	3,765	15	477.6	31.84	8,194.48
5	E	3,500	265	8,487.62	32.03	16,682.1
6	E	3,235	265	8,543.72	32.24	25,225.82
7	C	3,220	15	486.18	32.41	25,712.87
8	E	3,140	80	2,597.6	32.47	28,310.47
9	C	3,125	15	487.05	32.47	28,797.52
10	E	2,875	250	8,131.85	32.53	36,929.37
11	E	2,660	215	7,024.05	32.67	43,953.42
12	P	2,310	350	11,474.41	32.78	55,427.83
13	P	1,960	350	11,600.33	33.14	67,028.16
14	P	1,610	350	11,683.78	33.38	78,711.94
15	P	1,260	350	11,861.64	33.89	90,573.58
16	P	910	350	11,937.61	34.11	102,511.19
17	P	560	350	12,052.3	34.44	114,563.49
18	P	210	350	12,145.17	34.7	126,708.66
19	P	12	198	6,898.49	34.84	133,607.15

Cement Type	Theoretical Required Volume (ft^3)
Expanding cement	42,025
Chemical seal ring	1,930
Prehydrated filler cement	89,654

[a]E = Expanding Cement
C = Chemical Seal Ring
P = Prehydrated Filler Cement

NOTE: Volumes are theoretical, based on nominal bored hole dimensions

SPECIFICATION TITLE PAGE

SPECIFICATION NO. B-314-C-X28038

QA LEVEL I

CONSTRUCTION SPECIFICATION FOR

CASING FIELD WELDING SERVICES

BWIP EXPLORATORY SHAFT

PROJECT B-314

Prepared By:

Kaiser Engineers, Inc./Parsons Brinckerhoff Quade & Douglas, Inc.

For the U.S. Department of Energy

Contract No. DE-AC06-80RL10000

Burnett H. Litchman Specifications Engineer	12-20-82 Date	J.N. Rogers Job Engineer	12-20-82 Date
[signature] Design Manager	12/20/82 Date	D.L. Watson by [signature] Project Engineer	12-21-82 Date
H. Thayer by L. Thomas QC Engineer/Constr. Engr.	12/21/82 Date	L.S. Thomas Quality Assurance Engineer	12/21/82 Date
P.G. Bubber Deputy Project Manager	12/21/82 Date	J.S. Ritchie by PGB Project Manager	12/21/82 Date

ROCKWELL HANFORD OPERATIONS:

_____ _____
Date

CASING FIELD WELDING SERVICES

TABLE OF CONTENTS

CASING FIELD WELDING SERVICES

PART I - GENERAL

1.1 SCOPE

This specification describes the requirements for the field welding and emplacement support for joining and handling 17 units of 112-inch and 98 units of 72-inch inside diameter shaft casing, associated casing appurtenances and attachments described herein, other casing welding and miscellaneous welding as directed by the Contracting Officer.

1.1.1 Work Included

The Contractor shall furnish all labor, tools, equipment, facilities, materials, supplies, procedures, records, and transportation, unless otherwise specified, necessary to perform the work noted below.

1.1.1.1 Casing joining welding operations required to join 40-foot units of 112-inch ID casing into one continuous string for lowering into a 144-inch diameter hole and to join 40-foot units of 72-inch ID casing into one continuous string for lowering into a 110-inch diameter hole; casing units will be welded in a predetermined "best-fit" sequence.

1.1.1.2 Other casing welding operations required directly on the casing, and on casing appurtenances and components other than specified above. Such welding will include the following:

a. Attaching grout guides and support plates to casing

b. Attaching ventilating and dewatering lines, and associated support plates and skid plates to casing

c. Attaching centralizers to casing

d. Seal welding radiographic testing (RT) inspection portholes

e. Attaching monitoring lines to casing

f. Installing mining inspection porthole assemblies in casing

g. Weld backing rings

1.1.1.3 Casing handling operations required to move and position 112-inch and 72-inch ID casing units within and from designated laydown area, to and within welding operations area(s), and to and within drill rig pick-up area.

1.1.1.4 Handling operations required to move and/or position casing appurtenances and components within and from laydown (storage) area, to and within welding operations area(s), and to and within drill rig work areas.

1.1.1.5 Miscellaneous welding as directed by the Contracting Officer, not directly a part of the casing or attachment welding operations specified above.

1.1.1.6 Preparation and qualification of material, welding, handling, control, inspection, and documentation procedures, manuals, and programs.

1.1.1.7 Qualification of welders, welding operators, and inspectors.

1.1.1.8 Preparation, maintenance, and management of documentation and records as specified herein.

1.1.1.9 First line inspection, verification, and documentation of supplier performed activities affecting quality.

1.1.1.10 Providing filler metals and other supplies for welding operations.

1.1.2 Work Not Included

The following material and services will be provided by Others.

1.1.2.1 Nondestructive examination services, materials, and equipment

1.1.2.2 Casing units, appurtenances, components, and attachments

1.1.2.3 Designated work and handling area

1.1.2.4 Electrical power and water sources

1.1.2.5 Lowering casing into emplacement hole

1.2 DEFINITIONS

1.2.1 Site

"Site" shall mean the immediate vicinity of BWIP Exploratory Shaft at Hanford, Washington, as shown on the Drawings.

1.2.2 Owner

"Owner" shall mean the Department of Energy (DOE) or its appointed representative.

1.2.3 Engineer

"Engineer" shall mean the Owner's appointed representative identified in the Contract, and authorized to act on technical matters as specified herein.

1.2.4 Drawings

"Drawings" shall mean those design drawings listed in the "Special Conditions".

1.2.5 Contractor

"Contractor" shall mean the party responsible to the Owner for the work specified herein.

1.2.6 Seller

"Seller" as used in Appendix A, "Bidder and Seller Information Requirements" shall mean the Contractor as defined above.

1.2.7 Unit

"Unit" shall mean a prefabricated casing assembly, of length indicated on the Drawings, consisting of a welded steel cylinder with attached circumferential external stiffener and lifting lug rings and internal continuous-slot channels, with ends of unit suitably prepared for field welding, and individually identified by a mark number.

1.2.8 Stiffener

"Stiffener" shall mean the circumferential solid bar reinforcing rib welded to the outside of each unit.

1.2.9 Inspection Port

"Inspection port" shall mean a screwed plugged cavity in the casing plate required for placing a radioactive source for use in radiographic examination.

1.2.10 Lifting Lug Ring

"Lifting lug ring" shall mean the circumferential solid bar rib welded to the upper end of each unit to provide a lifting shoulder.

1.2.11 Grout Guide

"Grout guide" shall mean the slotted vertical piping that is to be attached to the outside of the casing to provide a conduit for placing grout.

1.2.12 Continuous-Slot Channel

"Continuous-slot channel" shall mean the rings, with formed channel cross section, welded to the inside of each unit for supporting hardware to be furnished and installed by Others.

