

**COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION (CLEAN I)  
Northern and Central California, Nevada, and Utah  
Contract Task Order 0235**

**Prepared For**

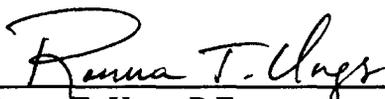
**DEPARTMENT OF THE NAVY  
Stephen Chao, P.E.  
Engineering Field Activity West  
Naval Facilities Engineering Command  
San Bruno, California**

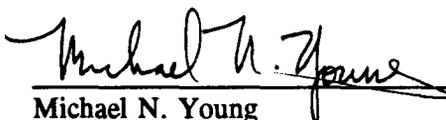
**SITE 9 CORRECTIVE ACTIONS  
SVE/AS SYSTEMS  
PRELIMINARY SPECIFICATIONS**

**February 6, 1996**

**Prepared By**

**PRC ENVIRONMENTAL MANAGEMENT, INC.  
135 Main Street, Suite 1800  
San Francisco, California  
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**SITE 9 CORRECTIVE ACTIONS**  
**SVE/AS SYSTEMS**  
**AT**  
**MOFFETT FEDERAL AIRFIELD, CALIFORNIA**

**SPECIFICATION PREPARED BY:**  
**PRC ENVIRONMENTAL MANAGEMENT, INC.**  
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**SPECIFICATIONS SECTIONS SUMMARY**

**SITE 9 SVE/AS SYSTEM  
SPECIFICATION LIST**

<u>Section</u>	<u>Title</u>
00501	List of Drawings
01010	Summary of Work
01300	Submittals
01400	Quality Control
01500	Construction Facilities
01560	Temporary Controls
02050	Demolition and Removal
02221	Extraction Trench and Pipe Trench Construction
02260	Pneumatic Soil Fracturing
02510	Surface Restoration
02675	Drilled Sparge, Monitor, and Fracture Wells
02831	Fence, Chain Link
03302	Cast-In-Place Concrete
11171	Vapor Treatment System Packaged Catalytic Oxidizer
11303	Liquid Phase Granular Activated Carbon (GAC) Systems
15011	Mechanical General Requirements
15056	Vapor Extraction Blower Systems
15080	Piping, Valves, and Appurtenances
15488	Air Compressor Systems
16011	Electrical General Requirements
16402	Wiring Systems
16900	Controls and Instrumentation

**SECTION 00501  
 LIST OF DRAWINGS**

1.1 SUMMARY

This section lists the drawings for the project pursuant to contract clause "DFARS 252.236-7001, Contract Drawings, Maps and Specifications."

1.2 CONTRACT DRAWINGS

Contract drawings are as follows, with each drawing bearing the general title "Site 9 SVE/AS Systems":

Dwg. No.	Rev. No.	NAVFAC Drawing No.	Title
T-1			Title Sheet
T-2			Symbols Legend
C-1			Site Plan, Vapor Extraction System, Building 29 Area
C-2			Site Plan, Air Sparge System, Building 29 Area
C-3			Site Plan, Vapor Extraction System, Building 31 Area
C-4			Site Plan, Air Sparge System, Building 31 Area
C-5			Site Plan, Surface Restoration, Building 29 Area
C-6			Site Plan, Surface Restoration, Building 31 Area
C-7			Extraction Trench Cross Section & Details
C-8			Sparge and Monitoring Well Cross Section & Details
C-9			SVE and AS Systems Plan & Details
P-1			P&ID, Vapor Extraction Piping Distribution, Building 29 Area
P-2			P&ID, Vapor Extraction System, Building 29 Area
P-3			P&ID, Vapor Treatment System, Building 29 Area
P-4			P&ID, Vapor Extraction Piping Distribution, Building 31 Area
P-5			P&ID, Vapor Extraction System, Building 31 Area
P-6			P&ID, Vapor Treatment System, Building 31 Area
P-7			P&ID, Air Sparge System, Building 29 Area
P-8			P&ID, Air Sparge System, Building 31 Area
E-1			Electrical Site Plan
E-2			Electrical One-Line Diagrams
E-3			Building 31 and 29 Area Treatment Electrical Plans
E-4			PLC Control Panel
E-5			Control Panel Wiring Diagram
E-6			Control Panel Wiring Diagram
E-7			Control Panel Wiring Diagram
E-8			Control Panel Wiring Diagram

### 1.3 SUPPLEMENTARY DRAWINGS

Supplementary drawings are not a part of the contract but are for information only.

#### 1.3.1 Utility Drawings

Contractor is responsible for field verifying the locations of all existing utilities in the vicinity of construction. Utility drawings are the property of the government and shall not be used for any purpose other than that intended by the contract. Contractor shall obtain and examine copies of all pertinent utility drawings prior to field verifying utility locations.

#### 1.3.2 Subsurface Data

Subsurface data have been obtained by the Government as part of various environmental investigations at Moffett Federal Airfield. The data are available for examination at Moffett Federal Airfield.

END OF SECTION

**SECTION 01010  
SUMMARY OF WORK**

**PART 1 GENERAL**

**1.1 WORK COVERED BY CONTRACT DOCUMENTS**

**1.1.1 Project Description**

The work involves construction of soil vapor extraction (SVE) trenches, air sparge (AS) injection wells, and piping distribution systems, and installation of extraction and injection mechanical equipment. The work also includes connection of mechanical equipment motors to existing electrical service.

The work area will be comprised of two regions of Site 9, one near Building 29 and one near Building 31 (these regions correspond to the two separate soil contaminant plume areas). Each area will have an independent SVE and air sparge system. The Building 29 area system will require construction of 30 SVE trenches and 46 air sparge wells. The Building 31 area system will include construction of 15 SVE trenches and 17 air sparge wells. Three extraction blowers, 1 sparge air compressor, and 1 vapor treatment unit will be installed for each system. Installation of the vapor extraction and treatment equipment for each area will require construction of a concrete pad and corresponding fenced area.

Pneumatic fracturing of site soils will be implemented contingent upon performance of the systems during initial operation. Fracturing is anticipated to be required at approximately 80 locations at depths of approximately 6 to 10 feet below ground surface. Following installation of the SVE/AS systems and assessment of system performance, proposed fracturing locations will be reviewed. Fracturing will then be conducted at selected locations.

Construction of the SVE/AS systems will require removing approximately 25,000 square feet of existing pavement and repaving the demolished areas after the systems have been installed.

**1.1.2 Location**

The work shall be located at Moffett Federal Airfield, Site 9, as shown on the drawings.

**1.2 CONSTRUCTION BY REMEDIAL ACTION CONTRACTOR**

Western Division Naval Facilities Engineering Command entered into Contract Number N62474-93-D-2151 with IT Corporation. The contract title is Environmental Remedial Action Contract for Sites in Northern and Central California and in Nevada. The work will be constructed under that contract. The contract between IT Corporation and the Navy includes provisions that would otherwise be specified in Sections 01020 "Allowances" and 01025 "Measurement and Payment." All applicable provisions contained in the remedial action contract apply to the work.

1.3 SUBMITTALS

Submit all submittals in accordance with Section C, Part 7 of Contract Number N62474-93-D-2151 and with Section 01300, "Submittals".

1.3.1 SD-04, Drawings

a. Traffic Control Plan G

1.3.2 SD-18, Records

a. List of Contact Personnel G

1.4 SPECIAL SCHEDULING REQUIREMENTS

a. The entire Airfield and NASA facilities and programs will remain in operation during the construction period. Work should be scheduled so that regular traffic flow can be maintained with minimal diversions and conducted so as to cause the least possible interference with normal operations. Advanced notification of disruptions to regular operations should be provided.

1.5 CONTRACTOR PERSONNEL REQUIREMENTS

1.5.1 Subcontractors and Personnel

Furnish a list of contract personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.5.2 Identification Badges

Identification badges, if required, will be furnished without charge. Application for and use of badges will be as directed. Immediately report instances of lost or stolen badges to the Contracting Officer.

1.6 CONTRACTOR ACCESS AND USE OF PREMISES

1.6.1 Station Regulations

Ensure that Contractor personnel employed at Moffett Federal Airfield become familiar with and obey Airfield regulations. Keep within the limits of the work and avenues of ingress and egress. Do not enter restricted areas unless required to do so and until cleared for such entry. Permission to interrupt station roads or utility services shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption. The Contractor's equipment shall be conspicuously marked for identification.

1.6.2 Working Hours

Regular working hours shall consist of a period established by the Contracting Officer between 7 a.m. and 5 p.m., Monday through Friday, excluding Government holidays.

1.6.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Provide written request 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, the various work areas shall be lighted in a manner approved by the Contracting Officer.

1.6.4 Occupied Buildings

The Contractor shall be working around existing buildings that are occupied. Do not enter the buildings without prior approval of the Contracting Officer. Coordinate necessary access to any buildings with Contracting Officer.

1.7 EXISTING WORK

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work that have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.8 LOCATION OF UNDERGROUND FACILITIES

Obtain and examine copies of all pertinent station drawings prior to construction. Then scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the locations and elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed, but indicated or discovered during scanning, in locations to be traversed by piping, or other work to be installed.

1.9 PRECONSTRUCTION CONFERENCE

After award of the contract, but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation and submission of the schedule of prices, shop drawings and other submittals, scheduling, programming and prosecution of work. Major subcontractors who will be engaged in the work shall also attend.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

**SECTION 01300  
SUBMITTALS**

**PART 1 GENERAL**

The specifications for the submittals for this delivery order are found in PART 7.0 SUBMITTALS in the specifications for the base contract beginning on Page C-43 with the following changes.

