ATTACHMENT I1
APPENDIX G

TECHNICAL SPECIFICATIONS

PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO

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ATTACHMENT I1
APPENDIX G

TECHNICAL SPECIFICATIONS

PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO

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DIVISION 1 - GENERAL REQUIREMENTS

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Section 01010 - Summary of Work
Part 1 - General

1.1 Scope

This section includes:

- Scope of Work
- Definitions and Abbreviations
- Drawings
- Work by Others
- Contractors Use of Site
- Contractors Use of Facilities
- Work Sequence
- Work Plan
- Submittals

1.2 Scope of Work

The Contractor shall furnish all labor, materials, equipment and tools to perform operations in connection with the construction of two (2) panel closure systems for each panel, one of each to be installed in the air intake drift and the air exhaust drift of a waste-emplacement panel, as shown on the drawings and called for in these specifications.

Four (4) possible arrangements of the concrete barrier and isolation walls are shown on the attached Figure I1-1 "Plan Variations."

- Concrete barrier without disturbed rock zone (**DRZ**) removal in combination with construction isolation wall (Sketch A).

- Concrete barrier without DRZ removal in combination with an explosion isolation wall (Sketch B).

- Concrete barrier with DRZ removal up through clay seam G and down through marker bed 139 (**MB 139**) in combination with a construction isolation wall (Sketch C).

- Concrete barrier with DRZ removal in combination with an explosion isolation wall (Sketch D) (This is the only approved configuration in this Permit).

The scope of work shall include but not be limited to the following units of work:

- Develop work plan, health and safety plan (**HASP**) and contractors quality control plan (**CQCP**)

- Prepare and submit all plans requiring approval

- Mobilize to site

- Coordinate construction with operations

- Perform the following for the air intake entry and the air exhaust entry.
  - Excavate the surface preparation for the explosion isolation wall
  - Construct the explosion isolation wall
  - Excavate the DRZ
  - Install the form work for the concrete barrier
  - Place concrete for the concrete barrier
  - Grout the interface of concrete barrier/back wall
  - Provide contact grouting along the contact surface (if required by the engineer)

- Clean up construction areas in underground and above ground

- Submit all required record documents

- Demobilize from site

1.3 Definitions and Abbreviations

Definitions

Contact-handled waste—Contact-handled defense transuranic (**TRU**) waste with a surface dose rate not to exceed 200 millirem per hour.

Concrete barrier—A barrier placed in the access drifts of a panel to restrict the mass flow rate of volatile organic compounds (**VOC**).

Concrete block—Concrete used for construction of either an explosion-isolation wall or a construction-isolation wall.

Construction-isolation wall—A wall immediately adjacent to the panel waste-emplacement area that is made of concrete block, with mortar or steel frame to isolate construction personnel from coming into contact with the waste.

Creep—Plastic deformation of salt under deviatoric stress.

Design migration limit—A mass flow rate that is at least 1 order of magnitude below the health-based levels for VOCs during the Waste Isolation Pilot Plant (**WIPP**) operational period.

Disturbed rock zone (**DRZ**)—A zone surrounding underground excavations where stress redistribution occurs with attendant dilation and fracturing.

Explosion-isolation wall—A concrete-block wall adjacent to the panel waste-emplacement area with mortar that can sustain the pressure and temperature transients of a methane explosion.

Health-based concentration level—The concentration level for a VOC in air that must not be exceeded at the point of compliance during the WIPP operational period.

Health-based migration limit—The mass flow rate of a VOC from all closed panels that results in the health-based concentration level at the point of compliance.

Hydration temperature—The temperature developed by a cementitious material due to the hydration of the cement.

Interface grouting—Grouting performed through grout boxes and pipe lines to fill the void at the concrete barrier/back-wall interface.

Methane explosion—A postulated deflagration caused by the buildup of methane gas to explosive levels.

Partial closure—The process of rendering a part of the underground repository inactive and closed according to approved facility closure plans. The partial-closure process is considered complete after partial-closure activities are performed in accordance with approved Resource Conservation and Recovery Act (**RCRA**) partial closure plans.

Point of compliance—The operating point of compliance for VOC levels at the WIPP, which is the 16-section land withdrawal boundary.

Remote-handled waste—Any of the various forms of high beta-gamma defense TRU waste requiring remote-handling and with a surface dose rate exceeding 200 millirem per hour.

Standard barrier—A concrete barrier emplaced into the panel-access drifts without major excavation of the surrounding rock.

Volatile Organic Compound (**VOC**)—Any VOC comprising the land-disposal-restricted indicator VOC constituents in the WIPP waste inventory.

Abbreviations/Acronyms

ACI	American Concrete Institute
AISC	American Institute for Steel Construction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DRZ	Disturbed rock zone
EPA	U.S. Environmental Protection Agency
MB 139	Marker Bed 139
MSHA	U.S. Mine Safety and Health Administration
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
MOC	Management and Operating Contractor (Permit Condition I.D.3)
RCRA	Resource Conservation and Recovery Act
SMC	Salado Mass Concrete

USACE	U.S. Army Corps of Engineers
WIPP	Waste Isolation Pilot Plant

1.4 List of Drawings

The following drawings are made apart of this specification:

762447-E1	Panel closure system, air intake and exhaust drifts, title sheet
762447-E2	Panel closure system, underground waste-emplacement panel plan
762447-E3	Panel closure system, air intake drift, construction details
762447-E4	Panel closure system, air exhaust drift, construction details
762447-E5	Panel closure system, construction and explosion walls, construction details
762447-E6	Panel closure system, air intake and exhaust drifts, grouting and miscellaneous details

1.5 Work by Others

Survey

All survey work to locate the barriers and walls, control and confirm excavation, and complete the work will be supplied by the Permittees. All survey measurements for record purposes will also be performed/supplied by the Permittees. The Contractor shall be responsible for verifying the excavation dimensions to develop the form work to fit the excavation.

Excavation

The Permittees may elect to perform certain portions of the work, notably the excavation. The work performed by the Permittees will be defined prior to the contract.

1.6 Contractor's Use of Site

Site Conditions

The site is located near Carlsbad, New Mexico, as shown on the site location maps and the title sheet drawing. The underground arrangements and location of the WIPP waste-emplacement panels are shown on the plan view drawing. The work described above is to construct the concrete barriers in the air intake and exhaust drifts of one of the panels upon completion of the disposal phase of that panel. The waste-emplacement panels are located approximately 2,150 feet below the ground surface. The Contractor shall visit the site and become familiar with the site and site conditions prior to preparing his bid proposal.

Contractor's Use of Site

Areas at the ground surface will be designated for the Contractor's use in assembling and storing his equipment and materials. The Contractor shall utilize only those areas designated.

Limited space within the underground area will be designated for the Contractor's use for storage of material and setup of equipment.

Coordination of Contractor's Work

The Contractor is advised that on-going waste emplacement and excavation operations are being conducted throughout the period of construction of the panel barrier system. The Contractor shall coordinate his construction operations with that of the waste emplacement and mining operations. All coordination shall be through the Engineer.

1.7 Contractor's Use of Facilities

Existing facilities at the site which are available for use by the Contractor are:

- WIPP roadheader
- Waste shaft conveyance
- Salt skip hoist
- (1) 20 ton forklift
- (1) 40 ton forklift
- 460 volt AC, 3 phase power
- Water (underground, at waste shaft only) (above ground, at location designated by Engineer)

Additional information on these facilities is presented in Section 02010.

1.8 Work Sequence

Work Sequence shall be as shown on the drawings and directed by the Engineer .

1.9 Work Plan

The Contractor shall prepare and submit for approval by the Engineer a Work Plan fully describing his proposed construction operation. The work plan shall define all proposed equipment. The work plan shall also include the method of excavation, grouting, and pumping concrete. The work plan shall also contain such items as control of surface dust emissions. No work shall be performed prior to approval of the Work Plan.

1.10 Submittals

Submittals to the Permittees shall be in accordance with the Permittees' Submittal Procedures and as required by the individual specifications. Approval by the Permittees shall not constitute approval by NMED. Any submittals that propose a change to the panel closure requirements of this Permit (e.g., changes in grout composition, detailed design, etc.) shall be submitted to NMED as required by 20.4.1.900 NMAC (incorporating 40 CFR §270.42).

Part 2 - Products

Not used.

Part 3 - Execution

Not Used.

1 End of Section

Section 01090 - Reference Standards
Part 1 - General

1.1 Scope

This section includes:

- Provision of Reference Standards at Site.
- Acronyms used in Contract Documents for Reference Standards. Source of Reference Standards.

1.2 Quality Assurance

For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

Conform to reference by date of issue current on the date of the agreement between the Permittees and the contractor.

The Contractor shall obtain copy of the standards referenced in the individual specification sections. Maintain a copy at jobsite during submittals, planning, and progress of the specific work, until completion of work.