1.2.13 Ventilation Line

"Ventilation line" shall mean the vertical piping that is to be attached to the outside of the casing for supplying ventilation air to the bottom of the casing after installation of the casing.

1.2.14 Dewatering Line

"Dewatering line" shall mean the vertical piping that is to be attached to the outside of the casing for removal of water from the bottom of the casing after installation of the casing.

1.2.15 Hold Point

"Hold point" shall mean that activity in the production sequence where work shall not proceed without written release by the Inspector.

1.2.16 Witness Point

"Witness point" shall mean that activity in the production sequence scheduled for surveillance by the Inspector where work may proceed upon verbal release by the Inspector or upon the expiration of a one hour wait for inspection from the scheduled time.

1.2.17 Inspector

"Inspector" shall mean those persons or agencies appointed by the Owner to conduct quality control surveillance and inspection activities of the fabrication process and to authorize acceptance and release to lower casing into the shaft hole.

1.2.18 Double Jointing

"Double-jointing" shall mean the joining together by welding of two casing units in the horizontal position.

1.2.19 Casing Section

"Casing Section" shall mean the assembly resulting from double jointing.

1.2.20 Pickup Area

"Pickup area" shall mean the area adjacent to the drilling "V" door where a casing unit or section is placed in the horizontal position to be picked up by both the drill rig and a crane, for erecting the unit or section to a vertical position. The crane transfers its portion of the load to the drill rig during the transition from horizontal to vertical position of the casing joint.

1.2.21 Elevator

"Elevator" shall mean a hinged collar furnished by Others that is attached to the upper lifting lug ring of each casing unit. It is used for lifting casing units or sections into the vertical position and for lowering the casing unit, section or string into the shaft hole.

1.2.22 Elevator Sling

"Elevator sling" is a device furnished by Others used to support the elevator from the drill rig main hook.

1.2.23 Casing Running

"Casing running" shall mean the joining together by welding of casing units or sections in the vertical position, attaching appurtenances, and lowering the resulting casing string in the shaft hole.

1.2.24 Match Mark

"Match mark" shall mean a mark placed on each end of a casing unit to indicate a best fit alignment between two casing units for assembly in a predetermined sequence.

1.2.25 The applicable definitions contained in the following publications shall also pertain:

a. ANSI NQA-1, Supplement S-1

b. AWS A3.0

1.3 CITED REFERENCES

Work performed and materials furnished under this specification shall conform to the requirements of the documents listed below, to the extent specified herein. In the event of conflict between applicable requirements of two or more of those documents, the most stringent requirement shall apply.

ANSI - American National Standards Institute

NQA-1-1979	Quality Assurance Program Requirements for Nuclear Power Plants
N45.2.2-1978	Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants
N45.2.15-1981	Hoisting, Rigging and Transporting of Items at Nuclear Power Plants

API, American Petroleum Institute

Spec. 5A	Casing, Tubing, and Drill Pipe, 1979, w/Supplement 1, March 1980

ASTM, American Society for Testing and Materials

A 53-77a	Pipe, Steel, Black and Hot-Dipped Zinc Coated Welded and Seamless
A 570-79	Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
A 588-81	High-Strength Low-Alloy Structural Steel with 50,000 psi Minimum Yield Point to 4 in. Thick
E 165-75	Liquid Penetrant Inspection Method
E 709-80	Magnetic Particle Examination

ASME, American Society of Mechanical Engineers

Boiler and Pressure Vessel Code as amended through 1981

Section V,	Nondestructive Examination
Section VIII,	Pressure Vessels, Division 1
Section IX,	Welding and Brazing Qualifications

AWS, American Welding Society

A3.0-80	Welding Terms and Definitions
D1.1-82	Structural Welding Code - Steel

DOE, U. S. Department of Energy

HS-BP-8002,	Supplier Acceptance Data Package (ADP)

1.4 QUALITY ASSURANCE

1.4.1 The materials and services furnished hereunder are for components of a structure classified Quality Level I for nuclear safety purposes and are therefore subject to the requirements of a quality assurance program established and implemented in accordance with ANSI NQA-1 and its Supplements, ANSI N45.2.2, and ANSI N45.2.15.

1.4.2 Each bidder shall submit with the proposal his quality assurance program and quality control manual for review and evaluation as to his acceptability as a qualified vendor of nuclear Quality Level I materials and services.

1.4.3 The Contractor shall be responsible for assuring that his subcontractors' quality-assurance/quality control programs are in compliance with the Specifications. Subcontracting shall conform to the provisions of ANSI NQA-1, Basic Requirements 4 and 7, and Supplements 4S-1 and 7S-1.

1.4.4 Subsequent to the notice to proceed, the Owner will provide the Contractor comments on the quality assurance program and the quality control manual submitted with the bid. Prior to the start of fabrication, the Contractor shall re-submit the program and manual incorporating the Owner's comments. Subsequently, a joint Owner/Contractor quality assurance coordinating meeting shall be conducted to clarify requirements and acceptance criteria. Upon acceptance by the Owner of the program and manual, as revised, the Contractor shall proceed with fabrication in accordance with the provisions of the program and accepted procedures.

1.5 INSPECTION PROGRAM

1.5.1 The Contractor shall be responsible for the physical performance and documentation of all required in-process inspection, verification, testing, and other quality control functions during the field assembly and installation of the casing string.

1.5.2 The Inspector will perform the surveillance inspection of all required documentation and in-process operations to ensure compliance with the requirements herein.

1.5.3 The Owner will identify to the Contractor the authorized agencies and individuals who will perform inspection surveillance functions.

1.5.4 The Work will be inspected by the Contractor and the Inspector during all stages of the work. The Contractor shall furnish all facilities, tools, jigs, gauges, materials, and personnel necessary for inspection. This shall include personnel, equipment,

and materials necessary for inspection other than nondestructive examinations. The Inspector shall inspect and accept full penetration casing and utility line welds. The Contractor's inspection and test personnel shall be certified and qualified in accordance with ANSI NQA-1, Supplement 2S-1 and Appendix 2A-1. The Inspector shall have access to all areas of the Contractor's and his subcontractors' plants concerned with the supply of materials for field assembly of the casing string. Inspection by the Inspector shall not relieve the Contractor of his responsibility to perform work that complies with the requirements of the Specification and the Drawings.