1. Change subparagraph 7.4.7.j to read "forward six copies" instead of two.
2. Change subparagraph 7.4.6.d to read "retain five copies" instead of three.
3. Insert the Sample Forms Submittal Register (PART A and PART B) after page C-45.
4. Insert the Submittal Register (PART A), with columns (a) through (e) filled in, behind the blank sample forms at the end of Section 7.0.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

**END OF SECTION**

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

CONTRACT NO:

PROJECT TITLE:

SPEC SECTION NO.(a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT(b)	SPEC PARA. NO.(c)	CLASSIF/ APPR BY CO.(d)	GOVT OR A/E REVR(e)	TRANS CONTL NO.(f)	PLANNED SUBMITTAL DATE(g)
01010	SD-04 DRAWINGS a. Traffic Control Plan	1.3.1		G		
01010	SD-18 RECORDS a. List of Contact Personnel	1.3.2		G		
01400	SD-18 RECORDS a. Quality Control Plan	1.2.1		G		
01560	SD-08 STATEMENTS a. Environmental Protection Plan b. Preconstruction Survey Report c. MSDS d. Health and Safety Plan e. Pollution Prevention Plan f. Notice of Intent	1.4.1		G G G G G G		
01560	SD-18 RECORDS a. Solid Waste Disposal Permits/Manifests b. Disposal Permits for Hazardous Waste Manifests	1.4.2		G		
02050	SD-08 STATEMENTS Demolition Plan	1.3.1				
02221	SD-12 FIELD TEST REPORTS a. Backfill Material b. Pipe Bedding Material c. Filter Material d. In-Place Density	1.3.1				
02260	SD-08 STATEMENTS a. Name and address of vendor b. Performance Information	1.2.1		G G		
02510	SD-05 DESIGN DATA a. Job-mix Formula for Asphalt Concrete	1.2.1				
02510	SD-08 STATEMENTS a. Asphalt Concrete	1.2.2				
02510	SD-12 FIELD TEST REPORTS a. Asphalt Concrete	1.2.3				
02510	SD-13 CERTIFICATES a. Aggregates b. Asphalt Cement c. Asphaltic Emulsion	1.2.4				

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

**CONTRACT NO:**

**PROJECT TITLE:**

SPEC SECTION NO.(a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT(b)	SPEC PARA. NO.(c)	CLASSIF/ APPR BY CO.(d)	GOVT OR A/E REVR(e)	TRANS CONTL NO.(f)	PLANNED SUBMITTAL DATE(g)
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02675 SD-08 STATEMENTS 1.2.1  
 a. Water Disposal Methods  
 b. Soil Disposal Methods

02831 SD-02 MANUFACTURER'S CATALOG DATA 1.2.1  
 a. Chain-link fencing components  
 b. Accessories

03302 SD-04 DRAWINGS 1.2.1  
 a. Treatment Area Pads

03302 SD-10 TEST REPORTS 1.2.2  
 a. Compressive Strength

03302 SD-13 CERTIFICATES 1.2.3  
 a. Cement  
 b. Aggregate  
 c. Admixtures

11171 SD-02 MANUFACTURER'S CATALOG DATA 1.3.1  
 a. Catalytic Oxidizer  
 b. Controls and Instrumentation

11171 SD-04 DRAWINGS 1.3.2  
 a. Proposed Equipment Installation  
 b. Piping and Instrumentation  
 c. General Arrangement  
 d. Electrical

11171 SD-10 TEST REPORTS 1.3.3  
 a. Instrument Readings  
 b. Computations  
 c. Methods  
 d. Performance

11171 SD-13 CERTIFICATES 1.3.4  
 a. Catalytic Oxidizer

11171 SD-19 OPERATION AND MAINTENANCE MANUAL 1.3.5  
 a. Catalytic Oxidizer

11303 SD-10 TEST REPORTS 1.2.2  
 a. Pressure Drop and Flowrate Relationships  
 b. Carbon Adsorption Isotherms

11303 SD-02 MANUFACTURER'S CATALOG DATA 1.2.1  
 a. GAC Unit  
 b. Holding Tank

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

CONTRACT NO:

PROJECT TITLE:

SPEC SECTION NO.(a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT(b)	SPEC PARA. NO.(c)	CLASSIF/ APPR BY CO.(d)	GOVT OR A/E REVR(e)	TRANS CONTL NO.(f)	PLANNED SUBMITTAL DATE(g)
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11303 SD-13 CERTIFICATES 1.2.3

11303 SD-19 OPERATION AND MAINTENANCE MANUALS 1.2.4

- a. Operating Instructions
- b. Monitoring Requirements
- c. Alarm Conditions and Procedures Necessary to Return to Normal Operation
- d. Carbon Changeout Procedures
- e. Trouble-shooting Guidelines
- f. Preventable Maintenance and Inspections Procedures
- g. Parts List

15056 SD-02 MANUFACTURER'S CATALOG DATA 1.3.1

- a. Blower
- b. Inlet Air Filters
- c. Inlet Air Filter Enclosures
- d. Discharge Line Silencers
- e. Air/Water Separators
- f. Vacuum Relief Valves
- g. Produced Water Pumps
- h. Pressure and Temperature Gauges
- i. Motor Control Equipment

15056 SD-04 DRAWINGS 1.3.2

- a. Motor Control and Instrument Panel Layout
- b. Motor Control and Instrument Wiring Diagrams

15056 SD-08 STATEMENTS 1.3.3

- a. Factory Test Procedures
- b. Factory Testing Certification
- c. Field Test Procedures
- d. Training Material

15056 SD-10 TEST REPORTS 1.3.4

- a. Blower
- b. Instrumentation
- c. Sound Level

15056 SD-18 RECORDS 1.3.5

- a. Posted Operating Instructions for Blowers

15056 SD-19 OPERATION AND MAINTENANCE MANUALS 1.3.6

- a. Blower System
- b. Air/Water Separator
- c. Produced Water Pump

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

**CONTRACT NO:**

**PROJECT TITLE:**

SPEC SECTION NO.(a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT(b)	SPEC PARA. NO.(c)	CLASSIF/ APPR BY CO.(d)	GOVT OR A/E REVR(e)	TRANS CONTL NO.(f)	PLANNED SUBMITTAL DATE(g)
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15080	SD-02 MANUFACTURER'S CATALOG DATA a. Pipe and Fittings b. Joints and Couplings c. Valves	1.3.1				
15488	SD-02 MANUFACTURER'S CATALOG DATA a. Air Compressor b. Air Receiver c. Pipe d. Fittings e. Valves f. Pressure Gauges g. Hangers and Supports	1.2.1				
15488	SD-04 DRAWINGS a. Motor Control Panel Wiring Diagrams	1.2.2				
15488	SD-05 DESIGN DATA a. Seismic Tiedowns	1.2.3				
15488	SD-06 INSTRUCTIONS a. Air Receiver	1.2.4				
15488	SD-10 TEST REPORTS a. Air Compressor b. Air Receiver c. Hydrostatic Test d. Lack Tightness Tests	1.2.5				
15488	SD-18 RECORDS a. Posted Operating Instructions for Air Compressor	1.2.6				
15488	SD-19 OPERATION AND MAINTENANCE MANUALS a. Air Compressor b. Motor Control Equipment	1.2.7				
16011	SD-02 MANUFACTURER'S CATALOG DATA	1.5.1				
16011	SD-04 DRAWINGS	1.5.2				
16011	SD-06 INSTRUCTIONS	1.5.3				
16011	SD-13 CERTIFICATES a. Reference Standard Compliance b. Independent Testing Organization Certificate	1.5.4				
16011	SD-19 OPERATIONS AND MAINTENANCE MANUALS a. Operating Instructions	1.5.5				

**SAMPLE FORM SUBMITTAL REGISTER (PART A)**

CONTRACT NO:

PROJECT TITLE:

SPEC SECTION NO.(a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT(b)	SPEC PARA. NO.(c)	CLASSIF/ APPR BY CO.(d)	GOVT OR A/E REVR(e) )	TRANS CONTL NO.(f)	PLANNED SUBMITTAL DATE(g)
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16402	<b>SD-02 MANUFACTURER'S CATALOG DATA</b> a. Receptacles b. Circuit Breakers c. Switches d. Transformers e. Enclosed Circuit Breakers f. Motor Controllers	1.3.1				
16402	<b>SD-04 DRAWINGS</b> a. Panelboards b. Transformers	1.3.2				
16402	<b>SD-19 OPERATION AND MAINTENANCE MANUALS</b> a. Electrical Systems	1.3.3				
16900	<b>SD-02 MANUFACTURER'S CATALOG DATA</b>	1.3.1				
16900	<b>SD-04 DRAWINGS</b>	1.3.2				
16900	<b>SD-19 OPERATION AND MAINTENANCE MANUALS</b>	1.3.3				

**SECTION 01400  
QUALITY CONTROL**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM A 880	1989 Criteria for Use in Evaluation of Testing Laboratories and Organization for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C 1077	1992 Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3666	1992 (Rev. A) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 3740	1988 Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	1990 Evaluation of Testing and Inspection Agencies as Used in Construction
ASTM E 543	1992 (Rev. C) Evaluating Agencies that Perform Nondestructive Testing

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-18, Records**

**a. Quality Control (QC) plan G**

Submit a QC plan within 30 calendar days after receipt of Notice of Award.

**1.3 INFORMATION FOR THE CONTRACTING OFFICER**

Deliver the following to the Contracting Officer:

- a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet): Original and 1 copy, by 10:00 a.m. the next working day after each day that work is performed;**

- b. **Monthly Summary Report of Field Tests:** Original and 1 copy attached to Contractor Quality Control Report at the end of each month;
- c. **QC Meeting Minutes:** 1 copy within 2 calendar days of the meeting;
- d. **Rework Items List:** 1 copy by the last working day of the month and;
- e. **Testing Plan and Log,** 1 copy at the end of each month.
- f. **QC Certifications:** As required by the paragraph titled "QC Certifications."

#### 1.4 QC PROGRAM REQUIREMENTS

QC program requirements are specified in RAC Contract No. N62474-93-D-2151 with International Technology (IT) Corporation.

#### 1.5 QC ORGANIZATION

##### 1.5.1 QC Manager

##### 1.5.1.1 Duties

Provide a QC Manager at the work site to manage and implement the QC program. The QC Manager is required to attend QC meetings with Navy, attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval except those designated for Contracting Officer approval, ensure testing is performed, and prepare QC certifications and documentation required in this Contract. No work or testing may be performed unless the QC Manager is on site. In addition to managing and implementing the QC program, the QC Manager may perform other duties.

##### 1.5.1.2 Qualifications

An individual with a minimum of 5 years experience as a foreman, superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts.

##### 1.5.2 Submittal Reviewers Duties and Approving Authority

Each submittal shall be reviewed for compliance with contract requirements by a Registered Engineer qualified in the discipline being reviewed prior to certification or approved by the QC Manager. Unless specifically indicated otherwise, the approving authority for submittals shall be the QC Manager. If a technical section designates the Contracting Officer, or other authority to approve a particular submittal, then the Contracting Officer shall be the approving authority.

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Requirements

Provide for approval by the Contracting Officer a QC plan that covers both on-site and off-site work and includes the following:

- a. Duties, responsibilities, and authorities of each person in the QC organization.
- b. A listing of outside organizations such as architectural and consulting engineering firms or laboratories that will be employed by the Contractor and a description of the services these firms will provide.
- c. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of nonconforming work.
- d. Testing laboratory information required by the paragraphs titled "Accredited Laboratories" or "Testing Laboratory Requirements," as applicable.
- e. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.
- f. Procedures to identify, record, track, and complete rework items.
- g. A chart showing the QC organizational structure and its relationship to the production side of the organization.
- h. Names and qualifications, in resume format, for each person in the QC organization.
- i. Procedures for reviewing, approving, and managing submittals. Provide the names of the persons in the QC organization authorized to review and certify submittals prior to approval.
- j. Documentation procedures, including proposed report formats.
- k. A list of the definable features of work. A definable feature of work is a task that is separate and distinct from other tasks and requires separate control requirements. As a minimum, if approved by the Contracting Officer, consider each section of the specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each section of the specifications.