Should specified reference standards conflict with the contract documents, request clarification from the Engineer before proceeding.

1.3 Schedule of References

Various publications are referenced in other sections of the specifications to establish requirements for the work. These referenced are identified by documents number and title. The addresses of the organizations whose publications are referenced are listed below.

ACI	ACI International P.O. Box 19150 Detroit, MI 48219-0150 Ph: 313-532-2600 Fax: 313-533-4747
AITC	American Institute of Timber Construction 7012 So. Revere Parkway, Suite 140 Englewood, CO 80112 Ph: 303-792-9559 Fax: 303-792-0669

1	AISC	American Institute of Steel Construction One E. Wacker Dr., Suite 3100 Chicago, IL 60601-2001 Ph: 312-670-2400 Fax: 312-670-5403
2	ANSI	American National Standards Institute 11 West 42nd St. New York NY 10036 Ph: 212-642-4900 Fax: 212-302-1286
3	API	American Petroleum Institute 1220 L. St., NW Washington, DC 20005 Ph: 202-682-8375 Fax: 202-962-4776
4	ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103 Ph: 215-299-5585 Fax: 215-977-9679
5	AWS	American Welding Society 550 LeJeune Road Miami, FL 33135 Ph: 800-443-9353 Fax: 305-443-7559
6	CFR	Code of Federal Regulations Government Printing Office Washington, DC 20402 Ph: 202-783-3238 Fax: 202-223-7703
7	EPA	Environmental Protection Agency Public Information Center 401 M St., SW Washington, DC 20460 Ph: 202-260-2080
8	FTM-STO	Federal Test Method Standards Standardization Documents Order Desk Bldg. 4D 700 Robbins Ave. Philadelphia, PA 19111-5094 Ph: 215-697-2179 Fax: 215-697-2978

NRMCA	National Ready-Mixed Concrete Association 900 Spring St. Silver Spring, MD 20910 Ph: 301-587-1400 Fax: 301-585-4219
NTIS	National Technical Information Service U.S. Department of Commerce Springfield, VA 22161 (703) 487-4650
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
USACE	U.S. Army Corps of Engineers U.S. Army Engineer Waterway Experiment Station ATTN: Technical Report Distribution Section, Services Branch, TIC 3909 Halls Ferry Rd. Vicksburg, MS 39180-6199 Ph: 601-634-2355 Fax: 601-634-2506
MOC	Washington TRU Solutions LLC Carlsbad, New Mexico 88221

End of Section

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Section 01400 - Contractor Quality Control
Part 1 - General

1.1 Scope

This section includes:

- Contractor Quality Control Plan (**CQCP**)
- Reference Standards
- Quality Assurance
- Tolerances
- Testing Services
- Inspection Services
- Submittals

1.2 Related Sections

- 01090 - Reference Standards
- 01600 - Material and Equipment
- 02222 - Excavation
- 02722 - Grouting
- 03100 - Concrete Formwork
- 03300 - Cast-in-Place Concrete
- 04100 - Mortar
- 04300 - Unit Masonry System

1.3 Contractor Quality Control Plan

The Contractor shall prepare and submit for approval by the Engineer, a Quality Control Plan, as described in Section 3.2. No work shall be performed prior to approval of the Contractor's Quality Control Plan.

1.4 References and Standards

Refer to individual specification sections for standards referenced therein, and to Section 01090 - Reference Standards for general listing.

Standards referenced in this section are as follows:

ASTM C1077	Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C1093	Practice for Accreditation of Testing Agencies for Unit Masonry
ASTM E329	Practice for Use in the Evaluation of Inspection and Testing Agencies as Used in Construction
ASTM E543	Practice for Determining the Qualification of Nondestructive Testing Agencies
ASTM E548	Practice for Preparation of Criteria for Use in the Evaluation of Testing Laboratories and Inspection Bodies

1.5 Quality Assurance

- Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality
- Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship
- Perform work by persons qualified to produce required and specified quality
- Verify that field measurements are as indicated on shop drawings
- Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.6 Tolerances

Monitor excavation fabrication and installation tolerance control of work and products to produce acceptable work. Do not permit tolerances to accumulate.

Adjust products to appropriate dimensions; position before securing products in place.

1.7 Testing Services

Unless otherwise indicated by the Engineer, the Contractor shall employ an independent firm to perform the testing services and other services specified in the individual specification sections, and as required by the Engineer. Testing and source quality control may occur on or off the project site.

The testing laboratory shall comply with applicable sections of the reference standards and shall be authorized to operate in the state in which the project is located.

Testing equipment shall be calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

1.8 Inspection Services

The Contractor shall employ an independent firm to perform inspection services as a supplement to the Contractor's quality control as specified in the individual specification sections, and as required by the Engineer. Inspection may occur on or off the project site.

The inspection firm shall comply with applicable sections of the reference standards.

1.9 Submittals

The Contractor shall submit a Contractors' Quality Control Plan as described herein.

Prior to start of work, the Contractor shall submit for approval, the testing laboratory name, address, telephone number and name of responsible officer of the firm. He shall also submit a copy of the testing laboratory compliance with the reference ASTM standards, and a copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards with memorandum of remedies of any deficiencies reported by the inspection.

Prior to start of work, the Contractor shall submit for approval the inspection firm name, address, telephone number and name of responsible officer of the firm. He shall also submit the personnel proposed to perform the required inspection, along with their individual qualifications and certifications (Example: Certified AWS Welding Inspector.)

Part 2 - Products

Not used.

Part 3 - Execution

3.1 General

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both on site and off site, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 Quality Control Plan

3.2.1 General

The Contractor shall furnish for review and approval by the Engineer, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (**CQC**) Plan proposed to implement the requirements of the Contract. The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. Construction will be permitted to begin only after acceptance of the CQC Plan.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both on site and off site, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

- The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

- Description of the CQC System Manager's responsibilities and delegation of authority to adequately perform the functions of the CQC System Manager, including authority to

stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities.

- Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off site fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with the Permittees' Submittal Procedures.

- Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be subject to approval by the Engineer.)

- Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

- Reporting procedures, including proposed reporting formats.

- A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon by the Engineer.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Permittees reserve the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Engineer in writing of any proposed change. Proposed changes are subject to acceptance by the Engineer.

3.3 Quality Control Organization

3.3.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel supplemented by independent testing and inspection firms as required by the specifications, to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Engineer.

3.3.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, with a minimum of five years construction experience on construction similar to this contract. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate will be the same as for the designated CQC System Manager.

3.3.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel or third party inspectors to assist the CQC System Manager. These individuals shall be employed by the prime Contractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience. These individuals shall have no other duties other than quality control.

3.3.4 Organizational Changes

The Contractor shall maintain his CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Engineer for acceptance at the Contractors' expense.

3.4 Tests

3.4.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Engineer duplicate samples of test specimens for possible testing by the Engineer. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of an approved testing laboratory. The Contractor shall perform the following activities and record and provide the following data:

- Verify that testing procedures comply with contract requirements.
- Verify that facilities and testing equipment are available and comply with testing standards.
- Check test instrument calibration data against certified standards.
- Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- Results of all tests taken, both passing and failing tests, will be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. If approved by

the Engineer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an off site or commercial test facility will be provided directly to the Engineer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.5 Testing Laboratory

The testing laboratory shall provide qualified personnel to perform specified sampling and testing of products in accordance with specified standards, and ascertain compliance of materials and mixes with requirements of Contract Documents. The testing laboratory shall promptly notify the Engineer and Contractor of any observed irregularities or non-conformance of Work or Products.

Reports indicating results of tests, and compliance (or noncompliance) with the contract documents will be submitted in accordance with the Permittees' submittal procedures.

The Contractor shall cooperate with the independent testing firm, furnish samples, storage, safe access, and assistance by incidental labor as required. Testing by the independent firm does not relieve the contractor of the responsibility to perform the work to the contract requirements.

The laboratory may not:

- Release, revoke, alter, or enlarge on requirements of the contract
- Approve or accept any portion of the work
- Assume any duties of the Contractor.

The laboratory has no authority to stop the work.

3.6 Inspection Services

The inspection firm shall provide qualified personnel at site to supplement the Contractor's Quality Control Program to perform specified inspection of Products in accordance with specified standards. He shall ascertain compliance of materials and mixes with requirements of Contract Documents, and promptly notify the CQC System Manager, the Engineer and the Contractor of observed irregularities or non-conformance of Work or Products. The inspector does not have the authority to stop the work. The inspector shall refer such cases to the CQC System Manager who has the authority to stop work (see Section 3.2.2).

Reports indicating results of the inspection and compliance (or noncompliance) with the contract documents will be submitted in accordance with the Permittees' submittal procedures.

The Contractor shall cooperate with the independent inspection firm, furnish samples, storage, safe access and assistance by incidental labor, as requested.