1.5.5 An inspection plan, identifying all activities that affect the quality of services and materials specified, and incorporating hold points and witness points, shall be developed by the Contractor and submitted to the Owner, after notice to proceed, for review, comment, and acceptance. The inspection plan shall be subject to the Owner's review for conformance to the accepted quality assurance program and incorporation of hold and witness points. Fabrication shall not commence prior to acceptance of the inspection plan by the Owner. The inspection plan shall identify pertinent activities and operations, and steps critical to quality control. The following shall be included as minimum hold points:

1.5.5.1 Casing Welding Hold Points

a. Verification that each casing unit (and casing section) just prior to welding fit-up and alignment is the correct mark number, in appropriate sequence, correct configuration and is within dimensional tolerances specified by design drawings. Identify, record, and report any deficiencies to the Inspector prior to fit-up and alignment operations relative to established "match mark".

b. Verification that each casing-unit and casing-section weld joint fit-up and alignment is within dimensional tolerances specified by design drawings and Owner-approved welding procedure specifications. Identify and record the fit-up and alignment dimension(s) maximum/minimum tolerances and their locations relative to established "match mark" prior to the start of root welding.

c. Verification that each welder/welding operator assigned has been qualified in accordance with specification requirements, has in his possession approved and certified filler metal specified by the approved welding procedure and has read and understands the approved welding procedure, prior to start of each casing weld joint.

d. Any volumetric (RT/UT) nondestructive examination prior to release of the weld or unit for further processing.

e. Any release for lowering casing into the shaft hole.

1.5.5.2 Casing Attachment Welding Hold Points

Verification that all casing attachments are welded at the correct location and conform to configuration and dimensional requirements of design drawings prior to release to the rig, or lowering into the shaft hole.

1.5.5.3 Casing Handling Hold Points

Verification that casing lifting devices are attached to casing units or assemblies at approved and designated points to prevent overstressing or deforming prior to the "lift".

1.5.6 Daily inspection reports shall be prepared for each shift period while field welding support operations are in progress. Inspection reports shall document results of inspections and examinations of attributes and characteristics identified on the Contractor's Inspection Plan.

1.5.6.1 For casing welding operations, the information and data identified on the attached sample inspection reports shall be recorded by the Contractor and submitted by the end of the next succeeding shift. The Contractor may use his own form so long as the pertinent data are recorded. (See Appendix B)

1.5.6.2 The identification, marking, and reporting of inspection results shall be performed in such a manner as to correlate the location and results of the inspected item to a specified orientation reference mark approved by the Owner/Engineer.

1.6 RECORDS AND SUBMITTALS

1.6.1 The Contractor shall establish and maintain a records system in accordance with ANSI NQA-1, Basic Requirement 17, Supplement 17S-1, and Appendix 17A-1. This system shall be incorporated into the Contractor's quality assurance program and submitted for the Owner's review and acceptance. The records system shall provide complete traceability of all materials, equipment, workmanship, quality controls, and handling of each unit. All documentation shall be clear, legible, and of suitable quality for microfilming and for long term storage.

1.6.2 The Contractor shall obtain, maintain, and submit to the Owner the following:

1.6.2.1 Welding electrode and flux manufacturers' material certification, including the heat number and AWS/ASME specification.

1.6.2.2 Welder and welding machine operator test result records.

1.6.2.3 Welding procedure specifications and qualification records.

1.6.2.4 Completed weld report for each casing unit covering all completed welds and containing all the information necessary to verify the quality of the weld and weld deposited material. Radiographs with completed report form and other nondestructive examination reports shall be included. The reports shall be in the format shown in the accepted quality control manual.

1.6.2.5 Welding support operation plan, identifying sequence of operations, schedule, methods of operation, description of handling and welding equipment, and layout of material during operations.

1.6.2.6 Certification documentation for inspection and test personnel per ANSI NQA-1, Supplement 2S-1, and Appendix 2A-1.

1.6.2.7 A listing of the completed units that indicates the actual fit-up sequence for field assembly of the continuous casing string.

1.6.2.8 Contractor's certificate of compliance that the completed work meets the requirements of the Specification and Drawings.

1.6.3 The Supplier shall submit the information listed in Appendix A, "Bidder and Seller Information Requirements".

1.6.4 All Supplier final data shall be submitted in accordance with DOE HS-BP-8002.

1.7 NONCONFORMING CONDITIONS

The Supplier shall identify each nonconforming condition relative to this Specification and the Drawings and shall notify the Owner and Engineer of each such condition. Disposition to "use as is" or to "repair" for each nonconforming condition shall require approval by the Owner/Engineer as a condition of acceptance of the work.

1.8 JOB CONDITIONS

The most critical welding operations are those performed on the drill rig floor, as they significantly impact the cost, schedule and quality of the

casing emplacement operations. Rig floor space is normally very limited for conducting welding operations. For these reasons, the requirements noted below shall be satisfied to the greatest extent practical.

1.8.1 Welding Equipment

The Supplier shall provide and maintain sufficient welding equipment, supplies and spare parts in operating condition to sustain the welding support services for casing running operations 24 hours a day for the duration of the casing running operations. Such equipment shall be modularized to the greatest practical extent to permit rapid replacement in the event of a malfunction. Further, welding equipment used on the rig floor area shall be portable and of such compact size and set up in such a manner as to minimize the congestion of equipment in the immediate rig floor work areas.

1.8.2 Planning and Execution

Welding and handling services supporting the casing running (emplacement) operations on the drill rig shall be planned and executed to complete the required welding in the shortest possible time and to minimize lost running time and to maintain the highest quality of work. The Field Welding Services Contractor shall work closely with the Drilling Rig Services Contractor to optimize casing running support operations.

1.8.3 Welding Procedure Specifications

Welding procedure specifications for welding full penetration casing or utility weld joints shall be specified and qualified in such a manner as to satisfy the most stringent requirements of both the AWS D1.1 and ASME Section IX welding codes. Welding procedures shall identify all variables, parameters and their tolerances that affect the quality and reproducibility of the weld.

1.8.4 Workmanship Weld Sample

Workmanship weld sample(s) representative of full penetration casing weld joint(s) shall be provided at the construction site for reference purposes. The workmanship weld sample shall be prepared in compliance with the requirements noted below:

1.8.4.1 Minimum sample weld assembly size shall be 12 inches x 18 inches

1.8.4.2 Test plates of different thicknesses representing maximum wall thickness transition as specified on drawings

1.8.4.3 Material shall be same as casing (i.e., ASTM A441 and A588)

1.8.4.4 Workmanship sample shall include minimum and maximum permissible weld joint configuration, fit-up and alignment tolerances:

a. Mismatch both (+) and (-) (max.)

b. Root openings (minimum and maximum)

c. Groove angle (minimum and maximum)

d. Root land (minimum and maximum).

1.8.4.5 Samples shall be made for weld joints with and without weld backing bar.

1.8.4.6 Weld sample shall meet workmanship and quality requirements specified for production weld including weld reinforcement.

1.8.4.7 Weld shall be made using the appropriate welding procedure and welder that has been qualified in accordance with this specification.

1.8.4.8 Welds shall be fully radiographed to the casing weld requirements of this Specification. The film shall contain weld sample identification, appropriate shims, screens and filters.

1.8.4.9 Documents provided with each weld sample shall include:

a. Radiographic film and reader sheet

b. Dimension sketch showing fit-up dimension and locations correlated to RT film

c. Inspection report

d. Reference welding procedure.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED PRODUCTS

Materials of Owner-furnished products will be as described below.

2.1.1 Casing, stiffeners, and lifting lug rings will be fabricated from steel plate and bar stock conforming to ASTM A 588.