1.6.2 Preliminary Work Authorized Prior to Approval

The only work that is authorized to proceed prior to the approval of the QC plan is mobilization of storage and office trailers, temporary utilities, and surveying.

1.6.3 Approval

Approval of the QC plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC plan and operations as necessary to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify his/her submitted qualifications.

1.6.4 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of 7 calendar days prior to a proposed change. Proposed changes must be approved by the Contracting Officer.

1.7 QC PLAN MEETING

Meet with the Contracting Officer to discuss the QC plan requirements of this Contract prior to submission of the QC plan. The purpose of this meeting is to develop a mutual understanding of QC plan requirements prior to plan development and submission.

1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC plan, but prior to the start of construction, meet with the Contracting Officer to discuss the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of QC details, including forms to be used for documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production, and QC personnel with the Contracting Officer. As a minimum, the Contractor's personnel required to attend shall include the project manager, project superintendent, and QC Manager. Minutes of the meeting shall be prepared by the QC Manager and signed by both the Contractor and the Contracting Officer.

1.9 QC MEETINGS

After the start of construction, the QC Manager shall conduct QC meetings once every 2 weeks at the work site with the project superintendent. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

- a. Review the minutes of the previous meeting;
- b. Review the schedule and the status of work;
  - Work or testing accomplished since last meeting;
  - Rework items identified since last meeting;
  - Rework items completed since last meeting;
- c. Review the status of submittals:
  - Submittals reviewed and approved since last meeting;
  - Submittals required in the near future;

- d. Review the work to be accomplished in the next 2 weeks and documentation required:
  - Establish completion dates for rework items;
  - Preparatory phases required;
  - Initial phases required;
  - Follow-up phases required;
  - Testing required;
  - Status of off-site work or testing;
  - Documentation required;
- e. Resolve QC and production problems; and
- f. Address items that may require revising the QC plan:
  - Changes in QC organization personnel;
  - Changes in procedures.

#### 1.10 THREE PHASES OF CONTROL

The QC Manager shall perform the three phases of control to ensure that work complies with Contract requirements. The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following for each definable feature of work: A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements.

##### 1.10.1 Preparatory Phase

Notify the Contracting Officer at least 2 work days in advance of each preparatory phase. Conduct the preparatory phase with the foreman responsible for the definable feature. Document the results of preparatory phase actions in the daily Contractor Quality Control Report. Perform the following prior to beginning work on each definable feature of work:

- a. Review the applicable specification;
- b. Review the Contract drawings;
- c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
- d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;
- e. Examine the work area to ensure that the required preliminary work has been completed;
- f. Examine the required materials, equipment, and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

- g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and
- h. Discuss construction methods.

#### 1.10.2 Initial Phase

Notify the Contracting Officer at least 2 work days in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the superintendent. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and
- d. Ensure that testing is performed by the approved laboratory.

#### 1.10.3 Follow-Up Phase

Document in the daily Contractor Quality Control Report, the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work:

- a. Work is in compliance with Contract requirements;
- b. Quality of workmanship is maintained;
- c. Testing is performed by the approved laboratory; and
- d. Rework items are being corrected.

#### 1.11 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in the Remedial Action Contract (RAC).

#### 1.12 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.12.1 Testing Laboratory Requirements

Provide an independent testing laboratory or procure a laboratory qualified to perform sampling and tests required by this Contract. When the proposed testing laboratory is not accredited by an acceptable accreditation program as described by the paragraph titled "Accredited Laboratories," submit to the Contracting Officer for approval certified statements signed by an official of the testing laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

- a. Sampling and testing shall be under the technical direction of a Registered Professional Engineer (P.E) with at least 5 years of experience in construction material testing.
- b. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077.
- c. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666.
- d. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.
- e. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A 880. Laboratories shall meet the requirements of ASTM E 329.
- f. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.
- g. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of Occupational Safety and Health Administration (OSHA) and United States Environmental Protection Agency (EPA).

1.12.2 Accredited Laboratories

Acceptable accreditation programs are the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program, and the American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer a copy of the Certificate of Accreditation, Scope of Accreditation, and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

1.12.3 Inspection of Testing Laboratories

Prior to approval of nonaccredited laboratories, the proposed testing laboratory facilities and records may be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

1.12.4 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing for compliance with the standards set forth in this Contract.

1.12.5 Test Results

Cite applicable Contract requirements, tests, or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms to or fails to conform to specified requirements. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.13 QC CERTIFICATIONS

1.13.1 Contractor Quality Control Report Certification

Each Contractor Quality Control Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the Contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.13.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.13.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested, and is in compliance with the Contract."

1.14 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.14.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day that construction or testing activities are conducted. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed, and dated by the Project Superintendent and shall contain the following information:

- a. Date of report, report number, name of contractor, Contract number, title and location of Contract, and superintendent present.
- b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.
- c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed, and hours worked.
- d. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:
  - Was a job safety meeting held? (If YES attach a copy of the meeting minutes)
  - Were there any lost time accidents? (If YES attach a copy of the completed OSHA report)
  - Was trenching/scaffold/high voltage electrical/high work done? (If YES attach a statement or checklist showing inspection performed)
  - Was hazardous material/waste released into the environment? (If YES, attach a description of meetings held and accidents that happened)
- e. A list of equipment/material received each day that is incorporated into the job.
- f. A list of construction and plant equipment on the work site including the number of hours used, idle, and down for repair.
- g. Include a "remarks" section in this report that will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, and a record of visitors to the work site.

1.14.2 Contractor Quality Control Report

Reports are required for each day that work is performed, for every 7 consecutive calendar days of no-work, and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed, and dated by the QC Manager and shall contain the following information:

- a. Identify the control phase and the definable feature of work.

- b. Results of Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.
- c. Results of Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed; include a list of who performed the tests.
- d. Results of Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed; include a list of who performed the tests.
- e. List the rework items identified but not corrected by close of business.
- f. List the rework items corrected from the rework items list along with the corrective action taken.
- g. Include a "remarks" section in this report that will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that as-built drawings have been updated, corrective direction given by the QC Organization, and corrective action taken by the Contractor.
- h. Contractor Quality Control Report certification.

#### 1.14.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks, and acknowledgement that an accredited or Contracting Officer-approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

#### 1.14.4 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Contracting Officer.

1.14.5 As-Built Drawings

The QC Manager is required to review the as-built drawings, to ensure that as-built drawings are kept current on a daily basis, and marked to show deviations from the Contract Drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.14.6 Report Forms

The following forms, which are attached at the end of this section, are acceptable for providing the information required by the paragraph titled "Documentation." Although use of these specific formats is not required, any other format used shall contain the same information:

- a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet
- b. Testing Plan and Log
- c. Rework Items List

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION



# CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE \_\_\_\_\_

PHASE  Y - YES;  N - NO. SEE REMARKS;  BLANK - NOT APPLICABLE IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT

<b>PREPARATORY</b>	THE PLANS AND SPECS HAVE BEEN REVIEWED.		
	THE SUBMITTALS HAVE BEEN APPROVED.		
	MATERIALS COMPLY WITH APPROVED SUBMITTALS.		
	MATERIALS ARE STORED PROPERLY.		
	PRELIMINARY WORK WAS DONE CORRECTLY.		
	TESTING PLAN HAS BEEN REVIEWED.		
	WORK METHOD AND SCHEDULE DISCUSSED.		

<b>INITIAL</b>	PRELIMINARY WORK WAS DONE CORRECTLY.		
	SAMPLE HAS BEEN PREPARED/APPROVED.		
	WORKMANSHIP IS SATISFACTORY.		
	TEST RESULTS ARE ACCEPTABLE.		
	WORK IS IN COMPLIANCE WITH THE CONTRACT.		

TESTING PERFORMED & WHO PERFORMED TEST

<b>FOLLOW-UP</b>	WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE.		
			TESTING PERFORMED & WHO PERFORMED TEST

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)	REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)
--	---

REMARKS

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

\_\_\_\_\_  
AUTHORIZED QC MANAGER AT SITE

\_\_\_\_\_  
DATE

## GOVERNMENT QUALITY ASSURANCE REPORT

DATE \_\_\_\_\_

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

\_\_\_\_\_  
GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE

\_\_\_\_\_  
DATE

# CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

CONTRACT NO.

REPORT NO.

PHASE Y - YES, N - NO, SEE REMARKS.  
BLANK - NOT APPLICABLE

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT

WORK COMPLIES WITH  
CONTRACT AS APPROVED  
IN INITIAL PHASE.

TESTING PERFORMED &  
WHO PERFORMED TEST

FOLLOW-UP

# CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

CONTRACT NO.

REPORT NO.

PHASE	Y - YES; N - NO. SEE REMARKS. BLANK - NOT APPLICABLE	IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT	
PREPARATORY	THE PLANS AND SPECS HAVE BEEN REVIEWED.		
	THE SUBMITTALS HAVE BEEN APPROVED.		
	MATERIALS COMPLY WITH APPROVED SUBMITTALS.		
	MATERIALS ARE STORED PROPERLY.		
	PRELIMINARY WORK WAS DONE CORRECTLY.		
	TESTING PLAN HAS BEEN REVIEWED.		
	WORK METHOD AND SCHEDULE DISCUSSED.		
PHASE	Y - YES; N - NO. SEE REMARKS. BLANK - NOT APPLICABLE	IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT	
INITIAL	PRELIMINARY WORK WAS DONE CORRECTLY.		
	SAMPLE HAS BEEN PREPARED/APPROVED.		
	WORKMANSHIP IS SATISFACTORY.		
	TEST RESULTS ARE ACCEPTABLE.		
	WORK IS IN COMPLIANCE WITH THE CONTRACT.		
		TESTING PERFORMED & WHO PERFORMED TEST	

# TESTING PLAN AND LOG

CONTRACT NUMBER		PROJECT TITLE AND LOCATION						CONTRACTOR				
SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		FREQUENCY	DATE COMPLETE	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE				

# REWORK ITEMS LIST

Contract No. and Title: \_\_\_\_\_

Contractor: \_\_\_\_\_

NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec. Section and Par. No., Drawing No. and Detail No., etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

**SECTION 01500  
CONSTRUCTION FACILITIES**

**PART 1 GENERAL**

**1.1 REFERENCES**

Not used.

**1.2 SUBMITTALS**

Not used.

**1.3 TEMPORARY UTILITIES**

Reasonable amounts of the following utilities will be made available without charge.

Electricity  
Potable Water

The Contractor shall pay all costs incurred in connecting, converting, and transferring the utilities to the work. The Contractor will be responsible for making connections, providing transformers and meters, and making disconnections. No connections to domestic water lines will be needed. The Contracting Officer shall indicate locations of existing sources of potable water that can be used by the Contractor. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

**1.4 STORAGE AREAS**

The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

**1.4.1 Storage Size and Location**

The open site available for storage shall be as specified by the Contracting Officer. Provide an 8 foot high security fence with a lockable gate around the storage area. Remove at the completion of work.