Inspection by the independent firm does not relieve the Contractor of the responsibility to perform the work to the contract requirements.

3.7 Completion Inspection

3.7.1 Pre-Final Inspection

At the completion of all work the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Once this is accomplished the Contractor shall notify the Engineer that the facility is complete and is ready for the "Prefinal" inspection. The Engineer will perform this inspection to verify that the facility is complete. A "Final Punch List" will be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and notify the Engineer so that a "Final" inspection can be scheduled. Any items noted on the "Final" inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work.

3.7.2 Final Acceptance Inspection

The final acceptance inspection will be formally scheduled by the Engineer based upon notice from the Contractor. This notice will be given to the Engineer at least 14 days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection.

3.8 Documentation

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- Contractor/subcontractor and their area of responsibility.
- Operating plant/equipment with hours worked, idle, or down for repair.
- Work performed each day, giving location, description, and by whom.
- Test and/or quality control activities performed with results and references to specifications/drawings requirements. List deficiencies noted along with corrective action.
- Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- Submittals reviewed, with contract reference, by whom, and action taken.
- Off-site surveillance activities, including actions taken.
- Instructions given/received and conflicts in plans and/or specifications.

- Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Engineer daily. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.9 Notification of Noncompliance

The Engineer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

End of section.

Section 01600 - Material and Equipment
Part 1 - General

1.1 Scope

This section includes:

- Equipment
- Products
- Transportation and handling
- Storage and protection
- Substitutions

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 02010 - Mobilization and Demobilization
- 02222 - Excavation
- 02722 - Grouting
- 03100 - Concrete Formwork
- 03300 - Cast-in-Place Concrete
- 04100 - Mortar
- 04300 - Unit Masonry System

1.3 Equipment

The Contractor shall specify his proposed equipment in the Work Plan. Power equipment for use underground shall be either electrical or diesel engine driven. All diesel engine equipment shall be certified for use underground.

1.4 Products

The Contractor shall specify in the Work Plan, or in subsequently required submittals the proposed products including, but not limited to the grout mix and its components, concrete mix and its components, mortar mix and its components, formwork, and masonry. The proposed products shall be supported by laboratory test results as required by the specifications. All products shall be subject to approval by the Engineer.

1.5 Transportation and Handling

- Transport and handle products in accordance with manufacturer's instructions.

- Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

- Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.6 Storage and Protection

- Store and protect products in accordance with manufacturers' instructions.

- Store with seals and labels intact and legible.
- Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- For exterior storage of fabricated products, place on sloped supports above ground.
- Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.7 Substitutions

1.7.1 Equipment Substitutions

The Contractor may substitute equipment for that proposed in the Work Plan subject to the Engineer's approval. The Contractor shall demonstrate the need for the substitution, and the applicability of the proposed substitute equipment.

1.7.2 Product Substitutions

The Contractor may not substitute products after the proposed products have been approved by the Engineer unless he can demonstrate that the supplier/source of that product no longer exists in which case he shall submit alternate products with lab test results to the Engineer for approval. In the case that product is a component in a mix, the Contractor shall perform mix testing using that component and submit laboratory test results.

Part 2 - Products

Not used.

Part 3 - Execution

Not used.

End of section.

DIVISION 2 - SITE WORK

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Section 02010 - Mobilization and Demobilization
Part 1 - General

1.1 Scope
This section includes:

- Mobilization of equipment and facilities to site
- Contractor use of site
- Use of existing facilities
- Demobilization of equipment and facilities
- Site cleanup

1.2 Related Sections
- 01010 - Summary of Work
- 01600 - Material and Equipment

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Mobilization of Equipment and Facilities to Site
Upon authorization to proceed, the Contractor shall mobilize his equipment and facilities to the jobsite. Equipment and facilities shall be as specified, and as defined in the Contractor's Work Plan. The Contractor shall erect the batch plant and assemble his equipment and materials in the areas designated by the Engineer. Facilities shall be located as near as practical to the existing utilities.

The Permittees will provide utilities (460 volt AC, 3 phase, and water) at designated locations. The Contractor shall be responsible for all hookups and tie-ins required for his operations.

The Contractor shall be responsible for providing his own office, storage, and sanitary facilities.

Areas will be designated for the Contractor's use in the underground area in the vicinity of the panel closure system installation. These areas are limited.

3.2 Use of Site
The Contractor shall use only those areas specifically designated for his use by the Engineer. The Contractor shall limit his on-site travel to the specific routes required for performance of his work, and designated by the Engineer.

3.3 Use of Existing Facilities

Existing facilities at the site which are available for use by the Contractor are:

- WIPP roadheader
- Waste shaft conveyance
- Salt skip hoist
- (1) 20 ton forklift
- (1) 40-ton forklift
- 460 Volt AC, 3 phase power
- Water (in mine, at waste shaft only-above ground at location designated by the Engineer).

The Contractor shall arrange for use of the facilities with the Engineer and coordinate his actions/requirements with that of the ongoing operations.

Use of water in the underground will be restricted. No washout or cleanup will be permitted in the underground. Above ground washout/cleanup or equipment will be allowed in the areas designated by the Engineer.

The Contractor is cautioned to be aware of the physical dimensions of the waste conveyance and the air lock (see Figures I1-2 and I1-3, attached).

The Contractor shall be responsible for any damage incurred by the existing site facilities as a result of his operations. Any damage shall be reported immediately to the Engineer and repaired at the Contractor's cost.

3.4 Demobilization of Equipment and Facilities

At completion of this work, the Contractor shall demobilize his equipment and facilities from the job site. The batch plant shall be disassembled and removed along with any unused material. All Contractor's equipment and materials shall be removed from the mine and all disturbed areas restored. Utilities shall be removed to their connection points unless otherwise directed by the Engineer.

3.5 Site Cleanup

At conclusion of the work, the Contractor shall remove all trash, waste, debris, excess construction materials, and restore the affected areas to its prior condition, to the satisfaction of the Engineer. A final inspection of the areas will be conducted by the Engineer and the Contractor before final payment is approved.

End of section.

Section 02222 - Excavation
Part 1 - General

1.1 Scope

This section includes:

- Excavation for main concrete barrier
- Excavation for surface preparation and levelling of base areas for isolation walls
- Disposition of excavated materials.

1.2 Related Sections

- 01010 - Summary of Work
- 01600 - Material and Equipment
- 03100 - Concrete Form Work
- 04300 - Unit Masonry System.

1.3 Reference Documents

"Reference Stratigraphy and Rock Properties for the Waste Isolation Pilot Plant (WIPP) Project" by R.D. Krieg-Sandia National Laboratory Document Sand 83-1908. [Available through National Technical Information Service (**NTIS**).]

1.4 Field Measurements and Survey

All surveys required for performance of the work will be provided by the Permittees. To develop the concrete formwork to fit the excavation, the Contractor shall be responsible for verifying the excavation dimensions.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Excavating for Concrete Barrier

Excavation for the main concrete barrier shall be performed to the lines and grades shown on the drawings. Excavate the back a minimum of 1 inch to 3 inches beyond clay seam G, and the floor a minimum of 1 inch to 3 inches below the anhydride marker bed 139 (**MB-139**) to assure removal of the disturbed rock zone (**DRZ**). Excavation shall be performed utilizing mechanical means such as a cutting head on a suitable boom, by drilling boreholes and using an expansive agent to fragment the rock or other competent equipment or methods submitted to the Engineer for review and approval. The use of explosives is prohibited. The existing WIPP roadheader mining machine may also be available for use. The Contractor is to determine availability and coordinate proposed use of the roadheader with the Engineer. The existing roadheader is capable of excavating the back and the portions of the ribs above the floor level. However, it is not capable of excavating the portion below floor level.

The tolerances for the concrete barrier excavation shall be +6 inches, to 0 inch. In addition, the Contractor is to remove all loose or spalling rock from the excavation surface to provide a sound surface abutting the concrete barrier. The Contractor shall provide and install roof bolts for support as required for personnel protection and approved ground control plans.

3.2 Excavating for Surface Preparation and leveling of Base Areas for Isolation Walls

The Contractor shall excavate a 6-inch surface preparation around the entire perimeter of the isolation walls. The surface preparation in the floor shall be made level to produce a surface for placing the first course of block in the isolation walls. Tolerances for the leveled portion of the surface preparation are ±1 inch. Excavation may be performed by either mechanical or manual means. Use of explosives is prohibited.

3.3 Disposition of Excavated Materials

The Contractor shall remove all excavated materials from the panel-access drift where they are excavated. Excavated materials shall be removed from the mine via the salt skip to the surface, where they will be disposed on site at a location as directed by the Engineer.

