

**ATTACHMENT G1
APPENDIX G**

TECHNICAL SPECIFICATIONS

**PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO**

Waste Isolation Pilot Plant
Hazardous Waste Permit
March 2018~~October 1, 2012~~

(This page intentionally blank)

**ATTACHMENT G1
APPENDIX G
TECHNICAL SPECIFICATIONS
PANEL CLOSURE SYSTEM
WASTE ISOLATION PILOT PLANT
CARLSBAD, NEW MEXICO**

TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS..... 1
 Section 01010 - Summary of Work 3
 Part 1 - General 3
 1.1 Scope..... 3
 1.2 Scope of Work 3
 1.3 Definitions and Abbreviations 4
 1.4 List of Drawings 6
 1.5 Work by Others 6
 1.6 Contractor's Use of Site 6
 1.7 Contractor's Use of Facilities..... 7
 1.8 Work Sequence 7
 1.9 Work Plan 7
 1.10 Submittals 7
 Part 2 - Products..... 7
 Part 3 - Execution 8
 Section 01090 - Reference Standards 9
 Part 1 - General 9
 1.1 Scope..... 9
 1.2 Quality Assurance 9
 1.3 Schedule of References 9
 Section 01400 - Contractor Quality Control 13
 Part 1 - General 13
 1.1 Scope..... 13
 1.2 Related Sections 13
 1.3 Contractor Quality Control Plan..... 13
 1.4 References and Standards..... 13
 1.5 Quality Assurance 14
 1.6 Tolerances 14
 1.7 Testing Services 14
 1.8 Inspection Services 14
 1.9 Submittals 15
 Part 2 - Products..... 15
 Part 3 - Execution 15
 3.1 General 15
 3.2 Quality Control Plan 15
 3.3 Quality Control Organization 17
 3.4 Tests..... 17

3.5	Testing Laboratory	18
3.6	Inspection Services	18
3.7	Completion Inspection.....	19
3.8	Documentation.....	19
3.9	Notification of Noncompliance	20
Section 01600 - Material and Equipment		21
Part 1 - General		21
1.1	Scope.....	21
1.2	Related Sections	21
1.3	Equipment.....	21
1.4	Products.....	21
1.5	Transportation and Handling	21
1.6	Storage and Protection	22
1.7	Substitutions	22
Part 2 - Products.....		22
Part 3 - Execution		22
DIVISION 2 - SITE WORK		23
Section 02010 - Mobilization and Demobilization.....		25
Part 1 - General		25
1.1	Scope.....	25
1.2	Related Sections	25
Part 2 - Products.....		25
Part 3 - Execution		25
3.1	Mobilization of Equipment and Facilities to Site.....	25
3.2	Use of Site	25
3.3	Use of Existing Facilities	26
3.4	Demobilization of Equipment and Facilities	26
3.5	Site Cleanup	26
Section 02222 - Excavation		27
Part 1 - General		27
1.1	Scope.....	27
1.2	Related Sections.....	27
1.3	Reference Documents	27
1.4	Field Measurements and Survey.....	27
Part 2 - Products.....		27
Part 3 - Execution		27
3.1	Excavating for Concrete Barrier	27
3.2	Excavating for Surface Preparation and leveling of Base Areas for Isolation Walls	28
3.3	Disposition of Excavated Materials.....	28
3.4	Field Measurements and Survey.....	28
Section 02722 - Grouting.....		29
Part 1 - General		29
1.1	Scope.....	29
1.2	Related Sections.....	29
1.3	References	29
1.4	Submittals for Review and Approval.....	29
1.5	Submittals for Construction	29
Part 2 - Products.....		30

2.1	Grout Materials	30
2.2	Product Data	30
Part 3 - Execution	.....	30
3.1	General	30
3.2	Interface Grouting of Concrete Barrier	31
3.3	Contact Grouting	32
3.4	Cleanup	33
3.5	Quality Control	33
DIVISION 3 - CONCRETE	.....	35
Section 03100 - Concrete Formwork	.....	37
Part 1 - General	.....	37
1.1	Scope	37
1.2	Related Sections	37
1.3	References	37
1.4	Submittals	37
1.5	Quality Assurance	38
Part 2 - Products	.....	38
2.1	Form Materials	38
Part 3 - Execution	.....	38
3.1	General	38
3.2	Shop Drawings	39
3.3	Fabrication	39
3.4	Installation	39
3.5	Quality Control	40
3.6	Handling, Shipping, Storage	40
Section 03300 - Cast-in-Place Concrete	.....	41
Part 1 - General	.....	41
1.1	Scope	41
1.2	Related Sections	41
1.3	References	41
1.4	Submittals for Review/Approval	42
1.5	Submittals at Completion	42
1.6	Quality Assurance	42
Part 2 - Products	.....	43
2.1	Cement	43
2.2	Aggregates	43
2.3	Water	43
2.4	Admixtures	44
2.5	Concrete Mix Properties	44
2.6	Salado Mass Concrete	44
Part 3 - Execution	.....	45
3.1	General	45
3.2	Pumping Concrete	46
3.3	Coordination of Work	46
3.4	Clean-Up	46
3.5	Quality Control	47
DIVISION 4 - MASONRY	.....	49
Section 04100 - Mortar	.....	51