**1.5 TEMPORARY SANITARY FACILITIES**

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required or approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance.

1.5.1 Sewage, Odor, and Pest Control

Use chemical toilets or comparably effective units, and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Include provisions for pest control and elimination of odors.

1.6 TEMPORARY BUILDINGS

1.6.1 Trailers or Storage Buildings

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Contracting Officer. The trailers or storage buildings shall be suitably painted and kept in a good state of repair. Failure of the Contractor to maintain the trailers or storage buildings in good condition will be considered sufficient reason to require their removal. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state or local standards for anchoring mobile trailers. After completion of the work, remove the structures from the site.

1.6.2 Identification of Contractor Vehicles

Each Contractor provided vehicle and towed trailer shall show the Contractor's name so that it is clearly visible on both front doors of the vehicle and both sides of a towed trailer and shall at all times display a valid state license plate and safety inspection sticker. Contractor vehicles operated on Government property shall be maintained in a good state of repair.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

**SECTION 01560  
TEMPORARY CONTROLS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**CODE OF FEDERAL REGULATIONS (CFR)**

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926-SUBPART V	Power Transmission and Distribution
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standard for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials, Tables, and Hazardous Materials Communications Regulations
49 CFR 178	Shipping Container Specification

**CORPS OF ENGINEERS (COE)**

COE EM-385-1-1	(1991) Safety and Health Requirements Manual
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**NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

NFPA 241	(1993) Safeguarding Construction, Alteration, and Demolition Operations
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1.2 Contractor Liabilities for Environmental Protection

Government installations must comply with environmental protection laws including but not limited to; the Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act, and the Federal Facilities Compliance Act. The Federal Environmental Protection Agency (EPA) has granted inspection and enforcement authority to state and local governments. Inspection by an EPA agency may include questioning of Contractor personnel who are working with or have contact with hazardous materials and waste. Contractors shall complete and provide environmental training documentation for training required by federal, state, and local regulations.

1.3 DEFINITIONS

1.3.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.3.2 Solid Waste

Rubbish, debris, garbage, and other discarded solid materials, except hazardous waste as defined in paragraph entitled "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.

1.3.3 Sanitary Wastes

Wastes characterized as domestic sanitary sewage.

1.3.4 Rubbish

Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.3.5 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

1.3.6 Chemical Wastes

This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.3.7 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.3.8 Hazardous Waste

Hazardous substances as defined in 40 CFR 261 or as defined by applicable State and local regulations.

1.3.9 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

1.3.10 Landscape Features

Trees, plants, shrubs, and ground cover.

1.3.11 Oily Waste

Petroleum products and bituminous materials.

1.3.12 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

Chlorofluorocarbon-11 (CFC-11)  
Chlorofluorocarbon-12 (CFC-12)  
Chlorofluorocarbon-13 (CFC-13)  
Chlorofluorocarbon-111 (CFC-111)  
Chlorofluorocarbon-112 (CFC-112)  
Chlorofluorocarbon-113 (CFC-113)  
Chlorofluorocarbon-114 (CFC-114)  
Chlorofluorocarbon-115 (CFC-115)  
Chlorofluorocarbon-211 (CFC-211)  
Chlorofluorocarbon-212 (CFC-212)  
Chlorofluorocarbon-213 (CFC-213)  
Chlorofluorocarbon-214 (CFC-214)  
Chlorofluorocarbon-215 (CFC-215)  
Chlorofluorocarbon-216 (CFC-216)  
Chlorofluorocarbon-217 (CFC-217)  
Halon-1211  
Halon-1301  
Halon-2402  
Carbon tetrachloride  
Methyl chloroform

1.3.13 Industrial Hygienist

An Industrial Hygienist must be certified by the American Board of Industrial Hygiene.

1.4 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."

1.4.1 SD-08, Statements

a. Environmental protection plan G

- b. Preconstruction survey report G
  - c. MSDS G
  - d. Health and safety plan G
  - e. Pollution Prevention Plan G
  - f. Notice of Intent G
- 1.4.2 SD-18, Records
- a. Solid waste disposal permits/manifests
  - b. Disposal permits/manifests for hazardous waste G
- 1.4.2.1 Solid Waste Disposal Permit
- Submit one copy of a state and/or local permit or license for the solid waste disposal facility.
- 1.4.2.2 Disposal Permit for Hazardous Waste
- Submit a copy of the applicable EPA and state permits, manifests, or licenses for transportation, treatment, storage, and disposal of hazardous waste by permitted facilities.
- 1.4.2.3 Laboratory Analysis of Waste
- Submit a copy of the laboratory analysis of waste collected from Contractor projects before disposing of waste.
- 1.5 ENVIRONMENTAL PROTECTION REQUIREMENTS
- Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, state, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.
- 1.5.1 Environmental Protection Plan
- Ten days after the award of contract, the Contractor shall meet with the Contracting Officer to discuss the proposed environmental protection plan and to develop mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. At a minimum, the environmental protection plan shall describe waste storage, transportation, and disposal procedures, and shall include an emergency response plan for potential fuel releases resulting from damage to subsurface utility lines.

- a. Describe in the Environmental Plan any permits required prior to working the area, and contingency plans in case an unexpected environmental condition is discovered.
- b. The plan should also include permitting plans for any transportation and disposal, excavation, or construction of hazardous waste that will required an environmental permit from an issuing agency: The Contractor is responsible for generating the permits and delivering the completed documents to the Contracting Officer. The Contracting Officer will review the permits and the Contractor shall file the documents with the appropriate agency and complete disposal with the approval of the Contracting Officer. Correspondence with the State concerning the environmental permits and completed permits shall be delivered to the Contracting Officer.

1.5.1.1 Environmental Plan Review

Fourteen days after the environmental protection meeting, submit to the Contracting Officer the proposed environmental plan for further discussion, review, and approval.

1.5.1.2 Commencement of the Work

As directed by the Contracting Officer, following approval.

1.5.2 Preconstruction Survey

Perform a preconstruction survey of the project site with the Contracting Officer, and document existing environmental conditions in and adjacent to the site. Photograph existing conditions in and adjacent to the site. Submit the photographs to the Contracting Officer.

1.5.3 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause except for those permits which will be obtained by the Contracting Officer as follows:

a. Construction Permit

For permits obtained by the Contracting Officer, whether or not required by the permit, the Contractor is responsible to perform quality control inspections of the work in progress, and to submit certifications to the applicable regulatory agency, via the Contracting Officer, that the work conforms to the contract and permit requirements. The inspections and certifications shall be provided through the services of a Professional Engineer, registered in the state where the work is being performed. As a part of the quality control plan, which is required to be submitted for approval by the quality control section, provide a subitem containing the name, P.E. registration number, address, and telephone number of the professional engineer(s) who will be performing the inspections and certifications for each permit listed above.

1.5.6 Class I ODS Prohibition

Class I ODS as defined and identified herein shall not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition shall be considered to prevail over any other provision, specification, drawing, or referenced documents.

1.6 SAFETY PROGRAM

COE EM-385-1-1. Submit safety program, including Accident Prevention Plan, for review and approval 15 calendar days prior to start of work at job site. Conform to the requirements of Federal, state and local laws, rules, and regulations. Work can not proceed until the Safety Program has been approved. The program shall include:

- a. 29 CFR 1910.
- b. 29 CFR 1926.
- c. 29 CFR 1926-SUBPART V, tagout and lockout procedures.
- d. COE EM-385-1-1.
- e. Contract Clause "FAR 52.236-13, Accident Prevention."
- f. Contract Clause "FAR 52.223-3, Hazardous Material Identification and Material Safety Data."
- g. MSDS, supply Material Safety Data Sheet for all hazardous materials brought on-site.
- h. NFPA 241.

1.6.1 Unforeseen Hazardous Material

If material that is not indicated on the drawings is encountered that may be dangerous to human health upon disturbance during construction operations, stop that portion of work and notify the Contracting Officer immediately. Intent is to identify materials such as PCB, lead paint, and friable and nonfriable asbestos. Within 14 calendar days the Government will determine if the material is hazardous. If the material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change.

1.6.2 Station Permits

Permits are required for, but are not necessarily limited to, welding, digging, and burning.

1.6.3 Hazardous Noise

Provide hazardous noise signs, as directed, wherever equipment and work procedures produce sound levels greater than 84 dB or 140 dB peak sound level.

1.6.4 Forms

Submit in accordance with the RAC.

1.6.5 Health and Safety Plan (HASP)

Provide in accordance with the RAC.

1.7 NOTICE OF INTENT

The Contractor shall prepare a completed Notice of Intent (NOI) form in accordance with the requirements of the State's general permit for storm water discharges from construction sites. Submit PPP, NOI, and the appropriate permit fee to the Contracting Office a minimum of 14 days prior to start of construction. No work will be allowed on site until an approved permit is received from the State.

The Contractor shall keep a copy of the approved permit on site at the Contractor's trailer at all times.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Land Resources

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officers permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.

3.1.1.1 Protection

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed.

3.1.1.2 Replacement

Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

3.1.2 Water Resources

3.1.2.2 Oily Wastes

Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

3.1.3 Temporary Construction

Remove traces of temporary construction facilities such as work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.3 EROSION AND SEDIMENT CONTROL MEASURES

3.3.1 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.3.4 Temporary Protection of Erodible Soils

Use the following method to prevent erosion and control sedimentation:

3.3.4.1 Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and strawbales to retard and divert runoff to protected drainage courses.

3.3.5 General Work Requirements

Provide and maintain erosion control measures in accordance with appropriate State and local regulations.

3.4 CONTROL AND DISPOSAL OF SOLID WASTES

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean.

3.4.1 Disposal of Rubbish and Debris

Dispose of rubbish and debris in accordance with the requirements specified below:

3.4.1.1 Removal From Government Property

Remove and dispose rubbish and debris from Government property.

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.5.1 Hazardous Waste Generation

Handle generated hazardous waste in accordance with 40 CFR 262.

3.5.2 Hazardous Waste Disposal

Dispose of hazardous waste in accordance with Federal, State, and local regulations, including 40 CFR 263, 40 CFR 264, and 40 CFR 265.

Removal of hazardous waste from Government property shall not occur without prior notification and coordination with the Contracting officer. Transport hazardous waste by a permitted, licensed, or registered hazardous waste transporter to a TSD facility. Hazardous waste shall be properly identified, packaged, and labeled in accordance with 49 CFR 172. Provide completed manifest for hazardous waste disposed of off-site to the Contracting Officer within 7 days of disposal. No hazardous waste shall be brought onto the station.

3.5.3 Hazardous Waste Storage

Store hazardous waste in containers in accordance with 49 CFR 178. Hazardous waste shall be identified in accordance with 40 CFR 261 and 40 CFR 262.

3.5.4 Spills of Oil and Hazardous Materials

Take precautions to prevent spills of oil and hazardous material. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable state regulations.