3.4 Field Measurements and Survey

All survey required for performance of the work will be provided by the Permittees. The Contractor shall protect all survey control points, bench marks, etc., from damage by his operations. MOC will verify by survey that the Contractor has excavated to the required lines and grades. The Contractor shall be responsible for verifying the excavation dimensions to develop concrete formwork to fit the excavation. No form work or block work is to be erected until this survey is completed. The Contractor is to coordinate the survey work with his operations to assure against lost time. The Contractor shall notify the Engineer at least 24 hours prior to the time surveying is required

End of section.

Section 02722 - Grouting
Part 1 - General

1.1 Scope

This section includes:

- Grouting of concrete barrier.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 03100 - Concrete Form Work
- 03300 - Cast-in-Place Concrete

1.3 References

ASTM C1107 Standard Specification for Nonshrink Grout

ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars

1.4 Submittals for Review and Approval

Thirty days prior to the initiation of grouting, the Contractor shall submit to the Engineer for review and approval, the following:

- Type of grout proposed
- Product data:
  - Manufacturer's specification and certified laboratory tests for the manufactured grout, if proposed
  - Certified laboratory tests for the salt-saturated grout, if proposed, using project-specific materials
- Proposed grouting method, including equipment and materials and construction sequence in Work Plan.

1.5 Submittals for Construction

Daily grouting report indicating the day, date, time of mixing and delivery, quantity of grout placed, water used, pressure required, problems encountered, action taken, quality control data, testing results, etc., no later than 24 hours following construction.

Part 2 - Products

2.1 Grout Materials

Grout used for grouting in connection with fresh water/plain cement concrete shall be nonshrink, cement-based grout, Five Star 110 as manufactured by Five Star Products Inc., 425 Stillson Road, Fairfield, Connecticut 06430 or approved equal. Mixing and installation shall be in accordance with the manufacturer's recommendations.

As an alternate to the above grout, in connection with the Salado Mass concrete mix, the Contractor shall use, subject to the approval of the Engineer, a salt saturated grout. The following formulation is suggested to the Contractor as an initiation point for selection of the grout mix. Salt saturated grout strength shall be 4500 psi at 28 days.

Salt-Saturated Grout (BCT-1F)

Component	Percent of total Mass (wt.)
Class H Cement	48.3
Class C Fly Ash	16.2
Cal Seal (Plaster - from Halliburton)	5.7
Sodium chloride	7.9
Dispersant	0.78
Defoamer	0.02
Water	21.1

Water for mixing shall be of potable quality, free from injurious amounts of oil, acid, alkali, salt, or organic matter, sediments, or other deleterious substances, as specified for concrete, Section 03300-2.3.

2.2 Product Data

If the Contractor proposes to utilize a manufactured nonshrink cement-based grout, he shall submit complete manufacturer's specifications for the product, along with certified laboratory test results of the material.

If the Contractor proposes to utilize the salt-saturated grout in connection with the Salado Mass concrete mix, he shall submit manufacturer's/supplier's specifications for the component materials, and certified laboratory test results for the resultant mix.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor material, equipment, and tools to perform all operations in connection with the grouting.

Grout delivery and return lines for interface grouting shall be installed in the form work or in the area to be grouted to provide uniform distribution of the grout as shown on the drawings. The exact location of the boxes and lines shall be determined in the field. Additional grout delivery and return lines and boxes may be required by the Engineer.

Pumps shall be positive displacement piston type pump designed for grouting service capable of operating at a discharge pressure of 100 psi. The Contractor shall supply a standby pump to be utilized in the event of a breakdown of the primary unit.

Mixers shall be high velocity "colloidal" type with a rotary speed of 1,200 to 1,500 rpm. Grout shall be mixed to a pumpable mix as per the manufacturer's recommendations.

Mixing water shall be accurately metered to control the consistency of the grout.

The Contractor shall provide all necessary valves, gages, and pressure hoses.

Water for mixing is available at the waste shaft. The Contractor is cautioned that <u>no free water discharges or spills are permitted</u> in the mine. All cleanup and washout operations shall be performed at the ground surface.

Potential spill areas in the underground shall be identified by the Contractor in the work plan. The Contractor shall provide adequate containment for potential spills. Isolation measures shall include, but are not limited to, lining with a membrane material (PVC, hypalon, HDPE), draped curtains (polyethylene, PVC, etc.), corrugated sheet metal protective walls or a combination of these and other measures.

If salt-saturated grout is selected for use, the Contractor shall make provisions to accurately proportion the components. Proportioning shall be by weighing. Sufficient quantities of dry components shall be developed prior to initiation of the grouting to perform the work so as not to incur delays during the mixing/placing sequence.

3.2 Interface Grouting of Concrete Barrier

After each cell of the concrete barrier has been allowed to cure for a period of seven days, or as directed by the Engineer, the Contractor shall interface grout the remaining space between the back wall and the top surface of the concrete barrier.

Each cell of the concrete barrier shall be grouted before the next adjacent cell is formed and concrete placed. Grout delivery and return lines shall be installed with the form work as shown and called for on the drawings, or as directed by the Engineer.

The placing of grout, unless otherwise directed by the Engineer shall be continuous until completed. Grouting shall progress from lower to higher grout pipes. Grouting shall proceed through a single delivery line until grout escapes from the adjacent return line. The Contractor shall then secure these lines and move to the next adjacent set of delivery and return lines. Pressure shall be adjusted to adequately deliver the grout to the forms, as witnessed by grout in the return line.

The grouting operation shall be conducted in a manner such that it does not affect the stability of the concrete barrier structure.

3.3 Contact Grouting

After completion of interface grouting if directed by the Engineer, the Contractor shall contact grout to fill any remaining voids at the concrete barrier/back wall interface. Contact grouting includes all operations to drill, clean, and grout holes installed in the concrete barrier.

The Contractor shall drill and grout the interface zone to the main concrete barrier as directed by the Engineer.

The location, direction, and depth of each grout hole shall be as directed by the Engineer. The order in which the holes are drilled and the manner in which each hole is drilled and grouted, the proportions of the water used in the grout, the time of grouting, the pressures used in grouting, and all other details of the grouting operations shall be as directed by the Engineer.

Wherever required, contact grouting will entail drilling the hole to a limited depth, installing a packer, and performing grouting.

3.3.1 Drilling

The holes shall be drilled with rotary-type drills. Drilling grout holes with percussion-type drills will not be permitted except as approved by the Engineer.

The requirements as to location, depth, spacing, and direction of the holes shall be as directed by the Engineer.

The minimum diameter shall be approximately 11/2 inches.

When the drilling of each hole or stage of has been completed, compressed air will be used to flush out drill cuttings. The hole shall then be temporarily capped or otherwise suitably protected to prevent the hole from becoming clogged or obstructed until it is grouted.

3.3.2 Materials for Contact Grouting

Standard weight black steel pipe conforming to ASTM A-53 shall be set in the concrete in the locations as directed by the Engineer. All pipe and fittings shall be furnished by the Contractor.

The size of the grout pipe for each hole and the depth of the holes for setting pipe for grouting shall be as directed by the Engineer. Care shall be taken to avoid clogging or obstructing the pipes before being grouted, and any pipe that becomes clogged or obstructed from any cause shall be cleaned satisfactorily or replaced.

The packers shall be furnished by the Contractor and shall consist of expansible tubes or rings of rubber, leather, or other suitable material attached to the end of the grout supply pipe. The packers shall be designed so that they can be expanded to seal the drill hole at the specified locations and when expanded shall be capable of withstanding without leakage, for a period of 5 minutes, air pressure equal to the maximum grout pressures to be used.

3.3.3 Grouting Procedures

Different grouting pressures will be required for grouting different sections of the grout holes. Pressures as high as necessary to deliver the grout but which, as determined by trial, are safe against concrete displacement shall be used in the grouting.

If, during the grouting of any hole, grout is found to flow from adjacent grout holes or connections in sufficient quantity to interfere seriously with the grouting operation or to cause appreciable loss of grout, such grout holes and connections shall be capped temporarily. Where such capping is not essential, inaugurated holes shall be left open to facilitate the escape of air as the grout is forced into other holes. Before the grout has set, the grout pump shall be connected to adjacent capped holes and to other holes from which grout flow was observed, and grouting of all holes shall be completed. If during the grouting of any hole, grout is found to flow from points in the barrier, any parts of the concrete structure, or other locations, such flows or leaks shall be plugged or caulked by the Contractor as directed by the Engineer.

As a safeguard against concrete displacement, excessive grout travel, or while grout leaks are being caulked, the Engineer may require the reduction of the pumping pressure, intermittent pumping, or the discontinuance of pumping.

The consistency of the grout mix shall be varied, as directed by the Engineer, depending on the conditions encountered. Where the grout hole or connection continues to take a large amount of grout after the mix has been thickened, the Engineer may require that pumping be done intermittently, waiting up to 8 hours between pumping periods to allow grout in the barrier to set. After the grouting is complete, the pressure shall be maintained by means of stopcocks, or other suitable valve that it will be retained in the holes or connections being grouted.