Part 1 - General	51
1.1 Scope.....	51
1.2 Related Sections.....	51
1.3 References	51
1.4 Submittals for Review and Approval.....	51
1.5 Submittals at Completion	51
1.6 Quality Assurance.....	52
1.7 Delivery Storage Handling.....	52
Part 2 - Products.....	52
2.1 Mortar Mix.....	52
Part 3 - Execution	52
3.1 General	52
3.2 Mortar Mixing	52
3.3 Installation.....	52
3.4 Field Quality Control.....	53
Section 04300 - Unit Masonry System.....	55
Part 1 - General	55
1.1 Scope.....	55
1.2 Related Sections.....	55
1.3 References	55
1.4 Submittals for Revision and Approval.....	55
1.5 Quality Assurance.....	55
Part 2 - Products.....	55
2.1 Concrete Masonry Units.....	55
2.2 Mortar	56
Part 3 - Execution	56
3.1 General	56
3.2 Installation.....	56
3.3 Field Quality Control.....	56

LIST OF FIGURES

Figure	Title
Figure G1G-1	Plan Variations
Figure G1G-2	Waste Handling Shaft Cage Dimensions
Figure G1G-3	Waste Shaft Collar and Airlock Arrangement

(This page intentionally blank)

1

DIVISION 1 - GENERAL REQUIREMENTS

2

1
2

(This page intentionally blank)

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 G1-1 "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

- 1 • Coordinate construction with operations
- 2 • Perform the following for the air intake entry and the air exhaust entry.
 - 3 – Excavate the surface preparation for the explosion isolation wall
 - 4 – Construct the explosion isolation wall
 - 5 – Excavate the DRZ
 - 6 – Install the form work for the concrete barrier
 - 7 – Place concrete for the concrete barrier
 - 8 – Grout the interface of concrete barrier/back wall
 - 9 – Provide contact grouting along the contact surface (if required by the engineer)
- 10 • Clean up construction areas in underground and above ground
- 11 • Submit all required record documents
- 12 • Demobilize from site

13 **1.3 Definitions and Abbreviations**

14 **Definitions**

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

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

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

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

24 Creep—Plastic deformation of salt under deviatoric stress.

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

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

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

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

- 1 Health-based migration limit—The mass flow rate of a VOC from all closed panels that results in
2 the health-based concentration level at the point of compliance.
- 3 Hydration temperature—The temperature developed by a cementitious material due to the
4 hydration of the cement.
- 5 Interface grouting—Grouting performed through grout boxes and pipe lines to fill the void at the
6 concrete barrier/back-wall interface.
- 7 Methane explosion—A postulated deflagration caused by the buildup of methane gas to
8 explosive levels.
- 9 Partial closure—The process of either rendering a part of the underground repository inactive
10 and closed according to approved facility closure plans or decontaminating and
11 decommissioning of Permit-related surface equipment, structures, and contaminated soils prior
12 to final facility closure. The partial-closure process is considered complete after partial-closure
13 activities are performed in accordance with approved Resource Conservation and Recovery Act
14 (RCRA) partial closure plans.
- 15 Point of compliance—The operating point of compliance for VOC levels at the WIPP, which is
16 the 16-section land withdrawal boundary.
- 17 Remote-handled waste—Any of the various forms of high beta-gamma defense TRU waste
18 requiring remote-handling and with a surface dose rate exceeding 200 millirem per hour.
- 19 Standard barrier—A concrete barrier emplaced into the panel-access drifts without major
20 excavation of the surrounding rock.
- 21 Volatile Organic Compound (VOC)—Any VOC comprising the land-disposal-restricted indicator
22 VOC constituents in the WIPP waste inventory.