3.5.6 Petroleum Products

Protect against spills and evaporation during fueling and lubrication of equipment and motor vehicles. Dispose of lubricants to be discarded and excess oil.

3.7 DUST CONTROL

Keep dust down at all times, including nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not shake bags of cement, concrete mortar, or plaster unnecessarily.

3.9 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA.

END OF SECTION

**SECTION 02050  
DEMOLITION AND REMOVAL**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

**ANSI A10.6 (1990) Demolition Operations**

**1.2 GENERAL REQUIREMENTS**

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the buildings. Store materials that cannot be removed daily in areas specified by the Contracting Officer.

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.3.1 SD-08, Statements**

**a. Demolition plan G**

Submit proposed demolition and removal procedures to the Contracting Officer for approval before work is started.

**1.4 REGULATORY AND SAFETY REQUIREMENTS**

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," safety requirements shall conform with ANSI A10.6.

**1.5 DUST AND DEBRIS CONTROL**

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Work

Protect existing work which is to remain in place, be reused, or remain the property of the Government. Repair items which are to remain and which are damaged during performance of the work to their original condition, or replace with new. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.6.3 Trees

Conform to Section 01560, "Temporary Controls," for protection of natural resources.

1.6.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

1.7 BURNING

Burning will not be permitted.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

Provide, erect, and maintain temporary barriers and security devices. Notify Contracting Officer of work which may affect adjacent structures, potential noise, utility outage, or disruption. Coordinate with the Contracting Officer.

3.1.1 Utilities and Related Equipment

Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer. If utility lines are encountered that are not shown on drawings, contact the Contracting Officer for further instructions.

3.1.2 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base to a depth, as indicated, below existing adjacent grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.2 DEMOLITION REQUIREMENTS

Conduct demolition to minimize interference with adjacent structures. Conduct operations with minimum interference to public accesses. Maintain protected egress and access at all times. Do not close or obstruct roadways without approval by the Contracting Officer.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition and removal procedures, and authorization by the Contracting Officer to begin demolition. The Government will not be responsible for the condition or loss of, or damage to, such property after notice to proceed.

3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site as directed by the Contracting Officer.

3.4 CLEANUP

3.4.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets or adjacent areas. Clean up spillage from pavements, streets and adjacent areas.

END OF SECTION

**SECTION 02221**  
**EXTRACTION TRENCH AND PIPE TRENCH CONSTRUCTION**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 136	(1993) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2321	(1989) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

**COMMERCIAL ITEM DESCRIPTIONS (CID)**

CID A-A-1909 Fertilizer

**CORPS OF ENGINEERS (COE)**

COE EM-385-1-1 (1992) Safety and Health Requirements Manual

**STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION**

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**1.2 DEFINITIONS**

**1.2.1 Hard Materials**

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.2 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.3 Backfill

Material used in refilling a cut, trench, or other excavation.

1.2.4 Pipe Bedding Material

A dense, well-graded aggregate mixture of sand, gravel, or crushed stone, mixed individually, or in a combination with each other, and placed on a subgrade to provide a suitable foundation for pipe.

1.2.5 Extraction Trench

Trench equipped with horizontal well screen and permeable filter material constructed to enable vacuum extraction of soil contaminants.

1.2.6 Permeable Filter Material

A permeable aggregate mixture of gravel or crushed stone placed in extraction trenches beneath and around extraction well screen to act as a filtration medium.

1.2.7 Extraction Well Screen

Horizontal well screen placed in filter material and laid along the length of each extraction trench.

1.2.8 Extraction Well Riser Pipe

Vertical pipe and associated fittings connecting subsurface extraction well screen to vacuum extraction system.

1.2.9 Cohesive Materials

Materials ASTM D 2487 classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

1.2.10 Unsuitable Materials

Vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals."

1.3.1 SD-12, Field Test Reports

- a. Backfill materials tests
- b. Pipe bedding material test
- c. Filter material test
- d. In-place density tests

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.1 Backfill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.2 PIPE BEDDING MATERIAL

ASTM D 2487, classification SW, SP.

2.3 EXTRACTION WELL SCREEN

Slotted PVC well screen with a minimum unit open area of 20 square inches per foot.

Design Basis:

Longyear Circumslot  
Longyear Company  
Salt Lake City, Utah  
(404) 469-2720

Johnson Vee-Wire  
Johnson Filtration Systems  
P.O. Box 64118  
St. Paul, Minnesota 55164  
(800) 833-9473

Certainteed Certa-Lok  
Certainteed Pipe & Plastics Group  
P.O. Box 860  
Valley Forge, Pennsylvania 19482  
(610) 341-6820

2.4 EXTRACTION WELL RISER PIPE

PVC pipe and fittings conforming to the requirements of Section 15080.

2.5 PERMEABLE FILTER MATERIAL

One-inch maximum combined aggregate conforming to the following grading requirements as specified in Section 90-3.04 of SS-1.

Sieve Sizes	Percentage Passing
2"	—
1-1/2"	100
1"	90-100
3/4"	55-100
3/8"	45-75
No. 4	35-60
No. 8	27-45
No. 16	20-35
No. 30	12-25
No. 50	5-15
No. 100	1-8
No. 200	0-4

2.6 GEOTEXTILE FABRIC

Nonwoven, polypropylene geotextile fabric with a minimum weight of 4 ounces per square yard. The fabric shall be of uniform thickness and strength.

2.6 IMPERMEABLE LINER

Impervious, 30 mil thick high density polyethylene sheeting.

2.7 EXTRACTION WELLHEAD ASSEMBLY

All pipe, valves, and fittings composing each wellhead assembly shall conform to the requirements of Section 15080, "Pipe, Valves, and Appurtenances."

2.7.1 Pressure Gauge

Type C. Range 0 to 100 inches of water column.

2.7.2 Sample Port

One-quarter-inch female NPT port. Provide 1/4" NPT male plug with square head.

2.7.3 Throttle Valve

Globe.

2.8 EXTRACTION WELL BOXES

2.8.1 Well Vault

Square or rectangular, galvanized steel, traffic-rated well vault with hinged, lockable lid. Minimum inside opening 21 inches. Approximate skirt length 22 inches.

2.8.2 Monitoring Well Manhole

Circular, steel, traffic-rated monitoring well manhole and cover. Nominal diameter 12 inches. Approximate skirt length 12 inches.

2.9 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Yellow:	Gas, Oil; Dangerous Materials
Gray:	Compressed Air

Minimum thickness of the tape shall be 0.10 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm (3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.10 BASE COURSE

Aggregate material conforming to the requirements of Section 02510.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Asphalt Removal

Saw cut asphalt with straight, parallel lines a minimum of 6 inches wider on each side than the anticipated trench area. Remove and dispose of asphalt debris off-site.

Remove base course from areas where excavation is indicated and stockpile separately from other excavated materials within a proximity of the excavation. Stockpiled base course material shall be used as a base course for new asphalt.

3.1.2 Stripping

Strip existing topsoil from unpaved areas to a depth of 4 inches without contamination by subsoil material. Stockpile topsoil separately from other excavated material and locate convenient to finish grading trench area.

3.1.3 Unsuitable Material

Remove unsuitable materials as defined in PART 1, DEFINITIONS.

3.2 PROTECTION

3.2.1 Protection Systems

Provide shoring, bracing, and sheeting in accordance with COE EM-385-1-1, except that banks may be sloped only when approved by the Contracting Officer.

3.2.2 Surface Drainage

Provide temporary ditches, swales, and other drainage features and equipment as required to divert surface drainage away from areas of construction.

3.2.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated on the drawings. Reuse excavated materials as specified in Section 3.5.

Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Refill with backfill and compact to 95 percent of ASTM D 1557 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with permeable filter material in accordance with the requirements of paragraph 3.5.1.1 of this Section.

3.3.1 Extraction Trenches

Segregate wet soils excavated from the lower portions of the trench and remove to an area designated by the contracting officer. Segregate the upper two feet of dry soils excavated from each trench from the remaining dry excavated soils and stockpile both soil groups near the trench on an impermeable liner. The upper two feet of soils will be used as clean backfill during backfilling operations, as described in Section 3.5. Grade bottom of trenches to provide uniform support for extraction well screen before permeable filter material placement.

During excavation, soil samples will be collected by a geologist or field engineer provided by Navy from trench sidewalls to ascertain the extent of contamination local to the trench. Samples will be collected at a frequency of 1 per trench. Analyze each sample for the following:

Parameter	Method	QC Level
TPH-purgeable as gasoline	EPA Modified 8015	3
Benzene	EPA Modified 8015	3
Toluene	EPA Modified 8015	3
Ethylbenzene	EPA Modified 8015	3
Total xylenes	EPA Modified 8015	3

Submit all raw analytical data, including chromatograms and quality control results, to the Contracting Officer.

### 3.3.2 Pipe Trenches

Excavate to the dimensions indicated. Grade bottom of trenches to provide uniform support for each section of pipe after granular pipe bedding material placement.

### 3.3.3 Hard Material and Rock Excavation

Remove hard material and rock encountered in a manner that will leave foundation material in an unshattered and solid condition. Remove to elevations necessary for placement of designated materials.

### 3.4 EXTRACTION SCREEN AND RISER PIPE INSTALLATION

Install as indicated. Place in trench carefully to avoid damaging the well screen. Replace damaged well screen with undamaged screen material. Maintain extraction well riser pipe in a vertical position within the specified wellbox location as shown.

### 3.5 BACKFILLING

Backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

#### 3.5.1 Extraction Trench

##### 3.5.1.1 Permeable Filter Material Backfilling

Provide to the dimensions indicated. Place in 6-inch lifts and compact.

### 3.5.1.2 Geotextile Fabric Placement

Place geotextile fabric above granular filter material as shown. Allow a minimum of 6 inches overlap along the sides of the trench. Fabric should be placed in each trench to completely cover the granular filter material.

### 3.5.1.3 Soil Backfilling

Backfill dry contaminated soils above the geotextile liner as shown. If necessary complete with clean excavated soils. Backfill carefully to avoid damaging the liner. Place the impermeable geomembrane liner above the compacted contaminated soils. Backfill with remaining excavated clean soils to the dimension indicated for each trench.

### 3.5.1.4 Impermeable Liner Placement

Place the impermeable liner in the trench above the contaminated backfill as shown. Allow a minimum overlap of 10 inches along the sides of the trench. Liner should be placed in each trench in one continuous piece, devoid of tears, holes, or other imperfections which may compromise the sealing capabilities of the liner. If damage occurs, repair the liner in accordance with manufacturers recommendations or remove and replace with undamaged material. Seal liner to the extraction well riser pipe using airtight fabricated boots of the same material as the liner. The boots shall be fused to the liner and shall be sealed to the riser pipe with stainless steel tightening bands to produce an airtight seal.

### 3.5.2 Pipe Trench

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under paved areas in 6 inch lifts to top of trench and in 6 inch lifts to one foot over pipe outside structures and paved areas.