3.4 Cleanup

No clean-up or washing of equipment with water is allowed in the underground. No free water spills are permitted. All clean out or wash out requiring water will be performed above ground at the location approved by the Engineer. See note above regarding potential spill areas in Section 3.1 - General.

3.5 Quality Control

The Contractor shall provide a third-party quality control inspector at the site throughout the grout placement operations. The inspector shall determine that the grout mix is properly proportioned and properly mixed to the approved consistency. The inspector shall sample and make one set of grout cubes for compression testing for every 50 cubic feet of grout placed, or fraction thereof, for each day of grout placement.

End of section.

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DIVISION 3 - CONCRETE

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Section 03100 - Concrete Formwork
Part 1 - General

1.1 Scope

This section includes:

- Formwork for cast-in-place concrete with shoring, bracing, and anchorage
- Accessory items, grout pipes, concrete delivery pipes.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 02722 - Grouting
- 03300 - Cast-in-Place Concrete
- 04300 - Unit Masonry System

1.3 References

ACI 301	Specifications for Structural Concrete for Buildings
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 347	Recommended Practice for Concrete Formwork
ASTM A-36	Standard Specification for Structural Steel
ASTM A-53	Standard Specification for Pipe, Steel, Black, and Hot-Dipped Zinc Coated
ASTM A-325	High Strength, Structural Bolts
ASTM A-615	Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcements
AWS A3.0	Welding Terms and Definitions
AWS A5.1	Specification for Mild Steel Covered Arc Welding Electrodes
AWS D1.1	Structural Welding Code-Steel
AISC	Manual of Steel Construction Latest Edition

1.4 Submittals

The Contractor shall submit the following 30 days prior to initiation of work at site.

Shop detail drawings with appropriate calculations to support the adequacy or the formwork.

Mill test certification of materials utilized in construction of the forms.

Details of installation contained in the Contractor's Work Plan.

1.5 Quality Assurance

Design and detail the formwork under direct supervision of a professional structural Engineer experienced in design of this work and licensed in the state of New Mexico.

Perform work in accordance with ACI 301, 318, and 347, AISC and AWS standards. Maintain one copy of all standards at site.

Perform all fabrication in accordance with AISC manual of steel construction.

Perform all welding in accordance with AWS D1.1 structural welding code.

Perform all bolting in accordance with AISC specification for structural joints using ASTM A325 or A490 bolts.

Part 2 - Products

2.1 Form Materials

Forms for the concrete barrier shall be constructed of ASTM A-36 steel.

Pipe inserts shall be ASTM A-53 black standard weight pipe.

Form spacers shall be ASTM A-36 round stock.

Bolts shall be ASTM A325 high strength structural bolts.

Grout pipes shall be ASTM A-53 standard weight pipe or flex conduit as shown on the drawings.

Rock anchors shall develop strength equal to or greater than ASTM A-36 round stock.

Welding electrodes shall conform to AWS A5.1.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor material equipment and tools to perform all operations in connection with the design, detail, fabrication and erection of the formwork and the fabrication and installation of grout pipes for the main concrete barrier.

The Contractor may, at his option submit an alternate design or modify the design shown on the drawings, subject to the approval of the Engineer. All designs must be supported by design calculations stamped and sealed by a registered professional engineer.

The Contractor shall furnish, fabricate and install all grout pipes and grout boxes for both the concrete barrier and the isolation walls.

3.2 Shop Drawings

The Contractor shall design and detail all formwork for the concrete barrier, complete with any required bracing and shoring for the concrete barrier as shown on the drawings, in accordance with ACI 318 and 347 and the AISC manual of steel construction.

The details shall incorporate provision for adjusting and modifying the formwork to suit the excavation. Excavation tolerances are given in Section 02222 Excavation.

The Contractor shall be responsible for verifying the excavation dimensions to develop the concrete formwork to fit the excavation.

Prior to fabrication, the Contractor shall submit shop drawings complete with supporting calculations for review/approval by the Engineer 30 days prior to initiating work. The contractor shall incorporate all Engineer's comments, revisions, resolve all questions and resubmit drawings for final approval prior to proceeding with fabrication.

3.3 Fabrication

The Contractor shall fabricate all formwork and ancillary items in accordance with the latest edition of the AISC Manual of Steel Construction and the approved detail drawings.

Formwork shall contain all inserts for grouting and pumping concrete. Sufficient valving shall be provided on inserts to allow shut off of concrete and grout to prevent back flow through the form work.

All welding shall be in accordance with AWS D1.1 structural welding code including operator and procedure certifications. Elements shall be welded using E-7018 low hydrogen electrodes. Panels shall be piece marked to correspond to the erection drawing(s) and sequence at fabrication.

3.4 Installation

3.4.1 Grout Pipes

The Contractor shall furnish, fabricate, and install all grout pipes and boxes as approved by the Engineer. Grout pipes and boxes shall be attached to the back surface using masonry anchors as shown on the drawings or other approved methods. Grout pipes shall be connected to the inserts installed in the permanent forms and securely fastened to the formwork. All grout pipes will be blown out with compressed air after installation and prior to closure of the formwork to assure they are clean and free from debris or obstructions. Grout pipes shall then be temporarily capped to prevent entry of foreign matter until ready for grouting. The Contractor shall apply masking tape to the grout box openings to prevent concrete infiltration during concrete placement.

3.4.2 Formwork

The steel formwork for the concrete barrier is to remain in place at completion of each segment of the barrier, therefore all formwork shall be free from oil, grease, rust, dirt, mud or other material that would prevent bonding by the concrete. Forms will not be oiled or receive application of release agent.

The Contractor shall install formwork at the locations shown on the drawings to the lines and grades shown. Forms are to be mortar tight. The Contractor shall adjust the formwork to suit the contour of the excavation. Rock may be trimmed or chipped to suit where interferences are encountered. Where overexcavation has occurred in excess of the designed-in adjustability of the formwork, modifications shall be proposed to the Engineer for his approval prior to installation. Installation of the formwork shall be reviewed and approved by the Engineer prior to proceeding with concrete installation.

The Contractor shall provide a sealant or gasket material on mating surfaces to provide mortar-tite joints.

3.5 Quality Control

The Contractor shall arrange for and contract with an approved third party inspector to provide inspection/testing services for the fabrication and installation of the formwork and ancillary items, as required by the QA/QC plan.

The Contractor shall furnish certified mill test reports for all materials utilized in the fabrication.

All welding shall be in accordance with AWS D1.1 structural welding code. The Contractor shall furnish welding operator and procedure certifications for all operators and procedures utilized.

Fabricated components shall be inspected for dimension and overall quality. Welds shall be inspected by an AWS certified welding inspector.

The inspector shall visually inspect the installation for fit-up and dimensionally for location.

3.6 Handling, Shipping, Storage

The Contractor shall handle, ship, and store fabricated components with care to avoid damage. Stored components shall be placed on timbers or pallets off the ground to keep the units clean. Components shall be tarped while in outdoor storage. Components that become spattered or contaminated with mud will be thoroughly cleaned before delivering to the mine for installation. Damaged components will be rejected by the inspector and replaced by the contractor at his cost.

End of section.

Section 03300 - Cast-in-Place Concrete
Part 1 - General

1.1 Scope

This section includes:

- Cast-in-place concrete for concrete barrier
- Concrete mix design.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 02222 - Excavation
- 02722 - Grouting
- 03100 - Concrete Formwork

1.3 References

ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete
ACI 318.1	Building Code Requirements for Structural Plain Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 94	Standard Specification for Ready-Mixed Concrete
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	Standard Specification for Slump of Portland Cement Concrete
ASTM C 150	Standard Specification for Portland Cement
ASTM C 186	Standard Test Method for Heath of Hydration of Hydraulic Cement
ASTM C 403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C 618	Flyash and Raw or Calcined Natural Pozzolan for Use as an Admixture in Portland Cement Concrete

ASTM D 2216	Standard Test Method for Laboratory Determination of Water (moisture) Content of Soil and Rock
USACE CRD-C 36	Method of Test for Thermal Diffusivity of Concrete
USACE CRD-C 48	Standard Test Method for Water Permeability of Concrete
API 10	Cements
NRMCA	Check List for Certification of Ready Mixed Concrete Production Facilities
NRMCA	Concrete Plant Standards

MOC Standards

WIPP-DOE-71	Design Criteria Waste Isolation Pilot Plant, Revised Mission Concept -- IIA (DOE, 1984)
WP 03-1	WIPP Startup and Acceptance Test Program (Westinghouse, 1993b)
WP 09-010	Design Development Testing (Westinghouse, 1991)
WP 09-CN3021	Component Numbering (Westinghouse, 1994a)
WP 09-024	Configuration Management Board/Engineering Change Proposal (**ECP**) (Westinghouse, 1994b)

1.4 Submittals for Review/Approval

The Contractor shall submit the following for approval 30 days prior to initiating any work at the site.