23 **Abbreviations/Acronyms**

24	ACI	American Concrete Institute
25	AISC	American Institute for Steel Construction
26	ANSI	American National Standards Institute
27	ASTM	American Society for Testing and Materials
28	AWS	American Welding Society
29	CFR	Code of Federal Regulations
30	DOE	U.S. Department of Energy
31	DRZ	Disturbed rock zone
32	EPA	U.S. Environmental Protection Agency
33	MB 139	Marker Bed 139
34	MSHA	U.S. Mine Safety and Health Administration
35	NMAC	New Mexico Administrative Code
36	NMED	New Mexico Environment Department
37	MOC	Management and Operating Contractor (Permit Section 1.5.3)
38	RCRA	Resource Conservation and Recovery Act
39	SMC	Salado Mass Concrete
40	USACE	U.S. Army Corps of Engineers

1 WIPP Waste Isolation Pilot Plant

2 **1.4 List of Drawings**

3 The following drawings are made apart of this specification:

4	762447-E1	Panel closure system, air intake and exhaust drifts, title sheet
5	762447-E2	Panel closure system, underground waste-emplacement panel plan
6	762447-E3	Panel closure system, air intake drift, construction details
7	762447-E4	Panel closure system, air exhaust drift, construction details
8	762447-E5	Panel closure system, construction and explosion walls, construction details
9	762447-E6	Panel closure system, air intake and exhaust drifts, grouting and miscellaneous
10		details

11 **1.5 Work by Others**

12 Survey

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

17 Excavation

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

20 **1.6 Contractor's Use of Site**

21 Site Conditions

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

29 Contractor's Use of Site

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

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

34 Coordination of Contractor's Work

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

5 **1.7 Contractor's Use of Facilities**

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

- 7 • WIPP roadheader
- 8 • Waste shaft conveyance
- 9 • Salt skip hoist
- 10 • (1) 20 ton forklift
- 11 • (1) 40 ton forklift
- 12 • 460 volt AC, 3 phase power
- 13 • Water (underground, at waste shaft only) (above ground, at location designated by
14 Engineer)

15 Additional information on these facilities is presented in Section 02010.

16 **1.8 Work Sequence**

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

18 **1.9 Work Plan**

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

24 **1.10 Submittals**

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

30 **Part 2 - Products**

31 Not used.

1
2
3
4

Part 3 - Execution

Not Used.

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
AISC	American Institute of Steel Construction One E. Wacker Dr., Suite 3100 Chicago, IL 60601-2001

Ph: 312-670-2400
Fax: 312-670-5403

ANSI	American National Standards Institute 11 West 42nd St. New York NY 10036 Ph: 212-642-4900 Fax: 212-302-1286
API	American Petroleum Institute 1220 L. St., NW Washington, DC 20005 Ph: 202-682-8375 Fax: 202-962-4776
ASTM	American Society for Testing and Materials 1916 Race St. Philadelphia, PA 19103 Ph: 215-299-5585 Fax: 215-977-9679
AWS	American Welding Society 550 LeJeune Road Miami, FL 33135 Ph: 800-443-9353 Fax: 305-443-7559
CFR	Code of Federal Regulations Government Printing Office Washington, DC 20402 Ph: 202-783-3238 Fax: 202-223-7703
EPA	Environmental Protection Agency Public Information Center Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460 Ph: 202-272-0167
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 Nuclear Waste Partnership LLC
PO Box 2078
Carlsbad, New Mexico 88221

End of Section

1

2

1
2

(This page intentionally blank)

1 **Section 01400 - Contractor Quality Control**

2 **Part 1 - General**

3 **1.1 Scope**

4 This section includes:

- 5 • Contractor Quality Control Plan (**CQCP**)
- 6 • Reference Standards
- 7 • Quality Assurance
- 8 • Tolerances
- 9 • Testing Services
- 10 • Inspection Services
- 11 • Submittals

12 **1.2 Related Sections**

- 13 • 01090 - Reference Standards
- 14 • 01600 - Material and Equipment
- 15 • 02222 - Excavation
- 16 • 02722 - Grouting
- 17 • 03100 - Concrete Formwork
- 18 • 03300 - Cast-in-Place Concrete
- 19 • 04100 - Mortar
- 20 • 04300 - Unit Masonry System

21 **1.3 Contractor Quality Control Plan**

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

25 **1.4 References and Standards**

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

28 Standards referenced in this section are as follows:

29	ASTM C1077	Practice for Laboratories Testing Concrete and Concrete
30		Aggregates for Use in Construction and Criteria for Laboratory
31		Evaluation
32	ASTM C1093	Practice for Accreditation of Testing Agencies for Unit Masonry
33	ASTM E329	Practice for Use in the Evaluation of Inspection and Testing
34		Agencies as Used in Construction

1 ASTM E543 Practice for Determining the Qualification of Nondestructive
2 Testing Agencies

3 ASTM E548 Practice for Preparation of Criteria for Use in the Evaluation of
4 Testing Laboratories and Inspection Bodies