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with ASTM D 2321 materials as follows:

Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

## 3.6 EXTRACTION WELLHEAD ASSEMBLY INSTALLATION

Install as shown in the drawings. All components of the wellhead assembly shall be accessible from ground surface.

## 3.7 WELL VAULT INSTALLATION

Install as shown in the drawings. Imbed well vault skirts a minimum of 1 inch into portland cement grout placed beneath the vault.

3.8 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.9 COMPACTION

Expressed as a percentage of maximum dry density.

Use hand-operated, plate-type, vibratory, or other suitable hand tampers in extraction trenches and in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. If necessary, alter selected equipment or compaction methods to meet the specified compaction requirements.

3.9.1 Permeable Filter Material

Compact using hand operated tampers to prevent damage to extraction well screen.

3.9.2 Backfill

Compact to 95 percent of ASTM D 1557 maximum density in all locations.

3.9.3 Pipe Bedding Material

Compact lightly using hand operated tampers to prevent damage to piping.

3.10 FINISH OPERATIONS

3.10.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade to match preconstruction conditions.

3.10.2 Seeding

Where grass existed prior to construction, scarify existing subgrade. Provide 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor. Additional topsoil will not be required if work is performed in compliance with stripping and stockpiling requirements. Seed shall match existing vegetation. Provide seed at 5 pounds per 1000 square feet. Provide CID A-A-1909, Type I, Class 2, 10-10-10 analysis fertilizer at 25 pounds per 1000 square feet. Provide mulch and water to establish an acceptable stand of grass.

3.10.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

### 3.11 DISPOSITION OF SURPLUS MATERIAL

Transport wet contaminated soils in lined containers. Collect 1 sample from each 50 cy of wet contaminated soils before final disposition.

Collect 1 sample from each 50 cy of surplus dry soils. Analyze each sample for the following:

Parameter	Method	QC Level	Action Level (mg/kg)
TPH-purgeable as gasoline	EPA Modified 8015		150
Benzene	EPA Modified 8015		4.4
Toluene	EPA Modified 8015		2,700
Ethylbenzene	EPA Modified 8015		3,100
Total xylenes	EPA Modified 8015		980

Submit all raw analytical data, including chromatograms and quality control results, to the Contracting Officer.

If the laboratory analyses reveal that contaminant concentrations in the sample from each 50 cy batch of dry soils are all lower than the specified action levels, those 50 cy shall be considered clean. Dispose of dry soils with contaminant concentrations below negotiated site-specific action levels as directed by the contracting officer.

If the analytical results for any of the dry soil samples indicate that any of the constituents are above the action levels, all 50 cy shall be considered to be contaminated. Remove wet contaminated soils and dry soils exceeding the action levels to the biological treatment pad.

### 3.12 FIELD QUALITY CONTROL

#### 3.12.1 Sampling

Take the number and size of samples required to perform the following tests.

#### 3.12.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

##### 3.12.2.1 Backfill Material Testing

Test backfill material for moisture density relations in accordance with ASTM D 1557.

##### 3.12.2.2 Permeable Filter Material Testing

Test select material in accordance with ASTM C 136 for conformance to specified grading limits.

3.12.2.3 Pipe Bedding Material Testing

Test porous fill in accordance with ASTM C 136 for conformance to specified gradation.

3.12.2.4 Density Tests

Test density in accordance with ASTM D 1556, or ASTM D 2922. When ASTM D 2922 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 2922 tested as specified herein. Perform an ASTM D 1556 density test at the start of the job, and for every 10 ASTM D 2922 density tests thereafter. Test each lift at a randomly selected location in each extraction trench and at randomly selected locations every 2000 square feet in pipe trenches

END OF SECTION

**SECTION 02260  
PNEUMATIC SOIL FRACTURING**

**PART 1 GENERAL**

**1.1 SOIL FRACTURING SUMMARY**

Contingent upon initial soil vapor extraction (SVE) system performance, pneumatic soil fracturing (PF) will be employed in regions of low soil permeability to improve subsurface air flow and increase the amount of contamination removed by the vapor extraction systems. Fracturing will be achieved by the injection of high pressure ambient air into subsurface soils at discrete vertical intervals using drilled boreholes.

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-08, Statments**

Submit the following performance information for the pneumatic soil fracturing system:

a. Name and address of the pneumatic fracturing vendor.

b. Following applicable information completely filled in:

Anticipated minimum \_\_\_(psi) and maximum \_\_\_(psi) injection pressures.

Anticipated injection air flow rate \_\_\_(scfm) at \_\_\_(seconds) time interval during fracturing.

Anticipated average distance of fracturing influence away from fracture location \_\_\_(feet).

**1.3 SPECIAL SCHEDULING REQUIREMENTS**

Since exact fracturing locations will be determined in the field based on lithologic information obtained during SVE trench excavation and on SVE system extraction flowrates, fracturing shall be executed in a particular area only after the SVE system is installed and operational in the area being fractured.

**PART 2 PRODUCTS**

**2.1 PNEUMATIC FRACTURING EQUIPMENT AND SYSTEM PERFORMANCE**

The equipment and system used for pneumatic fracturing shall be capable of injecting clean, minimum "Grade D" quality air as set forth by the Compressed Gas Association. The fracturing system shall be capable of injecting air at pressures of at least 300 psi and at volumes of at least 1500 scfm for up to 20 seconds duration. The system shall also be capable of creating fractures at depths of 6 to 25 feet below ground surface with resulting fracture propagation distances of at least 20 radial feet from the injection well.

### PART 3 EXECUTION

#### 3.1 FRACTURE PROPAGATION

Execute soil fracturing to maximize the radial distance of fracture propagation at the targeted subsurface depth while minimizing any upcurling or fractures propagating to ground surface. At a minimum, fractures should propagate horizontally through soils at least 20 feet.

#### 3.2 FRACTURE LOCATION DETERMINATION

Propose specific fracturing locations and depths based on available soil lithologic information and actual extracted flowrate and vacuum data obtained during initial SVE system operation. Consult with Engineer and Contracting Officer before selecting final fracture locations and depths.

Approximately 40 to 50 fracturing locations at depths primarily in the range of 7 to 10 feet below ground surface (bgs) are anticipated. Some injections may be required as deep as 25 feet bgs. Approximately two injections will be required at each fracture location for a total of approximately 80 to 100 injections.

#### 3.3 FRACTURE WELL COMPLETION

To the extent possible, when fracture well locations coincide with air sparge injection well locations, the fracture borehole shall be further drilled and completed as an air sparge injection well. In locations where fracture wells will not be converted to sparge wells, boreholes will be backfilled by gravel up to the top of the fractured interval, then by 2 feet of well hydrated bentonite immediately above the gravel pack, and then with a 5% bentonite grout up to the ground surface.

#### 3.4 PROTECTION OF EXISTING STRUCTURES

All fractures will be executed to avoid any damage to subsurface or aboveground utilities or buildings. In areas where fracturing is required and potential damage to any structures is anticipated, the Contractor must receive approval from the Contracting Officer before proceeding.

END OF SECTION

**SECTION 02510  
SURFACE RESTORATION**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 136	1984 (Rev. A) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	1990 Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	1978 (R 1990) Moisture-Density Relations Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 2172	1988 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

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**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-05, Design Data**

- a. Job-mix formula for asphalt concrete

**1.2.1.1 Required Data**

Submit a job-mix formula for bituminous mixture 14 days before asphalt concrete is placed. Ensure formula is within the specified design range.

**1.2.2 SD-08, Statements**

- a. Asphalt concrete

Submit copies of weighmaster's certificates or certified delivery tickets for each truck load of material.

**1.2.3 SD-12, Field Test Reports**

- a. Asphalt concrete

Submit as required in paragraph titled "Field Quality Control."

1.2.4 SD-13, Certificates

- a. Aggregates for base course and asphalt concrete
- b. Asphalt cement
- c. Asphaltic emulsion

1.3 QUALITY ASSURANCE

Materials and workmanship specified herein shall be in accordance with the referenced articles, sections, and paragraphs of SS-1 except that contractual and payment provisions do not apply. Where the term "Engineer" is used, it shall mean the Contracting Officer. Where the term "state" is used, it shall mean "Federal Government."

1.4 EQUIPMENT

1.4.1 Mixing Plant and Construction Equipment

Section 39 of SS-1.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

2.1.1.1 Base Course

Section 26 of SS-1, Class 2, 3/4-inch maximum size gradation.

2.1.1.2 Asphalt Concrete

Section 39 of SS-1, Type B, conforming to 1/2-inch maximum, medium gradation.

2.1.2 Asphalt Materials

2.1.2.1 Asphalt Cement

Section 92 of SS-1, Grade AR-4000

2.1.2.2 Asphaltic Emulsion

Section 94 of SS-1, Grade SS-1h.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Subgrade

Prior to construction of base course, clean previously constructed subgrade of foreign substances.

3.1.2 Base Course

Base course shall be obtained from the recently excavated stockpile of base course material. Additional base course material, if needed, shall be obtained off-site.

3.1.3 Asphalt Concrete Preparation

Uniformly mix mineral aggregate with bituminous material in a central plant in accordance with Section 39 of SS-1. The percentage of asphalt cement binder shall be between 5 and 7 percent.

3.2 INSTALLATION

3.2.1 Base Course Installation

Place aggregate base in accordance with requirements of Section 26 of SS-1 and to the thickness shown. Grade and compact in 6-inch layers to at least 95 percent of maximum density according to ASTM D 1557 Method D. Maintain base course in proper condition until asphaltic concrete is in place, including drainage, rolling, shaping, and watering. Maintain sufficient moisture at the surface to prevent a dusty condition by light sprinkling with water. Recondition, reshape, and recompact areas of completed base course damaged by excessive moisture or other conditions.

3.2.2 Tack Coat

Apply asphaltic emulsion to existing pavement surfaces and to the surface of the base course in accordance with Section 39 of SS-1.

3.2.3 Asphalt Concrete Installation

3.2.3.1 Placing

Deliver bituminous mixtures to the roadbed at temperatures specified in Section 39 of SS-1. Spread in accordance with Section 39 of SS-1.

3.2.3.2 Compaction

Initial or breakdown rolling and final rolling of the uppermost layer of asphalt concrete shall be in accordance with Section 39 of SS-1. Compaction by vehicular traffic shall not be permitted.

3.2.3.3 Joining Pavement

Carefully make joints between old and new pavements and of successive days work in such manner as to ensure a continuous bond between old and new sections. Expose and clean edges of existing pavement. Cut edge to straight, vertical surfaces. Paint joints with a uniform tack coat before the fresh mixture is placed.

3.3 FIELD QUALITY CONTROL

3.3.1 Base Course Finish Surface

Surface tolerance shall conform to Section 26 of SS-1. When base course is constructed in more than one layer, specified smoothness requirements apply only to top surface.