Specific sources of supply and detailed product information for each component of the concrete mix is specified in Section 2.6 below.

Product Data - Laboratory test data and trial mix data for the proposed concrete to be utilized for the concrete barrier.

Proposed method of installation, including equipment and materials in work plan.

1.5 Submittals at Completion

Laboratory test data developed during the installation of the concrete barrier.

1.6 Quality Assurance

Perform work in accordance with the Contractor's Quality Control Plan and referenced ACI and ASTM standards.

Acquire cement, aggregate and component materials from the same source throughout the work.

Part 2 - Products

2.1 Cement

Portland cement shall conform to API 10 Class H oil well cements. The source of the cement to be used shall be indicated and manufacturer's certification that the cement complies to the applicable standard shall be provided with each shipment.

2.2 Aggregates

Aggregates shall be quartz aggregates conforming to the requirements of ASTM C33.

Fine aggregate shall meet the requirements of ASTM C33 having a fineness modules in the range of 2.80 to 3.00.

Coarse aggregate maximum size shall be 1 ½ inches and shall be clean, cubical, angular, 100 percent crushed aggregate without flat or elongated particles.

The source of the aggregate is to be indicated and test reports certifying that the aggregate complies with the applicable standard are to be submitted for approval with the trial mix data.

2.3 Water

Water used in mixing concrete shall be of potable quality, free of injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

Water shall conform to the provisions in ASTM C94, and in addition, shall conform to the following:

- pH not less 6.0 or greater than 8.0
- Carbonates and/or bicarbonates of sodium and potassium: 1000 ppm maximum
- Chloride ions (C1): 250 ppm maximum
- Sulfate ions (SO_4): 1000 ppm maximum
- Iron content: 0.3 ppm maximum
- Total solids: 2000 ppm maximum

When ice is used in concrete mix, the water used for making ice shall meet all of the above requirements.

The source of water is to be indicated and certified copies of test data from an approved laboratory confirming that the water to be used meets the above requirements shall be submitted for approval with the trial mix data.

2.4 Admixtures

Pozzolan shall conform to ASTM C618. Sampling and testing of pozzolans shall conform to ASTM C311. Approximately 5 percent by weight of pozzolan may be used to replace cement in the mixes when approved.

The source of any admixtures proposed are to be indicated and certified copies of test data from an approved laboratory shall be submitted for approval with the trial mix.

2.5 Concrete Mix Properties

The Contractor shall develop and proportion a Salado Mass Concrete mix for use in constructing the concrete barrier. Cement utilized in the mix shall be Class H. The Contractor shall demonstrate by trial mix that the proposed concrete meets the following properties:

Target properties for Barrier Concrete

Property	Comment
4-hr working time	Indicated by 8-inch slump (ASTM C 142) after 3-hr intermittent mixing. Max 10-inch slump at mixing.
Nonsegregating	Aggregates do not readily separated from cement paste during handling
Less than 25 °F heat rise prior to placement	Difference between initial condition and temperature after 4 hr.
4,500 psi compressive strength (f'_c)	At 28 days after casting (ASTM C39)
Volume stability	Length change between +0.05 percent and -0.02 percent (ASTM C 490)
Minimal entrained air	2 percent to 3 percent air

The Contractor shall provide certified copies of test data from an approved laboratory demonstrating compliance with the above target properties.

In addition to the target properties the Contractor shall provide certified test data for the trial mix for the following properties:

- Heat of hydration ASTM C-186
- Concrete Set ASTM C-403
- Thermal Diffusivity USACE CRD-C36
- Water Permeability USACE CRD-C43

2.6 Salado Mass Concrete

The Contractor shall utilize the Salado Mass concrete. The Contractor shall demonstrate that the Salado Mass concrete meets the target properties shown above. Recommended initial proportioning of the Salado Mass concrete is as follows:

Component	Percent of Total Mass
Class H Cement	4.93
Chem Comp III	2.85
Class F fly ash	6.82
Fine aggregate	33.58
Coarse aggregate	43.02
Sodium chloride	2.18
Defoaming agent	0.15
Sodium citrate	0.09
Water	6.38

The Contractor shall prepare a trial mix and provide certified test data from an approved testing laboratory for slump, compressive strength, heat rise, heat of hydration, concrete set time, thermal diffusivity, and water permeability as indicated above for the plain concrete mix.

Part 3 - Execution

3.1 General

The Contractor shall provide all labor material, equipment and tools necessary to develop, supply, mix, transport and place mass concrete in the forms as shown on the drawings and called for in these specifications

The Contractor will be required to provide and erect on the site a batch plant, suitable to store, handle, weight and deliver the proposed concrete mix. The batch plant shall be certified to NRMCA standards. The batch plant shall be erected on site in the location as directed by the Engineer.

The Contractor shall batch, mix, and deliver to the underground, sufficient quantity of concrete to complete placement of concrete within one form section, as shown on the drawings. Once begun, placement of concrete in a section shall be continuous until completed. The time for concreting one section will not exceed ten hours.

It is expected that addition of water to the dry materials and mixing of the concrete will occur at the ground surface with transport of wet concrete to a pump at the underground level where it will be pumped into the forms.

The Contractor is to provide all transport vehicles or means to transfer the wet concrete from the mixer truck to the pump. It is expected that the Contractor will use the waste conveyance hoist to transfer from the ground surface to the mine level. The Contractor is to familiarize himself with the dimensions of the waste conveyance and the airlock in order to provide suitable transport vehicles. The Contractor is also to familiarize himself with the capacity and speed of

the conveyance to allow transfer of sufficient concrete to sustain the continuing placement of concrete. (See Figures I1-2 and I1-3, attached).

The Contractor shall determine the horizontal distance to the entry where placement of the concrete barrier is to occur, and develop a route, with the approval of the Engineer for traffic flow within the underground.

Details of the logistics for handling the concrete shall be included in the Contractors' Work Plan, and submitted to the Engineer for approval prior to start of work at the site.

Potential spill areas in the underground shall be identified by the Contractor in the Work Plan. The Contractor shall provide measures to contain and isolate any water from contact with the halite in these areas. Suitable containment isolation measures shall include but are not limited to, lining with a membrane material (PVC, hypalon, HDPE), draped curtains (polyethylene, PVC, etc.), corrugated sheet metal protective walls or a combination of these and other measures.

3.2 Pumping Concrete

The Contractor shall provide pumping equipment suitable for placing the concrete into the forms. The Contractor at a minimum, shall provide an operating and a spare pump, to be used in the event of breakdown of the primary unit. After transporting and prior to pumping the concrete shall be remixed to compensate for segregation of aggregate during transport. The Contractor shall indicate the equipment proposed for pumping (manufacturer, model, type, capacity, pressure and remixing at the point of delivery in the Work Plan).

Each batch of concrete shall be checked at the surface at the time of mixing and again at the point of transfer to the pump for slump and temperature, and shall conform to the following:

- Maximum slump at mixing - 10 inches
- Maximum slump at delivery to pump - 8 inches
- Maximum mix temperature at placement = 70°F

Note: No water is to be added to the mix after the initial mixing and slump are determined.

The Contractor shall connect to the pipe ports fabricated into the forms for delivery of the concrete, beginning with the lowest ports first. Pumping shall continue until concrete is seen in the adjacent port at which time the delivery hose will be transferred to that port and the first port capped.

Pumping shall continue moving laterally then upward until the entire form is filled and the pour is completed.

3.3 Coordination of Work

The Contractor is to coordinate his work mixing, transporting, and placing the mass concrete with the on-going operations in the underground. Coordination of use of the facilities and existing equipment shall be through the Engineer.

3.4 Clean-Up

No clean up or washing of equipment with water will be allowed in the underground. No free water spills are permitted in the underground. All clean-out or wash-out requiring water will be performed above ground at the location approved by the Engineer.

3.5 Quality Control

The Contractor shall provide a third-party quality control inspector at the site throughout the concrete placement. The inspector shall be responsible for determining that the batch plant is proportioning the mix according to the approved proportions. The batch plant shall provide a print out of batch quantities for each truck delivered to the mine. The inspector shall also determine the slump for each batch as it is mixed and allow additional water to be added until the initial slump is achieved. No additional water is to be added after this time. Temperature will also be recorded at this time.

The inspector shall also determine the slump and temperature following the remixing when concrete is transferred to the pump. Concrete not meeting or exceeding the specification is to be rejected and removed from the underground.

Concrete test cylinders to determine unconfined compression strength shall be taken by the inspection at the delivery from remixer to the pump in the underground. Four (4) cylinders shall be made for each 50 cubic yards of concrete placed. Cylinders shall be sealed with polyethylene and taped and field cured at ambient temperatures in the mine adjacent to the concrete barrier area. Two (2) samples shall be tested at 7 days and the remaining two (2) at 28 days.