5 **1.5 Quality Assurance**

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

15 **1.6 Tolerances**

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

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

19 **1.7 Testing Services**

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

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

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

29 **1.8 Inspection Services**

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

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

1 **1.9 Submittals**

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

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

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

13 **Part 2 - Products**

14 Not used.

15 **Part 3 - Execution**

16 **3.1 General**

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

25 **3.2 Quality Control Plan**

26 **3.2.1 General**

27 The Contractor shall furnish for review and approval by the Engineer, not later than 30 days
28 after receipt of notice to proceed, the Contractor Quality Control (**CQC**) Plan proposed to
29 implement the requirements of the Contract. The plan shall identify personnel, procedures,
30 control, instructions, test, records, and forms to be used. Construction will be permitted to begin
31 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.

1 **3.2.4 Notification of Changes**

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

4 **3.3 Quality Control Organization**

5 **3.3.1 General**

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

12 **3.3.2 CQC System Manager**

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

22 **3.3.3 CQC Personnel**

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

29 **3.3.4 Organizational Changes**

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

33 **3.4 Tests**

34 **3.4.1 Testing Procedure**

35 The Contractor shall perform specified or required tests to verify that control measures are
36 adequate to provide a product which conforms to contract requirements. Upon request, the
37 Contractor shall furnish to the Engineer duplicate samples of test specimens for possible testing

1 by the Engineer. Testing includes operation and/or acceptance tests when specified. The
2 Contractor shall procure the services of an approved testing laboratory. The Contractor shall
3 perform the following activities and record and provide the following data:

- 4 • Verify that testing procedures comply with contract requirements.
- 5 • Verify that facilities and testing equipment are available and comply with testing
6 standards.
- 7 • Check test instrument calibration data against certified standards.
- 8 • Verify that recording forms and test identification control number system, including all
9 of the test documentation requirements, have been prepared.
- 10 • Results of all tests taken, both passing and failing tests, will be recorded on the CQC
11 report for the date taken. Specification paragraph reference, location where tests were
12 taken, and the sequential control number identifying the test will be given. If approved
13 by the Engineer, actual test reports may be submitted later with a reference to the test
14 number and date taken. An information copy of tests performed by an off site or
15 commercial test facility will be provided directly to the Engineer. Failure to submit
16 timely test reports as stated may result in nonpayment for related work performed and
17 disapproval of the test facility for this contract.

18 **3.5 Testing Laboratory**

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

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

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

29 The laboratory may not:

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

33 The laboratory has no authority to stop the work.

34 **3.6 Inspection Services**

35 The inspection firm shall provide qualified personnel at site to supplement the Contractor's
36 Quality Control Program to perform specified inspection of Products in accordance with

1 specified standards. He shall ascertain compliance of materials and mixes with requirements of
2 Contract Documents, and promptly notify the CQC System Manager, the Engineer and the
3 Contractor of observed irregularities or non-conformance of Work or Products. The inspector
4 does not have the authority to stop the work. The inspector shall refer such cases to the CQC
5 System Manager who has the authority to stop work (see Section 3.2.2).

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

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

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

12 **3.7 Completion Inspection**

13 **3.7.1 Pre-Final Inspection**

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

24 **3.7.2 Final Acceptance Inspection**

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

31 **3.8 Documentation**

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

- 36 • Contractor/subcontractor and their area of responsibility.
- 37 • Operating plant/equipment with hours worked, idle, or down for repair.

- 1 • Work performed each day, giving location, description, and by whom.
- 2 • Test and/or quality control activities performed with results and references to
- 3 specifications/drawings requirements. List deficiencies noted along with corrective
- 4 action.
- 5 • Quantity of materials received at the site with statement as to acceptability, storage,
- 6 and reference to specifications/drawings requirements.
- 7 • Submittals reviewed, with contract reference, by whom, and action taken.
- 8 • Off-site surveillance activities, including actions taken.
- 9 • Instructions given/received and conflicts in plans and/or specifications.
- 10 • Contractor's verification statement.

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

19 **3.9 Notification of Noncompliance**

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

27 End of section.

28

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.

1

DIVISION 2 - SITE WORK

2

1
2

(This page intentionally blank)

1 **Section 02010 - Mobilization and Demobilization**

2 **Part 1 - General**

3 **1.1 Scope**

4 This section includes:

- 5 • Mobilization of equipment and facilities to site
- 6 • Contractor use of site
- 7 • Use of existing facilities
- 8 • Demobilization of equipment and facilities
- 9 • Site cleanup

10 **1.2 Related Sections**

- 11 • 01010 - Summary of Work
- 12 • 01600 - Material and Equipment

13 **Part 2 - Products**

14 Not used.

15 **Part 3 - Execution**

16 **3.1 Mobilization of Equipment and Facilities to Site**

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

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

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

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

27 **3.2 Use of Site**

28 The Contractor shall use only those areas specifically designated for his use by the Engineer.
29 The Contractor shall limit his on-site travel to the specific routes required for performance of his
30 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 G1-2 and G1-3, 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.