2.1.2 The materials for the grout guides and accessories will be as noted below.

2.1.2.1 Grout guide pipe: ASTM A 53, Schedule 40, black, type F.

2.1.2.2 Support plates and guide plates: ASTM A 588.

2.1.3 The materials for the ventilation and dewatering lines and accessories will be as noted below.

2.1.3.1 Ventilation and dewatering line pipes and slip-on couplings: API Spec. 5A, Grade J-55, Casing.

2.1.3.2 Elbows: ANSI B16.9 long radius buttwelding 90° elbow for Schedule 40 pipe.

2.1.3.3 Support plates and skid plates: ASTM A 588.

2.1.4 The inspection port will be a forged steel half-coupling with plug of quality, configuration, and threads as stipulated in ANSI B16.11 and as shown on the Drawing.

2.1.5 The continuous-slot channel will be a commercial standard product fabricated from ASTM A 570, Grade C steel, with plain finish.

2.1.6 Centralizers will be fabricated from steel plate conforming to ASTM A 588.

2.2 CONTRACTOR-FURNISHED PRODUCTS

2.2.1 Filler Metals

Filler metals for arc welding shall conform to Tables 4.1.1 and 4.1.4 of AWS D1.1. Material selected shall be identified in the weld procedures submittal.

2.2.2 Welding Equipment

Welding equipment shall be furnished as required to execute the work in accordance with approved welding procedures, and to meet the requirements indicated in the Article herein titled Job Conditions.

2.2.3 Handling, Positioning, and Alignment Equipment

Equipment necessary for handling, positioning and aligning casing units and sections and the attachments thereto shall be furnished. Such equipment and the method of use shall be as required to prevent over-stressing, deforming or damaging the casing and its attachments, in compliance with ANSI N45.2.15. Written procedures, identifying and describing the equipment and the method of use, shall be submitted to the Owner for review and approval.

2.2.3.1 Casing handling equipment shall be capable of transporting and positioning 40-foot casing units and 80-foot casing sections, with or without attachments, from the laydown (storage) area to and from the welding areas, and to and from the drill rig. The equipment shall also be capable of placing one end of casing in the V-door of the drill rig and supporting the middle and lower end as each such unit or section is raised to a vertical position in the drill rig. The 80-foot casing sections are 112" ID and 72" ID and can weigh up to 60 tons and 80 tons respectively, depending on wall thickness. Cranes or side boom tractors of sufficient lifting capacity to elevate one end of a 40-foot casing unit or 80-foot casing section to a height as required by the Drilling Contractor from the ground will be required.

2.2.3.2 In order to "double-joint" 40-foot casing units into 80-foot casing sections, casing positioning equipment shall be furnished. The equipment shall have capacity to support and position the pairs of casing units in a horizontal position for welding. The procedure for casing positioning equipment, if used, shall include cross references to the appropriate welding process and procedure used with it. This equipment may also be required to position casing units or casing sections for the attachment of casing appurtenances.

2.2.3.3 External line-up clamps or other suitable equipment shall be furnished to align casing units or sections in the vertical position for welding to abutting units or sections. Alignment equipment shall be capable of aligning casing ends to the specified tolerance requirements.

2.2.3.4 An air seal cap may be required on the upper end of the vertical casing string during casing welding operations. Air temperature differences between the inside and outside of the casing, and internal and external air currents can cause differential pressure across the casing weld joint that may affect weld shielding and consequently weld quality. The air cap may be used to regulate this differential pressure, including inputting air to the inside of the casing if necessary.

2.2.3.5 Equipment shall be furnished as required for handling and aligning appurtenances for attachment to the casing. The nature of such equipment will depend on the work location(s) chosen by the Contractor for attaching the appurtenances.

PART 3 - EXECUTION

3.1 WELDING PROCESSES

Fusion welding processes for welding of casing and appurtenances shall be as permitted by AWS D1.1 and ASME Boiler and Pressure Vessel Code, Section IX.

3.2 WELD JOINT ROOT BEADS

The back side of every circumferential casing weld performed while the casing is in the horizontal position shall have the backing material removed. The inside diameter surface of the root bead shall be mechanically cleaned or air arc gouged to clean metal prior to the deposition of additional weld metal.

3.3 PREPARATION FOR WELDING

3.3.1 The edges of plates shall be formed to accommodate the applicable approved weld procedure specification. All projecting burrs shall be removed. Hammering or peening shall not be used to shape the edges preparatory to welding.

3.3.2 Surfaces to be welded shall be clean, smooth, and free of contaminants that might affect weld quality. Petroleum products shall not be used as cleaner on surfaces to be welded.

3.3.3 Weld backing rings shall be as shown on the Drawing and fabricated of ASTM A 588 steel or a material of equal chemical and mechanical properties.

3.4 QUALIFICATIONS

Welding procedure specifications shall be prepared, and the procedures, welders, and welding operators used for the welding of casing and appurtenances shall be qualified as specified herein. No previous procedure, welder, or welding operator qualification will be accepted. All procedure and performance qualification welds and tests shall be subject to witness by the Inspector. The Inspector shall be notified at least 48 hours in advance of qualification activities to permit him to attend.

3.4.1 Welding procedure specifications (WPS) shall be prepared in accordance with AWS D1.1, Section 5. The WPS shall include all essential and nonessential variables. All welding parameters shall be recorded in the WPS, with special description consideration to joint configuration and fit-up dimensions and weld metal deposition methods.

3.4.2 Welding procedures for full penetration casing and utility line welds shall be qualified in accordance with ASW D1.1, Section 5, Part B, except as follows:

a. Welding procedure qualification test welds shall be performed on test plates that exhibit the extremes of permissible fit-up and alignment tolerances.

b. Qualification test specimens shall be radiographically examined and accepted in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Articles UW51 a and b, prior to removing tensile and test bend specimens. Radiographic examination is in addition to applicable guided bend tests.

c. Guided bend tests are required for procedure qualification for plate thicknesses of 3/4" and thinner, and shall include both face and root bends. The acceptance criteria for guided bend tests shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

d. The base metal used in procedure qualification tests shall be of the same specification and grade as the casing and appurtenances to be welded.

3.4.3 Welders and welding operators shall be qualified prior to production welding. Qualification shall be in accordance with AWS D1.1, Section 5, Part C or Part D as applicable, except as follows:

a. Qualification test specimens shall be radiographically examined and accepted in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Articles UW51 a and b, prior to removing test bend specimens.

b. Guided bend test specimens shall be tested in accordance with AWS D1.1, Section 5, Part C or D as applicable, and ASME Boiler and Pressure Vessel Code, Section IX. Acceptance Criteria shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

3.4.4 Procedure, welder, and welding operator qualification records shall be maintained at the jobsite, including certified radiographic examination report, radiographic film, and qualification report for each welder and welding operator including his/her unique identifier.