End of section.

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DIVISION 4 - MASONRY

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Section 04100 - Mortar
Part 1 - General

1.1 Scope

This section includes:

- Mortar for Isolation Wall Construction.

1.2 Related Sections

- 01010 - Summary of Work
- 01400 - Contractor Quality Control
- 01600 - Material and Equipment
- 04300 - Unit Masonry System

1.3 References

ASTM C91	Standard Specification for Masonry Cement
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C207	Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C270	Standard Specification for Mortar for Unit Masonry
ASTM C7805	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C1142	Ready-Mixed Mortar for Unit Masonry
ASTM E447	Test Methods for Compressive Strength of Masonry Prisms

1.4 Submittals for Review and Approval

The Contractor shall submit for approval the following 30 days prior to the initiation of work at the site:

Design mix.

Certified laboratory tests for the proposed design mix, indicating conformance of mortar to property requirements of ASTM C270, and test and evaluation reports to ASTM C780.

1.5 Submittals at Completion

Certified laboratory test results for the construction testing of mortar mix.

1.6 Quality Assurance

Perform work in accordance with the Contractor's Quality Control Plan and referenced ASTM standards. Acquire cement, aggregate, and component materials from the same source throughout the work.

1.7 Delivery Storage Handling

Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

Part 2 - Products

2.1 Mortar Mix

The Contractor shall provide mortar for Isolation Walls, which shall be in conformance with ASTM C270 type M, using the property specification (3,000 psi at 28 days).

Sand for mortar shall conform to ASTM C144.

Water used for mixing mortar shall be of potable quality, free of injurious amounts of oil, acid alkali, organic matter, sediments, or other deleterious substances, as specified for Concrete, Section 03300 2.3.

The supply of materials as defined in the design mix shall remain the same throughout the job.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor material equipment and tools to perform all operations in connection with supplying and mixing mortar for constructing the isolation walls.

The Contractor shall fully describe his proposed mortar mixing operation, including proposed equipment and materials in the Work Plan.

3.2 Mortar Mixing

Mortar shall be machine-mixed with sufficient water to achieve satisfactory workability. Maintain sand uniformly damp immediately before the mixing process. If water is lost by evaporation, retemper only within one and one half hours of mixing. Use mortar within two hours of mixing at ambient temperature of 85° in the mine.

3.3 Installation

The Contractor shall install mortar to the requirements of Section 04300 Unit Masonry System.

3.4 Field Quality Control

The Contractor shall provide a third party Quality Control Inspector to perform all sampling and testing to confirm that the mortar mix conforms to the proposed mix properties developed in the design mix.

Construction testing of mortar mix shall be in accordance with ASTM C780 for compression strength. Four (4) prism specimens shall be taken for each 50 cu. ft. of mortar or fraction thereof placed each day.

End of Section.

Section 04300 - Unit Masonry System
Part 1 - General

1.1 Scope
This section includes:

- Concrete Masonry Units

1.2 Related Sections
- 01010 Summary of Work
- 01400 Contractor Quality Control
- 01600 Material and Equipment
- 02722 Grouting
- 03100 Concrete Formwork
- 04100 Mortar

1.3 References
ASTM C55 Standard Specification for Concrete Building Brick

ASTM C140 Standard Method of Sampling and Testing Concrete Masonry Units

1.4 Submittals for Revision and Approval
The Contractor shall submit for approval the following 30 days prior to initiation of the work at the site.

Certified laboratory test results for the proposed solid masonry units.

1.5 Quality Assurance
Perform the work in accordance with the Contractor's Quality Control Plan.

Part 2 - Products

2.1 Concrete Masonry Units
Concrete masonry units shall be solid (no cavities or cores), load bearing high-strength units having a minimum compressive strength of 3500 psi. Concrete masonry units shall be tested in accordance with ASTM C140. All other aspects of the concrete masonry units shall comply with ASTM C55, Type I Moisture Controlled.

Nominal modular size shall be 8 x 8 x 16 inches, or as otherwise approved by the Engineer.

Concrete brick shall comply with ASTM C55, Grade N, Type I (moisture controlled) having a minimum compressive strength of 3500 psi (Avg. 3 units) or 3000 psi for individual unit.

2.2 Mortar
Mortar shall be as specified in Section 04100 Mortar.

Part 3 - Execution

3.1 General

The Contractor shall furnish all labor, material, equipment and tools to perform all operations of installing Unit Masonry Isolation Walls to the lines and grades shown on the drawings.

The Contractor shall examine the excavation of the entry to affirm that the keys have been properly leveled and cut to the appropriate depths, at the proper locations prior to any to any work.

3.2 Installation

The Contractor shall install the isolation walls using concrete masonry units as specified above. Masonry units shall be installed with 3/8-inch mortar joints with full mortar bedding and full head joints. Masonry units shall be installed in running bond with headers every third course. Masonry units shall be mortared tight to the ribs and the back wall to provide a seal all around the isolation wall.

Concrete brick may be used as required for fit-up around grout pipes, or minimizing the dimensional fit-up at the top or sides of the isolation walls as approved by the Engineer. The interface between the top of the isolation wall and the back wall shall be completely mortared to provide full contact between the back and the block wall.

3.3 Field Quality Control

The Contractor shall provide a third-party Quality Control Inspector to inspect the installation of the Concrete Masonry Unit Isolation Walls. Inspection and testing of the mortar shall be in accordance with Section 04100 Mortar.

End of Section

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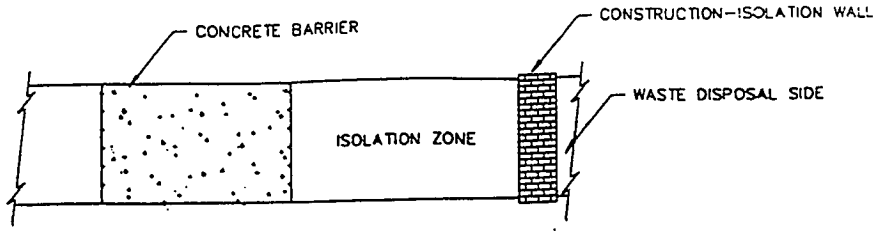
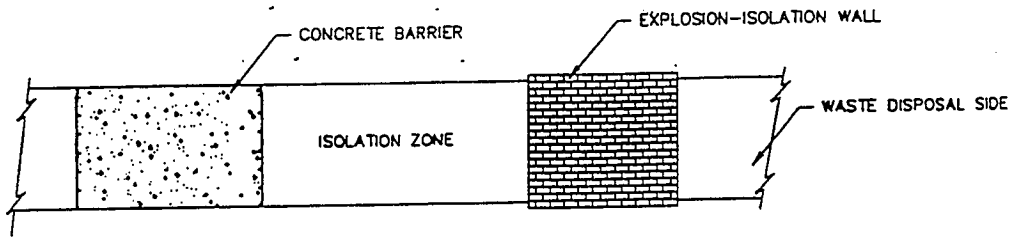
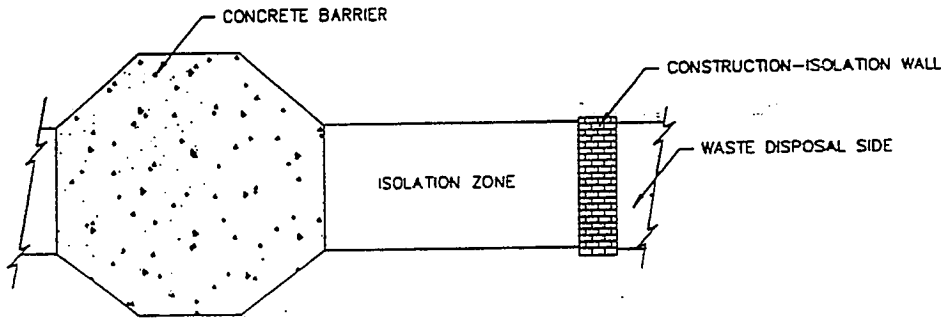
FIGURES