1 **Section 02222 - Excavation**

2 **Part 1 - General**

3 **1.1 Scope**

4 This section includes:

- 5 • Excavation for main concrete barrier
- 6 • Excavation for surface preparation and leveling of base areas for isolation walls
- 7 • Disposition of excavated materials.

8 **1.2 Related Sections**

- 9 • 01010 - Summary of Work
- 10 • 01600 - Material and Equipment
- 11 • 03100 - Concrete Form Work
- 12 • 04300 - Unit Masonry System.

13 **1.3 Reference Documents**

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

17 **1.4 Field Measurements and Survey**

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

21 **Part 2 - Products**

22 Not used.

23 **Part 3 - Execution**

24 **3.1 Excavating for Concrete Barrier**

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

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

5 **3.2 Excavating for Surface Preparation and leveling of Base Areas for Isolation Walls**

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

11 **3.3 Disposition of Excavated Materials**

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

15 **3.4 Field Measurements and Survey**

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

24 End of section.

25

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

1 exact location of the boxes and lines shall be determined in the field. Additional grout delivery
2 and return lines and boxes may be required by the Engineer.

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

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

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

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

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

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

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

22 **3.2 Interface Grouting of Concrete Barrier**

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

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

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

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

1 **3.3 Contact Grouting**

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

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

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

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

13 **3.3.1 Drilling**

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

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

18 The minimum diameter shall be approximately 1 1/2 inches.

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

22 **3.3.2 Materials for Contact Grouting**

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

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

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

1
2

(This page intentionally blank)

1

DIVISION 3 - CONCRETE

2

1
2

(This page intentionally blank)

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 of the formwork.

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

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

3 **1.5 Quality Assurance**

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

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

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

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

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

12 **Part 2 - Products**

13 **2.1 Form Materials**

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

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

16 Form spacers shall be ASTM A-36 round stock.

17 Bolts shall be ASTM A325 high strength structural bolts.

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

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

20 Welding electrodes shall conform to AWS A5.1.

21 **Part 3 - Execution**

22 **3.1 General**

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

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

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

3 **3.2 Shop Drawings**

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

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

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

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

15 **3.3 Fabrication**

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

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

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

25 **3.4 Installation**

26 **3.4.1 Grout Pipes**

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

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 Heat of Hydration of Hydraulic Cement
ASTM C 403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C 618	Fly ash and Raw or Calcined Natural Pozzolan for Use as an Admixture in Portland Cement Concrete

1	ASTM D 2216	Standard Test Method for Laboratory Determination of Water (moisture)
2		Content of Soil and Rock
3	USACE CRD-C 36	Method of Test for Thermal Diffusivity of Concrete
4	USACE CRD-C 48	Standard Test Method for Water Permeability of Concrete
5	API 10	Cements
6	NRMCA	Check List for Certification of Ready Mixed Concrete Production
7		Facilities
8	NRMCA	Concrete Plant Standards
9	MOC Standards	
10	WIPP-DOE-71	Design Criteria Waste Isolation Pilot Plant, Revised Mission Concept --
11		IIA (DOE, 1984)
12	WP 03-1	WIPP Startup and Acceptance Test Program (Westinghouse, 1993b)
13	WP 09-010	Design Development Testing (Westinghouse, 1991)
14	WP 09-CN3021	Component Numbering (Westinghouse, 1994a)
15	WP 09-024	Configuration Management Board/Engineering Change Proposal (ECP)
16		(Westinghouse, 1994b)

17 **1.4 Submittals for Review/Approval**

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

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

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

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

25 **1.5 Submittals at Completion**

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

27 **1.6 Quality Assurance**

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

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

3 **Part 2 - Products**

4 **2.1 Cement**

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

8 **2.2 Aggregates**

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

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

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

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

16 **2.3 Water**

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

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

- 21 • pH not less 6.0 or greater than 8.0
- 22 • Carbonates and/or bicarbonates of sodium and potassium: 1000 ppm maximum
- 23 • Chloride ions (Cl⁻): 250 ppm maximum
- 24 • Sulfate ions (SO₄²⁻): 1000 ppm maximum
- 25 • Iron content: 0.3 ppm maximum
- 26 • Total solids: 2000 ppm maximum