3.4.5 When there is a specific reason, as determined by the Inspector, to question the ability of a welder, welding operator, or welding equipment to consistently produce welds that meet the specifications, the welder or welding operator shall be requalified. If the welder or welding operator continues to produce welds that do not meet the specifications, the Contractor shall, at the request of the Inspector, remove the welder, welding operator, or welding equipment from the job.

3.5 WELD QUALITY AND WORKMANSHIP

3.5.1 Weld Type

Weld type shall be as shown on the Owner/Engineer approved Drawing.

3.5.2 Stress Risers

Visually discernable stress risers upon weld or parent metal surfaces, i.e. sharp and abrupt changes in weld bead geometry, laminations, inclusions, open porosity, arc starts, cold laps, lack of fusion, parent metal damage caused by removal of temporary appurtenances, chisel marks, or gouges, are not acceptable and shall be repaired prior to final inspection. Repair of welds shall be in accordance with the methods permitted by AWS D1.1 Article 3.7, except that oxygen gouging shall not be used on normalized steel.

3.5.3 Undercuts

Weld undercuts shall be rejected except intermittent undercuts (6" long in 24" of weld) having a smooth and gradual transition and having a depth of 1/32" or less are acceptable.

3.5.4 Acceptance Standards

Weld acceptance shall be in accordance with the criteria for workmanship and nondestructive examination as specified herein and in Sections V and VIII of the ASME Boiler and Pressure Vessel Code and in AWS D1.1, Section 5, Part C, and Section 8 for the inspection and examination methods used. The workmanship weld sample(s) prepared and approved as specified herein may be used as reference for determining weld acceptability. The Inspector shall have final acceptance authority over completed weldments.

3.6 TOLERANCES

Casing shall be joined to the following tolerances and as shown on the Drawings. Tolerances not specified otherwise shall be ± 1/8".

3.6.1 Weld Joint Root Openings

Longitudinal and circumferential plate welds shall have the option of a root gap ranging up to 3/16" maximum.

3.6.2 Mismatch

The mismatch of the interior surfaces of abutting casing units shall not exceed 1/8" along the circumferential weld seam.

3.6.3 Unit (Section) Straightness

Completed casing unit (section) shall be straight, with walls parallel to the axis of the casing within a tolerance not exceeding 3/16" in 10' when measured from a reference line parallel to the axis.

3.6.4 Casing Unit (Section) Ends

3.6.4.1 The planes of the ends of the casing unit (section) shall be normal to a line parallel to the axis of the casing section with a tolerance of ± 15 minutes of arc at all locations on the circumference.

3.6.4.2 The maximum gap between the end of the unit (section) and a plane surface pressed against the end of the unit (section) shall be 1/8 inch.

3.6.5 Fillet Weld Size

Close fit-up is required at those joints where fillet welds are applied in order to insure full fusion welds at the bottom of the fillet. Fillet weld specified size on approved Drawings is a minimum.

3.6.6 Weld Reinforcement

Weld reinforcement of inside diameter full penetration casing or utility line welds shall not exceed 1/8" and shall be smoothly blended from weld metal to parent metal. Outside diameter weld reinforcement shall not exceed 1/4", except mismatched weld joints may contain additional weld reinforcement not to exceed the amount of mismatch, and shall be smoothly blended from weld metal to the parent metal.

3.6.7 Tapered Transition

Casing weld joints having abutting surfaces of different thicknesses shall have an outside tapered weld reinforcement in compliance with Article UW-9(c) of ASME Boiler and Pressure Vessel Code, Section VIII.

3.7 IDENTIFICATION MARKING

3.7.1 Welder Stamps

Each qualified welder or welding operator shall be issued a unique stamp for identifying his or her work performed on the project. This stamp shall only be issued once for use on this project. Steel stamps issued shall imprint a radius, not a sharp notch.

3.7.2 Welder Stamp Application

All casing welds shall be identified to and bear the stamp of the responsible welder/welding operator. Identification marks and stamping shall be located adjacent to the weld but not closer than 1" from the heat affected zone (HAZ). Weld areas and the responsible welder/ welding operators shall be identified and recorded on the casing weld inspection report and on weld maps.

3.8 VISUAL INSPECTION

3.8.1 Visual inspection shall be performed during all in-process handling, fit-up, alignment, and welding operations and upon all completed welds. Visibly discernable weld defects shall be repaired and visually reinspected prior to the application of non-destructive examination procedures.

3.8.2 The Inspector may request non-destructive examination when the structural integrity of a completed weld or its repair is in question.

3.8.3 Standard of acceptance shall be as specified in Section 3.5, 3.6 herein and in AWS D1.1.

3.9 NONDESTRUCTIVE EXAMINATION

3.9.1 Radiographic Examination

3.9.1.1 Full penetration casing and utility line welds shall be 100% radiographically examined.

3.9.1.2 The radiographic inspections shall be performed as stipulated for techniques and quality in Paragraph UW51, Section VIII, ASME Boiler and Pressure Vessel Code.

3.9.1.3 Each radiographic film shall show not less than one foot of weld.

3.9.1.4 Exposed radiographic film that is defective shall be the basis for rejection of the film, and repeating the radiographic inspection of the weld.

3.9.2 Magnetic Particle Examination

3.9.2.1 The following casing attachment and appurtenance welds shall be magnetic particle examined:

a. Welds joining centralizers and skid plates to casing

b. Utility line seal welds

APPENDIX A (Sheet 1 of 2)

BIDDER AND SELLER INFORMATION REQUIREMENTS

TYPE OF INFORMATION	BY BIDDER	BY SELLER						
		NOTE - LAST COLUMN TO BE COMPLETED BY SELLER						
	COPIES WITH EACH BID	REPRODUCIBLE* TO BE SUBMITTED FOR REVIEW	CERTIFIED DRAWINGS TO BE SUBMITTED AFTER REVIEW			COPIES REQUIRED WITHOUT REVIEW	POST AWARD	
			PAPER PRINTS	REPRODUCIBLE*			REVIEW DATA REQUIRED (DAYS AFTER AWARD)	SELLER PROMISE SUBMITTAL (DAYS AFTER AWARD)
				PAPER	PERMANENT			
1. DRAWING LIST AND SCHEDULE								
2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION								
3. SCHEMATIC PIPING DIAGRAMS								
4. ELECTRICAL AND INSTRUMENTATION INFORMATION								
5. SHOP DETAIL DRAWINGS								
6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS								
7. LOAD DIAGRAMS								
8. DATA SHEETS, AS NOTED THEREON								
9. PERFORMANCE DATA AND CURVES								
10. CERTIFIED TEST AND INSPECTION REPORTS								
11. BILLS OF MATERIAL								
12. INSTALLATION INSTRUCTIONS								
13. MAINTENANCE AND OPERATING								
14. NAMEPLATE DATA, AND MOTOR LIST								
15. CALCULATIONS								
16. PRELIMINARY DESIGN DRAWINGS								
17. FINAL DESIGN DRAWINGS								
18. Quality Assurance Program	3	**	6	1				
19. Quality Control Manual	3	**	6	1				
20. Inspection Plan		**	6	1				
21. Casing Field Welding Inspection Daily Reports						3		
22. Welding Electrode & Flux Matte Manufacturer's Certificatio						3		
23. Welder & Welding Operator Test Records						3		
24. Weld Procedure Spec. & Qualification Records		**	6	1				
25. Weld Reports, Including NDE						3		
26. Welding Support Operation Plan		**	6	1				
27. Inspection & Test Personnel Qualification Certificates						3		
28. Casing Unit Actual Fitup Sequence						3		
29. Contractor's Certif.of Compliance						3		
30. Handling, Positioning & Alignment Equipment Procedures		**	6	1				