3.3.2 Gradation

3.3.2.1 Base Course Gradation

Perform base course gradation test in accordance with ASTM C 136. Perform one test for each 500 tons of material.

3.3.2.2 Asphalt Concrete Gradation

Perform asphalt concrete gradation test in accordance with ASTM C 136. Perform one test for each 100 tons of material.

3.3.3 Base Course Density

Perform one moisture-density relationship test (ASTM D1557, Method D) on a sample of base course material used.

Perform in-place density tests in accordance with ASTM D 1556. Perform two tests for each 2,000 square yards of surface area.

3.3.4 Asphalt Content of Asphalt Concrete

Determine percent asphalt content by extraction in accordance with ASTM D 2172, Method A. Perform one test for each 100 tons of material.

3.4 PROTECTION OF PAVEMENT

After final rolling, do not permit vehicular traffic on the pavement until pavement has cooled and hardened and in no case before 6 hours after rolling.

END OF SECTION

**SECTION 02675  
DRILLED SPARGE, MONITOR, AND FRACTURE WELLS**

**PART 1 GENERAL**

**1.1 SUMMARY**

The work includes the installation of air sparge injection wells, vadose and saturated zone monitoring wells, and pneumatic fracture wells which will be converted to sparge wells or abandoned. All monitoring wells will be installed in clusters, with three different casings (corresponding to three different screened intervals) per borehole. This specification section outlines materials and procedures to be used in the completion of these wells.

**1.2 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 150 (1994; Rev. A) Portland Cement

**ENVIRONMENTAL PROTECTION AGENCY (EPA)**

EPA 600/4-89/034 Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-08, Statements**

- a. Water disposal methods
- b. Soil disposal methods

**1.3 DELIVERY, STORAGE, AND HANDLING**

Deliver materials in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact. Replace defective or damaged materials with new materials.

**1.4 GENERAL REQUIREMENTS**

Provide each system complete and ready for operation. Each system, including equipment, materials, installation, and workmanship shall be in accordance with EPA 600/4-89/034, except as modified herein. In the manual referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" has been substituted for the word "should" wherever it appears. Reference to the "Project Representative" and the "Owner" shall be interpreted to mean the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Shall conform to the respective specifications and other requirements as specified herein.

#### 2.1.1 Casings

All well casing shall be made of Schedule 40 PVC. Air sparge and monitoring wells shall use 1" diameter casing and fracture wells not completed as sparge wells will not require any casing. All pipe casing joints shall be flush threaded for all portions, including the tops of the monitoring wells which shall be threaded for use with threaded air-tight caps. Sparge well casings should be completed with Tee fittings with the top portion of the Tee threaded and plugged air-tight with a threaded hexagonal-top brass plug.

#### 2.1.2 Well Screens and Diffusers

##### a. Monitoring Wells

All monitoring wells installed below the water table shall employ 0.010-inch slot well screens. Wells installed in the vadose zone shall employ 0.020-inch slot well screens.

##### b. Air Sparge Wells

Air sparge wells will inject air via 2 inch diameter fine bubble diffusers. Bubble diffusers shall provide bubbles of approximately 20 micron diameter.

#### 2.1.3 Filter Sand

Provide clean, silica sand with less than 5 percent feldspar, no fossils, carbonate, or organics with sizing as specified below.

##### a. Monitoring Wells

Screened portions of monitoring wells completed below the water table shall be backfilled with U.S Standard Sieve No. 10-20 sand. Monitoring wells completed in the vadose zone shall be backfilled with U.S Standard Sieve No. 8-12 sand.

##### b. Air Sparge Wells

Bubble diffuser sections shall be backfilled with U.S. Standard Sieve No. 20-40 sand.

##### c. Fracture Wells

Fracture wells not completed as sparge wells shall use U.S Standard Sieve No. 8-12 sand for the portions requiring sand backfill.

#### 2.1.4 Grout

Provide neat cement grout, Type I or II portland cement conforming to ASTM C 150, and water. The mixed grout shall contain no more than 26.45 liters of water per bag (7 gallons of water per bag) of cement. All grout shall contain 5 percent bentonite by volume.

2.1.5 Well Boxes and Wellhead Assemblies

All sparge and monitoring wells shall be furnished with flush-mounted, traffic-rated well boxes set in concrete as shown on the Drawings. Sparge well boxes will contain wellhead assemblies constructed in conformance with Section 15080, "Piping, Valves, and Appurtenances."

PART 3 EXECUTION

3.1 WELL CONSTRUCTION

3.1.1 Casing and Well Screen

Center the air sparge casings within the borehole to the extent practical. Center clustered monitoring wells within boreholes so that casing centers are approximately 3 inches apart and at least 3 inches from the nearest side of the well box. Seal the bottom of the deepest screen with a threaded plug, consisting of the same material and thickness as the screen body.

3.1.2 Bentonite Seals for Unsaturated Wells

Each monitoring well cluster will have one screened casing installed in the unsaturated zone. Bentonite installed above these sandpacks shall be hydrated for a minimum of 4 hours to create a tight seal before backfilling with grout.

3.1.3 Cluster Monitoring Well Labels

All monitoring wells within a well cluster shall be labeled with stamped metal tags indicating the location name and screened depth interval. Location names of monitoring wells are indicated on the Drawings. Screened depth indicators shall be as follows:

Deep	For the deepest of the two saturated wells of a cluster
Shallow	For the shallowest of the two saturated wells of a cluster
Vadose	For the well screened in the unsaturated interval

The following is an example of a label to be used for a monitoring well located at SMW9-1 and screened in the deepest saturated interval:

"SMW9-1-DEEP"

For grout intervals extending less than 2 feet above bentonite seals, bentonite can be used in place of grout to backfill borehole to the next sandpack.

3.1.4 Well Development for Saturated Zone Wells

The saturated zone monitoring wells will require development. Set the casings and allow the neat cement grout to harden a minimum of 48 hours prior to well development. Furnish pumps, compressors, plungers, bailers, and other equipment required to fully develop the well for the maximum yield of water per meter (foot) of drawdown and to limit sand intrusion during the life of the well. Pump the well free of accumulated silt and clay and other foreign matter.

3.1.5 Completion of Fracture Wells

Fracture wells to be later converted to air sparge wells shall be completed as per air sparge wells as shown in the Drawings and indicated here in the specifications. For fracture wells not being converted to sparge wells, all boreholes shall be filled to the surface with 5% bentonite cement grout, except for the fractured interval which shall be backfilled with sand.

3.2 WASTE DISPOSAL

Dispose of waste materials and soil removed from the drilled holes as directed by the Contracting Officer.

END OF SECTION

**SECTION 02831  
FENCE, CHAIN LINK**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

**ASTM F 883 (1990) Padlocks**

**FEDERAL SPECIFICATIONS (FS)**

**FS RR-F-191 (Rev. K) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification)**

**FS RR-F-191/1 (Rev. D) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)**

**FS RR-F-191/2 (Rev. D) Fencing, Wire and Post, Metal (Chain-Link Fence Gates) (Detail Specification)**

**FS RR-F-191/3 (Rev. D) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)**

**FS RR-F-191/4 (Rev. D) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)**

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-02, Manufacturer's Catalog Data**

- a. Chain-link fencing components
- b. Accessories

**1.3 DELIVERY, STORAGE, AND HANDLING**

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 CHAIN-LINK FENCING AND ACCESSORIES

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

2.1.1 Fabric

FS RR-F-191/1; Type I, zinc-coated steel, 9-gauge. Mesh size, 2 inches. Provide selvage knuckled at one selvage and twisted and barbed at the other. Height of fabric is 6 feet.

2.1.2 Gates

FS RR-F-191/2; Type I, single swing and Type II, double swing. Shape and size of gate frame, as indicated. Framing and bracing members, round or square of steel alloy. Steel member finish, zinc-coated. Gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade except that steel pipe frames shall be 1.90 inches od, 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces shall be 1.869 inches od, 0.940 lb/ft of length. Gate fabric, as specified for fencing fabric. Coating for steel latches, stops, hinges, keepers, and accessories, galvanized. Gate latches, fork type. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

2.1.3 Posts, Top Rails, and Braces

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A or B. End, corner, and pull posts; Class 1, steel pipe, Grade A or B. Braces and rails; Class 1, steel pipe, Grade A or B, in minimum sizes listed in FS RR-F-191/3 for each class and grade.

2.1.4 Fencing Accessories

FS RR-F-191/4. Provide wire ties constructed of the same material as the fencing fabric.

2.1.5 Concrete

Provide as specified in Section 03302, "Cast-In-Place Concrete (Minor Construction)."

2.1.6 Grout

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

2.1.7 Padlocks

ASTM F 883, with chain.

### **PART 3 EXECUTION**

#### **3.1 SITE PREPARATION**

##### **3.1.1 Clearing and Grading**

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

##### **3.1.2 Excavation**

Excavate to dimensions indicated for concrete-embedded items, except in bedrock. If bedrock is encountered, continue excavation to depth indicated or 18 inches into bedrock, whichever is less, with a diameter in bedrock a minimum of 2 inches larger than outside diameter of post. Clear post holes of loose material. Dispose of waste material outside limits of station.

#### **3.2 FENCE INSTALLATION**

##### **3.2.1 Post Spacing**

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more.

##### **3.2.2 Post Setting**

Set posts plumb. Allow concrete and grout to cure a minimum of 72 hours before performing other work on posts.

##### **3.2.3 Bracing**

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal truss rod and truss tightener used as a tension member.

##### **3.2.4 Top Rails**

Install top rails before installing chain-link fabric. Pass top rail through intermediate post caps. Provide expansion coupling spaced as indicated.

##### **3.2.5 Bottom Tension Wires**

Install bottom tension wires before installing chain-link fabric, and pull wire taut. Place bottom tension wires within 8 inches of respective fabric line.

3.2.6 Fabric

Pull fabric taut and secure fabric to top rail and bottom wire, close to both sides of each post and at maximum intervals of 24 inches on center. Secure fabric to posts using stretcher bars, ties or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post. Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is 2 inches above ground level.

3.3 ACCESSORIES INSTALLATION

3.3.1 Post Caps

Design post caps to accommodate top rail. Install post caps as recommended by the manufacturer.

3.3.2 Gates

Install swing gates to swing through 180 degrees from closed to open.

3.3.3 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.4 CLEANUP

Remove waste fencing materials and other debris from the station.

END OF SECTION

**SECTION 03302  
CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN CONCRETE INSTITUTE (ACI)**

ACI 301	1989 Structural Concrete for Buildings
ACI 304R	1989 Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	1991 Hot Weather Concreting
ACI 306.1	1990 Cold Weather Concreting

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 33	1992a Specification for Concrete Aggregates
ASTM C 94	1992 (Rev. A) Ready-Mixed Concrete
ASTM C 143	1990 (Rev. A) Slump of Hydraulic Cement Concrete
ASTM C 150	1992 Portland Cement
ASTM C 260	1986 Air-Entraining Admixtures for Concrete
ASTM C 309	1991 Liquid Membrane-Forming Compounds for Curing Concrete

**1.2 SUBMITTALS**

Submit the following in accordance with the Section 01300, "Submittals."