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

29 The source of water is to be indicated and certified copies of test data from an approved
30 laboratory confirming that the water to be used meets the above requirements shall be
31 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

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

4 **Part 3 - Execution**

5 **3.1 General**

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

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

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

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

20 The Contractor is to provide all transport vehicles or means to transfer the wet concrete from the
21 mixer truck to the pump. It is expected that the Contractor will use the waste conveyance hoist
22 to transfer from the ground surface to the mine level. The Contractor is to familiarize himself
23 with the dimensions of the waste conveyance and the airlock in order to provide suitable
24 transport vehicles. The Contractor is also to familiarize himself with the capacity and speed of
25 the conveyance to allow transfer of sufficient concrete to sustain the continuing placement of
26 concrete. (See Figures G1-2 and G1-3, attached).

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

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

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

11 **3.2 Pumping Concrete**

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

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

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

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

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

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

30 **3.3 Coordination of Work**

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

34 **3.4 Clean-Up**

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

1
2

(This page intentionally blank)

1

DIVISION 4 - MASONRY

2

1
2

(This page intentionally blank)

1 **Section 04100 - Mortar**

2 **Part 1 - General**

3 **1.1 Scope**

4 This section includes:

- 5
 - Mortar for Isolation Wall Construction.

6 **1.2 Related Sections**

- 7
 - 01010 - Summary of Work
 - 8 • 01400 - Contractor Quality Control
 - 9 • 01600 - Material and Equipment
 - 10 • 04300 - Unit Masonry System

11 **1.3 References**

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

21 **1.4 Submittals for Review and Approval**

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

24 Design mix.

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

27 **1.5 Submittals at Completion**

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

1 **1.6 Quality Assurance**

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

5 **1.7 Delivery Storage Handling**

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

8 **Part 2 - Products**

9 **2.1 Mortar Mix**

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

12 Sand for mortar shall conform to ASTM C144.

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

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

17 **Part 3 - Execution**

18 **3.1 General**

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

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

23 **3.2 Mortar Mixing**

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

28 **3.3 Installation**

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

1
2

(This page intentionally blank)

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.

1

FIGURES

2

(This page intentionally blank)