* Reproducible required only for Data larger than 11" x 17"

** One Reproducible (See above note) and 6 Prints.

See Next Page for Definitions and Instructions

3.9.2.2 The magnetic particle examination shall be in accordance with ASTM E 709 using the DC prod method, and ASME Section V, Standard SE 109.

3.9.2.3 The acceptance standard shall be as specified in the Article herein titled WELD QUALITY AND WORKMANSHIP, and ASME Section VIII, Appendix 6.

3.9.2.4 Surface imperfections interpretations in dispute with the magnetic particle examination indications shall be verified by an alternate nondestructive examination method as determined by the Inspector.

3.9.3 Liquid Penetrant Examination

3.9.3.1 The following casing attachment and appurtenance welds shall be liquid penetrant examined:

a. Any inspection port seal welds

b. Any utility line seal welds (as an alternate)

3.9.3.2 The liquid penetrant examination shall be in accordance with ASTM E165-75 and ASME Section V.

3.9.3.3 The acceptance standards shall be as specified in the Article herein titled WELD QUALITY AND WORKMANSHIP, and ASME Section VIII, Appendix 8.

PART 4 - DRAWINGS AND ATTACHMENTS

4.1 DRAWINGS

The KE/PB drawings listed in the "Special Conditions" are made a part of this Specification.

4.2 ATTACHMENTS

The appendices listed below are attached and made a part of this Specification.

Appendix A, Bidder and Seller Information Requirements

Appendix B, Casing Field Welding Inspection Data Forms (Sample)

BWIP10A: 12/03/82

APPENDIX A (Sheet 1 of 2)

BIDDER AND SELLER INFORMATION REQUIREMENTS

TYPE OF INFORMATION	BY BIDDER	BY SELLER						
		NOTE - LAST COLUMN TO BE COMPLETED BY SELLER						
	COPIES WITH EACH BID	REPRODUCIBLE* TO BE SUBMITTED FOR REVIEW	CERTIFIED DRAWINGS TO BE SUBMITTED AFTER REVIEW			COPIES REQUIRED WITHOUT REVIEW	POST AWARD: REVIEW DATA REQUIRED (WEEKS AFTER AWARD)	POST AWARD: SELLER PROMISE SUBMITTAL (WEEKS AFTER AWARD)
			PAPER PRINTS	REPRODUCIBLE* PAPER	REPRODUCIBLE* PERMANENT			
1. DRAWING LIST AND SCHEDULE								
2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION								
3. SCHEMATIC PIPING DIAGRAMS								
4. ELECTRICAL AND INSTRUMENTATION INFORMATION								
5. SHOP DETAIL DRAWINGS								
6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS								
7. LOAD DIAGRAMS								
8. DATA SHEETS, AS NOTED THEREON								
9. PERFORMANCE DATA AND CURVES								
10. CERTIFIED TEST AND INSPECTION REPORTS								
11. BILLS OF MATERIAL								
12. INSTALLATION INSTRUCTIONS								
13. MAINTENANCE AND OPERATING								
14. NAMEPLATE DATA, AND MOTOR LIST								
15. CALCULATIONS								
16. PRELIMINARY DESIGN DRAWINGS								
17. FINAL DESIGN DRAWINGS								
18. Quality Assurance Program	3	**	6	1				
19. Quality Control Manual	3	**	6	1				
20. Inspection Plan		**	6	1				
21. Casing Field Welding Inspection Daily Reports						3		
22. Welding Electrode & Flux Matte Manufacturer's Certificatio						3		
23. Welder & Welding Operator Test Records						3		
24. Weld Procedure Spec. & Qualification Records		**	6	1				
25. Weld Reports, Including NDE						3		
26. Welding Support Operation Plan		**	6	1				
27. Inspection & Test Personnel Qualification Certificates						3		
28. Casing Unit Actual Fitup Sequence						3		
29. Contractor's Certif.of Compliance						3		
30. Handling, Positioning & Alignment Equipment Procedures		**	6	1				

* Reproducible required only for Data larger than 11" x 17"

** One Reproducible (See above note) and 6 Prints.

See Next Page for Definitions and Instructions

DEFINITIONS

1. DRAWING LIST AND SCHEDULE A complete list of all drawings and data by title that the bidder expects to furnish on this order. Schedule to show, in weeks after award, submittal of each type of review and certified drawings.

2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION Drawings to scale showing the relative size, configuration, and location of all material to be furnished. Show two or more views of unit, clearances and area required for operation and maintenance. Show unit in relation to nearby structures and other equipment or operating floor, location of utility connections and direction of rotation, if applicable. When submitting data for "off the shelf" equipment/materials, catalog cuts and information are acceptable provided they are submitted in ample detail.

3. SCHEMATIC PIPING DIAGRAMS Show equipment to be interconnected, flow quantities, pipe sizes, valves and instruments.

4. ELECTRICAL AND INSTRUMENTATION INFORMATION Show all data pertaining to instrumentation, control and power electrical equipment. Include "one-line", "elementary" wiring, panel interior wiring and exterior interconnection wiring, dimensioned outlines of enclosures with raceway entries shown.

5. SHOP DETAIL DRAWINGS Show all necessary details and data required for fabrication and maintenance. For structural details show all connections and member sizes.

6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS Show all data required for foundation design including location, blockouts, embedded items, grout required, and size, type and projection of anchor bolts.

7. LOAD DIAGRAMS Show total static and dynamic loads and load centers.

8. DATA SHEETS Sheets shall be completed for the equipment proposed with all information noted thereon.

9. PERFORMANCE DATA AND CURVES

10. CERTIFIED TEST AND INSPECTION REPORTS Reports by recognized commercial laboratories of indicated chemical and physical tests of materials as required by the specifications. In addition where applicable, weld inspection and stress relieving records and code nameplate rubbings shall be furnished.

11. BILLS OF MATERIAL Show for each unit: item no., shop order no., mark or name, part no., or pattern no., and drawing reference.

12. INSTALLATION INSTRUCTIONS Complete, detailed and sequenced instructions for original installation and for removals and replacements as well as erection information.