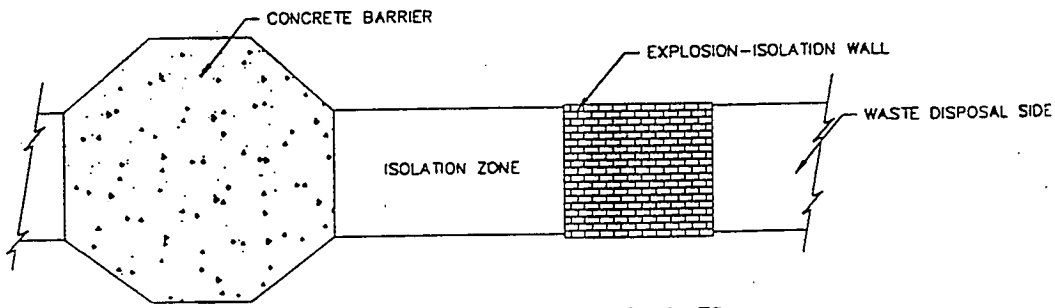
A. CONCRETE BARRIER WITHOUT DRZ REMOVED AND CONSTRUCTION ISOLATION WALL



B. CONCRETE BARRIER WITHOUT DRZ REMOVED AND EXPLOSION ISOLATION WALL

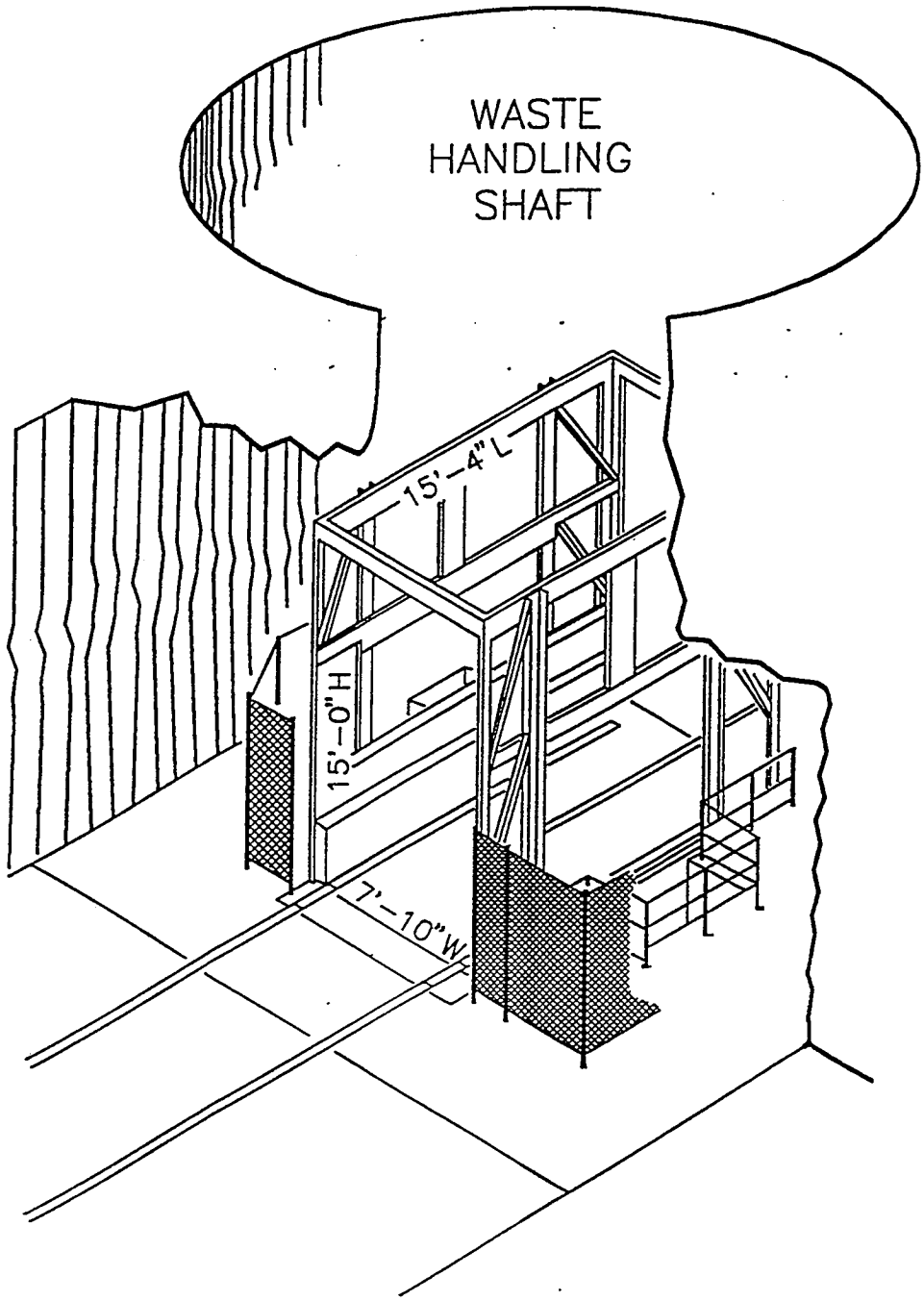


C. CONCRETE BARRIER WITH DRZ REMOVED AND CONSTRUCTION ISOLATION WALL



D. CONCRETE BARRIER WITH DRZ REMOVED AND EXPLOSION ISOLATION WALL

Figure I1G-1
Plan Variations



NOTES

(1) CAGE DIMENSIONS SHOWN ARE INSIDE.

(2) WASTE HOIST DESIGN CAPACITY IS 80,000 LBS.

Figure I1G-2
Waste Handling Shaft Cage Dimensions

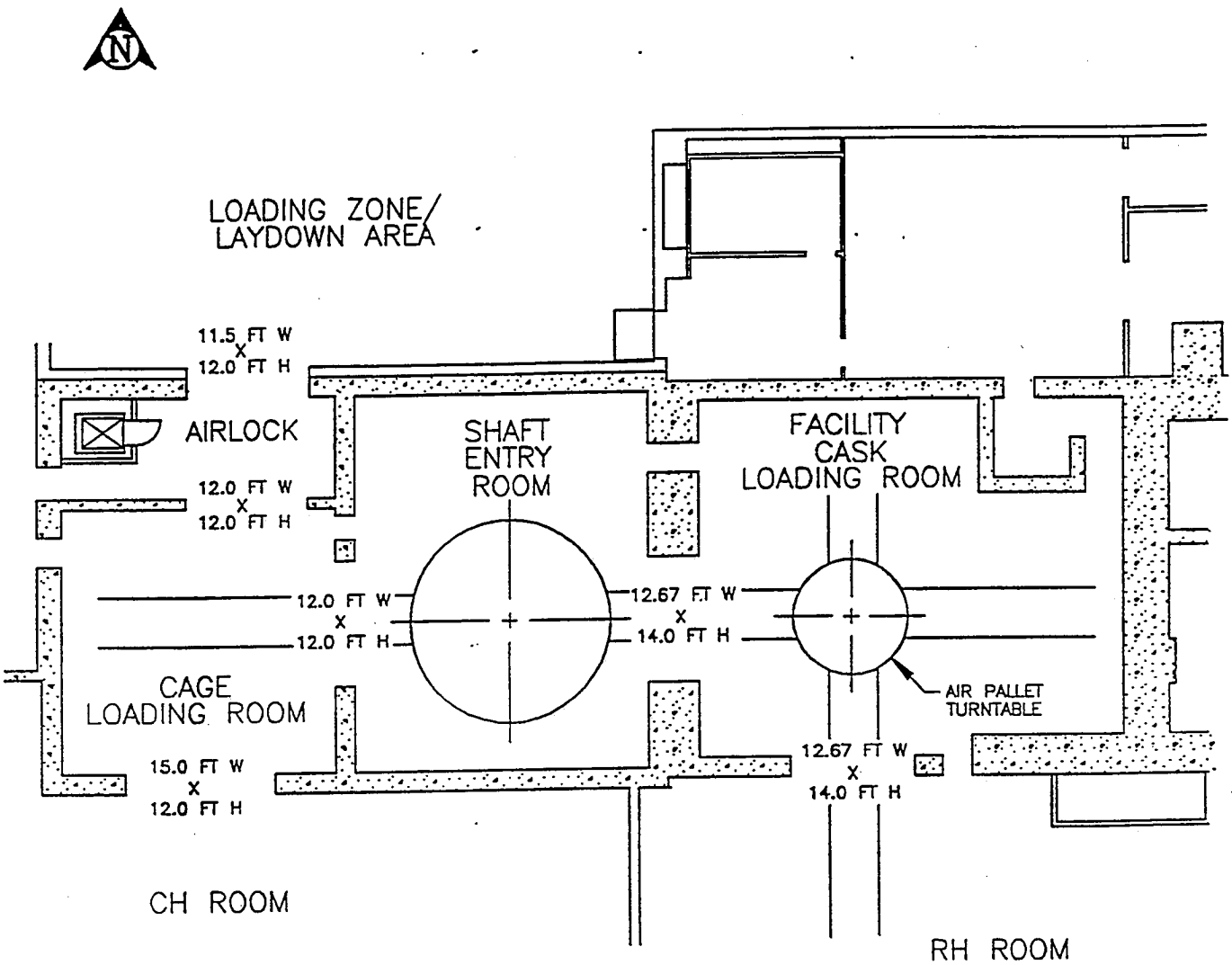


Figure I1G-3
Waste Shaft Collar and Airlock Arrangement