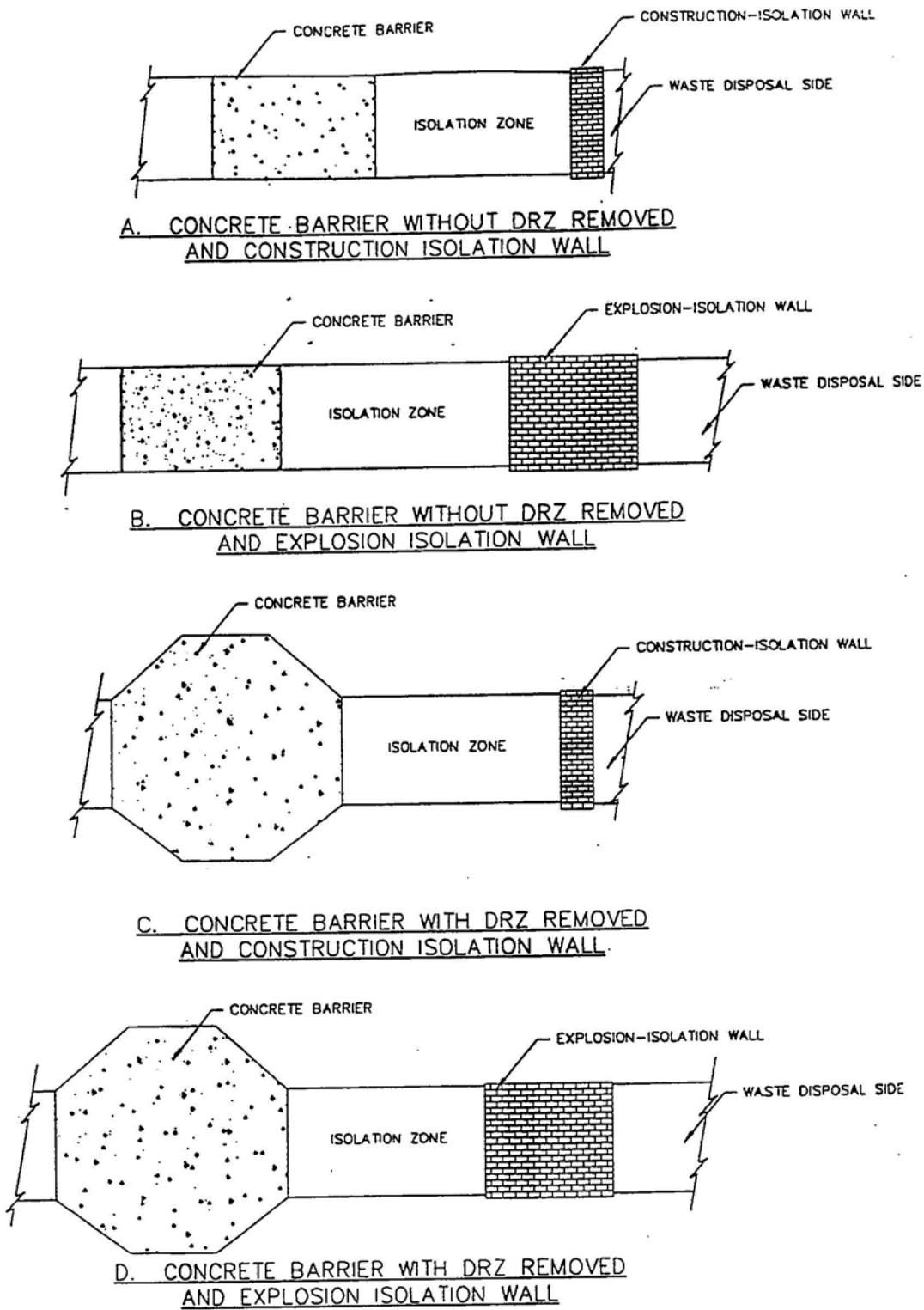


Figure G1G-1
Plan Variations

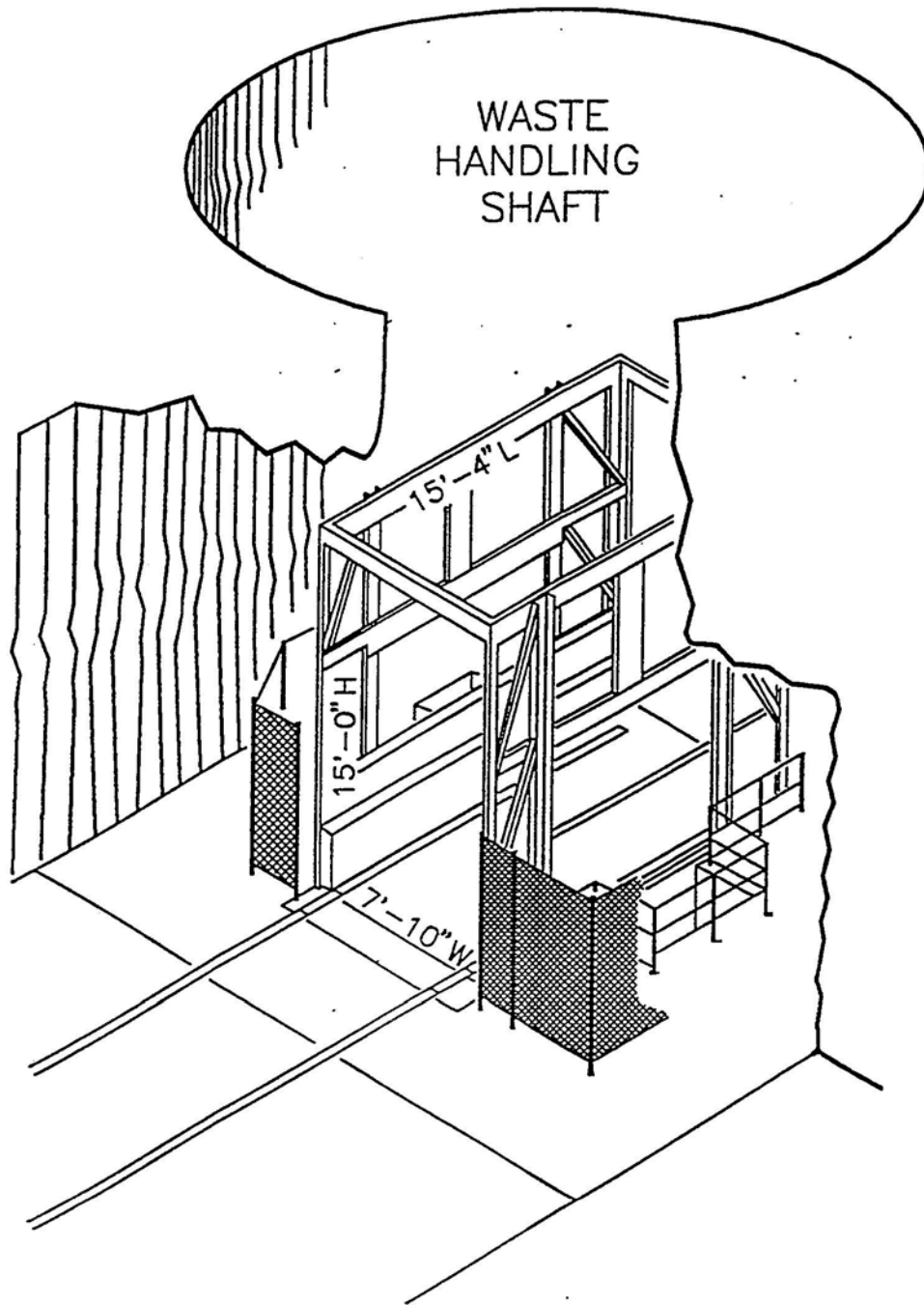


Figure G1G-2