13. MAINTENANCE AND OPERATING MANUALS Complete installation, starting and operating instructions. Complete descriptions of preventive and repair maintenance, including detailed lubrication chart showing every lubrication point, grade of lubricant, lubrication schedule and amount of oil or grease required for refill after drainage. Manuals include parts list with recommended spares.

14. NAMEPLATE DATA AND MOTOR LIST

15. CALCULATIONS Shall be checked and stamped by a registered professional engineer, licensed to practice in the state where installation occurs.

16. PRELIMINARY DESIGN DRAWINGS Seller provided design services such as pre-engineered buildings, silos and other structures, conveyor systems, bins and chute design, large ductwork and supports.

17. FINAL DESIGN DRAWINGS Same as Item No. 16.

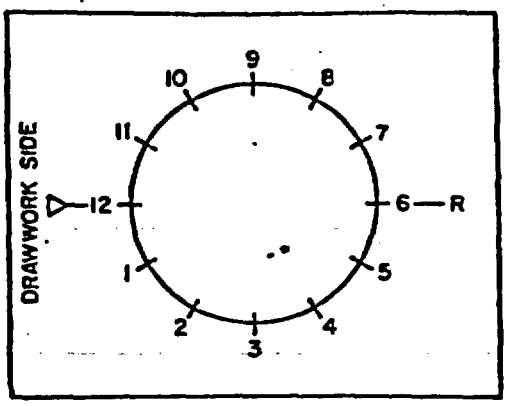
INSTRUCTIONS

1. DIMENSIONS Shown on all but schematic drawings and diagrams shall be in feet and inches, unless noted otherwise.

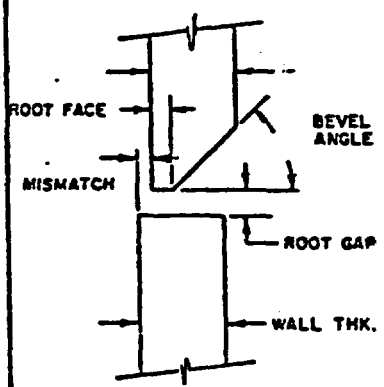
2. CERTIFIED DRAWINGS Shall be so marked by Seller. They shall conform to Seller's drawings as finally accepted by the Purchaser and shall be forwarded at commencement of manufacture. The drawings shall be revised and resubmitted to reflect any changes approved during the manufacturing period.

3. REPRODUCIBLE PERMANENT PRINTS Shall be cloth, "Chronaflex", or "Mylar". They shall depict the material as shipped and shall be forwarded upon completion of shipment.

APPENDIX B - CASING FIELD WELDING INSPECTION FORMS (SAMPLE)



Weld Ident. No.:_____
Casing Joint Ident., Lower:_____
Hole No.:_____ Upper:_____
Rig:_____
Site Location:_____
Weather Conditions:_____
Total Weld Cycle Time:_____
Weld Time:_____
Weld Repair Time:_____
Radio Time:_____
Alignment Time:_____
Lost Time:_____

Operation No.	Operation Description	Time Start	Time Finish	Time Lapse	Insp. Date
10	CASING DATA: Length_____ Weight_____ Material_____ P.O.#_____ Wall Thk._____ Bevel End I.D., Min._____ Max._____ Butt End: I.D., Min._____ Max._____ Remove Inspection Hole Plug:_____ Remarks:_____				
20	INTERNAL BRACING REMOVAL AND TACK WELD GRIND: Remarks:_____				
30	CASING PICK UP: Remarks:_____				
40	WELD GROOVE PREPARATION: Record dimensions and location of out-of-specification condition (ie., nicks, gouges, build up, grinding, fareing, etc.  Remarks:_____				
50	JOINT RELEASED FOR PICK UP @____HR._____DATE				
60	CASING ALIGNMENT: Remarks:_____				

APPENDIX B (Cont.)

Operation No.	Operation Description	Time Start	Time Finish	Time Lapse	Insp. Date
70	CASING WELD GROOVE CLEANING: Remarks: _____				
80	JOINT RELEASED FOR WELDING @ ____ HR. _____ DATE				
90	TACK WELDING: (see section I) _____ _____				
100	ROOT BEAD WELDING: (see section I) _____ _____ _____				
110	VISUAL ROOT AND TACK WELDING INSPECTION: No. of Def. | Description | Location				
120	RADIOGRAPHIC ROOT AND TACK WELDING INSPECTION: No. of Def. | Description | Location				
130	ROOT WELD REPAIRS: No. of Def. | Description | Location				
140	RADIOGRAPHIC INSPECTION OF ROOT WELD REPAIR: No. of Def. | Description | Location				
150	FILLER PASS WELD: (see section I) _____ _____				

APPENDIX B (Cont.)

Operation No.	Operation Description	Time Start	Time Finish	Time Lapse	Insp Date
160	VISUAL INSPECTION OF FILLER PASS WELD: No. of Def. | Description | Location				
170	RADIOGRAPHIC INSPECTION OF FILLER PASS WELD: No. of Def. | Description | Location				
180	FILLER PASS WELD REPAIR: Repair No. | Description | Location				
190	RADIOGRAPHIC INSPECTION OF FILLER PASS REPAIR WELD: No. of Def. | Description | Location				
200	WELD JOINT RELEASED FOR PLUG WELD AND GROUT LINES @ ____ HR. ____ DATE				
210	INSPECTION HOLE PLUG WELD:				
220	VISUAL INSPECTION OF HOLE PLUG WELD: No. of Def. | Description | Location				
230	MAGNAFLUX INSPECTION OF HOLE PLUG: No. of Def. | Description | Location				
240	WELD GROUT LINE AND/OR MONITOR LINE SPLICE JOINTS:				

250	I HAVE EXAMINED THIS WELD AND CERTIFY THAT IT MEETS THE MINIMUM STANDARDS OF THE APPROPRIATE SPECIFICATION AND STANDARDS WHICH APPLY TO THIS CASING WELD. CODES & STANDARDS: _____ NONDESTRUCTIVE TESTING REPRESENTATIVE _____ WELDING CONTRACTOR REPRESENTATIVE _____ A.E.C. REPRESENTATIVE _____ JOINT RELEASED FOR LOWERING @ _____HR._____DATE

Operation No.	Operation Description	Time			Insp.
		Start	Finish	Lapse	Date
260	LOWERING CASING AND PREPARE FOR NEXT CASING PICK-UP:				
270	OTHER MISCELLANEOUS RELATED CASING WELDING:				
280	GENERAL REMARKS:				

APPENDIX B (Cont.)