Waste Handling Shaft Cage Dimensions

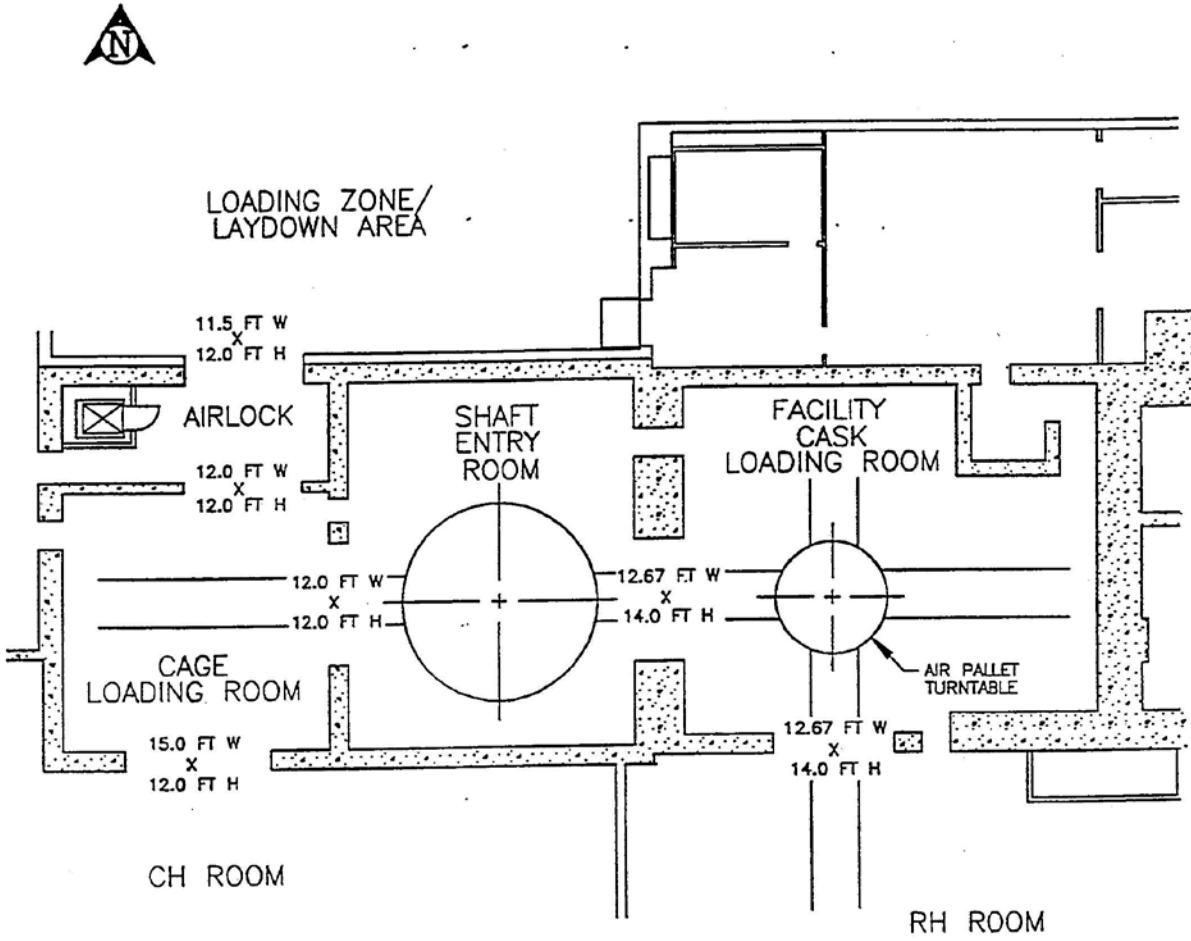


Figure G1G-3
Waste Shaft Collar and Airlock Arrangement