CASING FIELD WELDING INSPECTION (SUPPLEMENTARY) FORM

Weld Ident. No.:_____ Site Location:_____

Operation No.	Operation Description	Start	Finish	Lapse	Date

CASING FIELD WELDING INSPECTION FORM - SECTION I

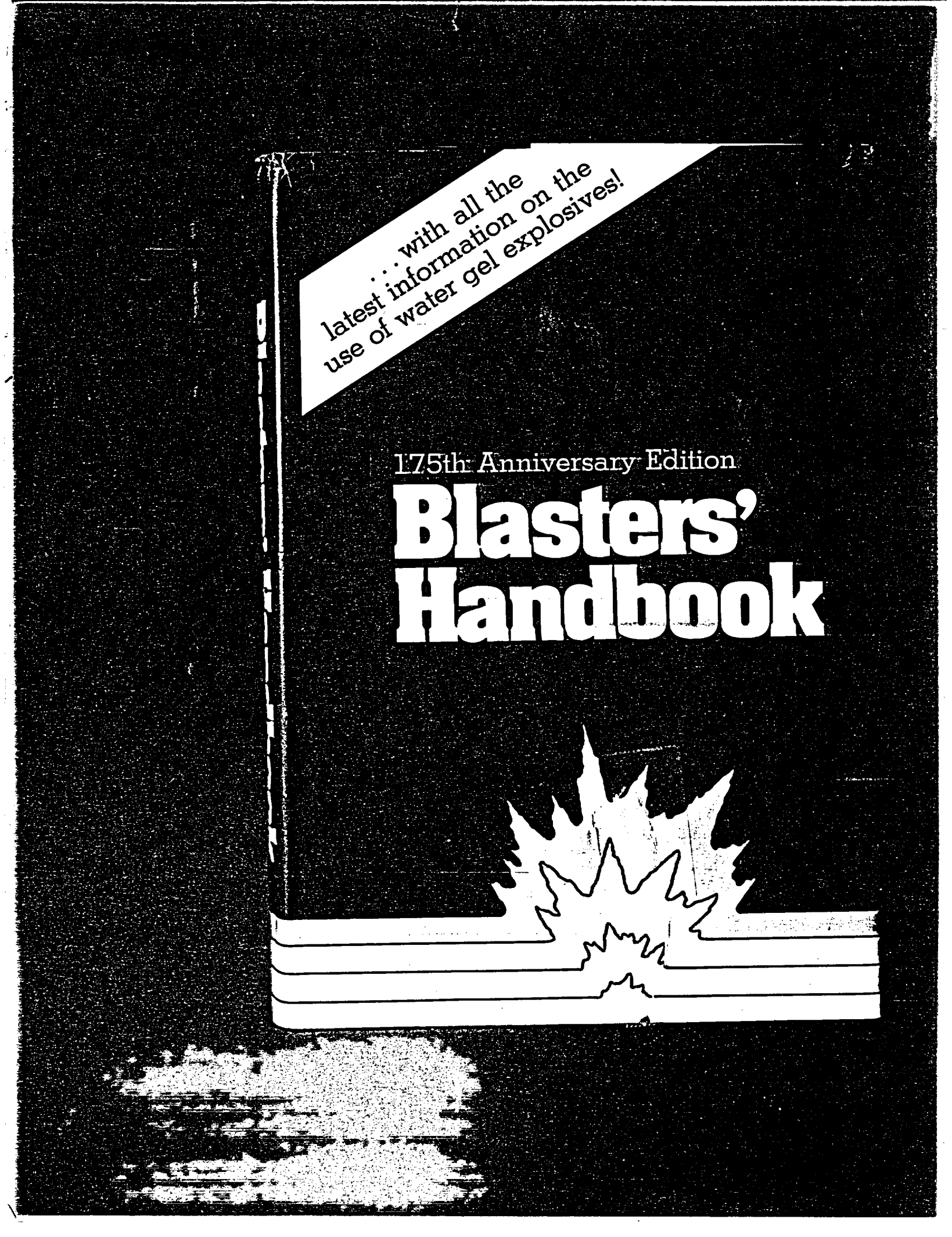
Shift:__________________ Weld Ident. No.:__________________ Site Location:__________________

WELDER	WELD PARAMETERS						PASS	WELD LOCATION	WELD POWER SUPPLY NO.	WIRE FEED MACHINE NO.	WELD GROOVE & DEPOSIT CLEAN	WELD REPAIR LOCATION	INSPECTION TIME & DATE	REMARKS
	VOLTS	AMP	SPEED	WIRE SPOOL NO.	GAS CFH	GAS BOTTLE SERIAL NO.								

Weld Wire Lot or Heat No.________________
Torch Gas Certification No.________________

Preheat Temperature________ Meas. Loc.________ Method_____
Interpass Temperature________ Meas. Loc.________ Method_____
Type of Preheating Equipment________________________

B-314-C-X28038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Blasters' Handbook

CASING CEMENTING

PART I - GENERAL

1.1 SCOPE

This Specification describes the requirements for the cementing of the 112-inch surface casing and the cementing and sealing of the 72-inch casing, and describes the requirements of the cement and chemical seal properties and additives, water, placement and testing for cementing and sealing.

1.1.1 Work Included

The Contractor shall furnish all labor, tools, equipment, storage and other facilities, materials, supplies, procedures, records, and transportation, unless otherwise specified, necessary to perform the work noted below.

1.1.1.1 Service engineer and qualified and trained maintenance and support engineers and technicians.

1.1.1.2 Tools, materials and equipment, including all batching, mixing and storage vessels.

1.1.1.3 Testing, monitoring and other services, including all required equipment.

1.1.1.4 Quality control and records management.

1.1.1.5 Temporary storage of all required materials.

1.1.1.6 Detailed grout and seal design.

1.1.1.7 Grout and seal placement plans and schedules.

1.1.2 Work Not Included

1.1.2.1 Water and water supply system

1.1.2.2 Water storage

1.1.2.3 Grout guides

1.1.2.4 Downhole logging tools and services

1.2 DEFINITIONS

1.2.1 Contractor

"Contractor" shall mean the party responsible to the Owner for the work specified herein.

1.2.2 Dewatering Line

"Dewatering line" shall mean the vertical piping that is to be attached to the outside of the casing for removal of water from the bottom of the casing after installation of the casing.

1.2.3 Engineer

"Engineer" shall mean the Owner's appointed representative authorized to act on technical matters as specified herein.

1.2.4 Grout Guide

"Grout guide" shall mean the slotted vertical piping attached to the outside of the casing to provide a conduit for placing grout.

1.2.5 Grout Pipe

"Grout Pipe" shall mean a pipe to convey cement, chemical seal, flushing or cleaning and like materials from the ground surface to the desired point of delivery.

1.2.6 Hold Point

"Hold point" shall mean that activity in the production sequence where work shall not proceed without written release by the Inspector.

1.2.7 Inspector

"Inspector" shall mean those persons or agencies appointed by the Purchaser to conduct quality control surveillance and inspection activities of the fabrication process and to authorize acceptance and release to lower casing into the shaft hole.

1.2.8 Logging

"Log/Logging" shall mean accurate technical measurement and recording of data.

1.2.9 Owner

"Owner" shall mean the Department of Energy (DOE) or its appointed representative.

1.2.10 Seller

"Seller" as used in Appendix A, "Bidder and Seller Information Requirements" shall mean the Contractor as defined above.