**1.2.1 SD-04, Drawings**

- a. Treatment area pads

**1.2.2 SD-10, Test Reports**

- a. Compressive strength test

1.2.3 SD-13, Certificates

- a. Cement
- b. Aggregates
- c. Admixtures

1.3 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until ready for concrete placement. Store concrete aggregate to prevent contamination or segregation.

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor Mix Design

ACI 301, except as modified herein. Unless indicated otherwise, concrete shall have a 28-day compressive strength of 3,000 psi. Slump shall be 3 inches maximum in accordance with ASTM C 143. Air content shall be 6 percent (plus or minus 1 percent). Provide ASTM C 33 aggregate Size No. 57 or 67.

2.1.2 Ready-Mixed Concrete

ASTM C 94, except as modified herein. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state.

2.2 MATERIALS

2.2.1 Cement

ASTM C 150, Type II cement. Blended cement using pozzolan or fly ash will not be used.

2.2.2 Water

Water shall be potable.

2.2.3 Aggregates

ASTM C 33. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance that may be deleteriously reactive with the alkalis in the cement.

2.2.4 Admixtures

ASTM C 260 for air-entrained concrete. Calcium chloride shall not be used as an admixture.

2.2.5 Materials for Curing Concrete

2.2.5.1 Liquid Membrane-Forming Compound

ASTM C 309, white pigmented, Type 2, Class B.

PART 3 EXECUTION

3.1 FORMS

ACI 301. Set forms true to line and grade and make mortar-tight. Before concrete placement, coat the contact surfaces of forms with a nonstaining form coating compound. Prevent concrete damage during form removal.

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301. Provide bars, wire fabric, and other reinforcing materials, including wire ties, supports, and other devices necessary to install and secure the reinforcement.

3.2.1 Cover and Splicing

ACI 301, unless otherwise indicated.

3.2.2 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.2.3 Construction Joints

ACI 301. Continue reinforcement across joints, unless otherwise indicated.

3.3 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

ACI 304R, except as modified herein. ASTM C 94; machine mix concrete and provide mandatory batch ticket information for each load of ready mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce maximum mixing time to 60 minutes if the air temperature is greater than 85 degrees F. Additional

water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Consolidate concrete slabs greater than 4 inches depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by tamping, spading, and settling with a heavy leveling straight edge.

3.3.1 Cold Weather

ACI 306.1. Provide and maintain 50 degrees F minimum concrete temperature. Do not place concrete when the ambient temperature is below 40 degrees F. Cover concrete and provide with a source of heat sufficient to maintain 50 degrees F minimum while curing.

3.3.2 Hot Weather

ACI 305R. Concrete temperature from initial mixing through final cure shall not exceed 90 degrees F. Cool ingredients before mixing, or substitute chip ice for part of required mixing water or use other suitable means to control concrete temperature to prevent rapid drying of newly placed concrete. Shade the fresh concrete and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit curing without damage.

3.4 SURFACE FINISHES

ACI 301 for repair and finish, unless otherwise specified.

3.4.1 Floated Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Surface shall be level to within 1/4 inch in 10 feet.

3.4.2 Broomed Finished

Provide for exterior walks, pads, patios, and ramps, unless otherwise indicated. Provide a floated finish, then finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab. Round edges and joints with an edger having a radius of 1/4 inch.

3.5 CURING AND PROTECTION

ACI 301. Protect concrete from injurious action by sun, rain, wind, flowing water, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the curing period.

3.5.1 Liquid Membrane-Forming Compound Curing

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound, unless otherwise recommended by the manufacturer's written instructions.

3.5.2 Protection of Treated Surfaces

Prohibit foot and vehicular traffic and other sources of abrasion for not less than 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

3.5.3 Curing Periods

Allow 7 days.

END OF SECTION

**SECTION 11171  
VAPOR TREATMENT SYSTEM  
PACKAGED CATALYTIC OXIDIZER**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**NATIONAL FIRE PROTECTION ASSOCIATION**

**NFPA 54 (1992) National Fuel Gas Code**

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION**

**NEMA ICS 6 (1993) Industrial Control and Systems Enclosures**

**UNDERWRITERS LABORATORY**

**UL 50 (1992; R 1994, Bul. 1993 and 1994) Safety Enclosures for Electrical Equipment**

**1.2 DEFINITIONS**

**1.2.1 Catalytic Oxidizer**

A vapor treatment system utilizing a catalyst at temperatures sufficient to destroy hydrocarbon contaminants in the vapor stream.

**1.2.2 Reactor Chamber**

The section of a catalytic oxidizer containing catalyst material.

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.3.1 SD-02, Manufacturer's Catalog Data**

- a. Catalytic Oxidizer
- b. Controls and Instrumentation

**1.3.2 SD-04, Drawings**

- a. Proposed Equipment Installation

- b. Piping and Instrumentation
  - c. General Arrangement
  - d. Electrical
- 1.3.3 SD-10, Test Reports
- a. Instrument Readings
  - b. Computations
  - c. Methods
  - d. Performance
- 1.3.4 SD-13, Certificates
- a. Catalytic Oxidizer
- 1.3.5 SD-19, Operation and Maintenance Manual
- a. Catalytic Oxidizer

1.4 SPECIAL TOOLS

Equipment specified under this section requiring special tools for assembly, adjustment, setting, or maintenance thereof shall be furnished as standard accessories.

PART 2 PRODUCTS

2.1 CATALYTIC OXIDIZER UNIT

Provide two (2) packaged-type catalytic oxidizers capable of destroying contaminants contained in vapors from the two vapor extraction blower systems (Buildings 29 and 31). Financing terms for the units shall be specified by the Contracting Officer.

Oxidizer unit components shall be mounted in a secure, lockable, sound attenuating cabinet. The cabinet shall have hinged doors for ease of access to unit components.

2.1.1 Capacities

The unit for the Building 29 area extraction system shall have a capacity of not less than 1,400 standard cubic feet per minute (scfm).

The unit for the Building 31 area extraction system shall have a capacity of not less than 850 scfm.

The units shall be capable of destroying contaminants in vapors with the following approximate initial composition:

TPH-purgeable as gasoline	4,900 ppm
BTEX (combined)	700 ppb
Dichloroethene	500 ppb
Trichloroethene	400 ppb
Trichloro-trifluoroethene	200 ppb
Vinyl Chloride	200 ppb

### 2.1.2 Emissions

Emissions from the oxidizers shall conform to State of California Bay Area Air Quality Management District requirements. These requirements include 90% contaminant removal efficiencies for offgas concentrations less than 1000 ppm, 97% removal efficiencies for offgas concentrations greater than 1000 ppm but less than 3000 ppm, and 98.5% removal efficiencies if offgas concentrations exceed 3000 ppm.

### 2.1.3 Noise Level

Noise level at one foot from each oxidizer component shall not exceed 84 decibels, A scale.

## 2.2 DILUTION AIR CONTROL

The oxidizer units shall be equipped with automatic modulating dampers or other means of diluting the inlet air stream during periods of high contaminant concentration. The amount of dilution air shall be controlled by the exit temperature of the catalyst or other appropriate means to prevent high temperature excursions.

## 2.3 LEL MONITOR

Lower explosive limit (LEL) sensors shall be installed at each system inlet to terminate operation of the systems at inlet concentrations exceeding 25 percent of LEL. A 4-20 mA d-c output shall be available, pre-wired to terminal strips for remote signal monitoring.

## 2.4 FLAME ARRESTOR

Each oxidizer unit shall be equipped with a flame arrestor at the system inlet.

## 2.5 BURNERS

Each burner shall be a complete burner assembly including fuel, control systems, and accessories. The burners shall be capable of natural gas operation.

Burners shall be mounted to allow the flame to fire in the direction of air flow. The burner configuration and firing characteristics shall provide uniform temperature entering the catalyst. The burners for each unit shall be capable of bringing the reactor to catalyst ready temperature with ambient air during startup, and shall have the capacities to maintain operating temperatures during contaminant free, full air flow conditions.

## 2.6 REACTOR CHAMBER

Reactor interior materials shall be capable of withstanding operational temperatures and pressures and any temperature and pressure fluctuations resulting from normal operational conditions. Each reactor chamber shall be provided with sufficient insulation between inner and outer shells to maintain external skin temperatures at safe levels.

The catalyst chamber shall be constructed and equipped with proper high temperature seals to ensure no contaminant bypass. Temperature sensors shall be located before and after the catalyst bed for proper temperature control.

The reactor shall be equipped with an access door for ease of servicing and inspection.

## 2.7 CATALYST

The catalyst shall be composed of a suitable material and shall be provided in sufficient quantities to achieve the required destruction and removal efficiency. Operating conditions shall be controlled within the specifications for the catalyst.

The catalyst shall be positioned to maintain uniform airflow and temperature throughout the catalyst bed. Catalyst life shall be guaranteed a minimum of 10,000 hours of operation at the specified flow rates and composition.

## 2.8 STACK

An exhaust stack shall be supplied with each catalytic oxidizer unit. Each stack shall have a minimum discharge height of 12 feet above grade.

## 2.9 CONTROLS AND INSTRUMENTS

Each catalytic oxidizer unit shall be equipped with controls and instrumentation to ensure safe and efficient operation. The following shall be provided, at a minimum, with each unit:

1. Startup Controls
2. Burner and Flame Safety Controls
3. Inlet and Outlet Temperature Controls
4. System Safety Shut-Down Controls

A programmable logic controller (PLC) based control system with digital temperature controllers shall be supplied in a NEMA 4/UL 50 panel within a weatherproof enclosure for each oxidizer unit. Analog signal outputs for all monitored variables and access to system shut down controls shall be available for inclusion into the overall remote SVE/AS PLC system.

2.10 SHUT-DOWN ALARM SYSTEM

A panel mounted alarm annunciator shall be provided to indicate the cause of any system shut downs. Each alarm point shall have a retransmit contact for remote monitoring. The retransmit contacts shall be prewired to panel terminal strips.

2.11 STARTUP AND TRAINING

A service technician shall be supplied for unit startup and operator training.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install as shown. Combustion air supply and ventilation shall be in accordance with NFPA 54.

3.2 UTILITY SERVICES CONNECTIONS

Connect to utility services as indicated.

3.3 FUEL SUPPLY

Install gas appliances and piping in accordance with NFPA 54, as applicable.

3.4 FIELD QUALITY CONTROL

Upon delivery to the site, equipment and materials shall be inspected by the Contracting Officer. Inspection will be continued during installation, after installation, and during tests. Inspections shall be made to assure equipment and installation comply with local, state, federal, and utility requirements for equipment, air pollution, and safety. Furnish labor, equipment, apparatus, and materials for testing. The Government will supply gas and electricity.

Test in accordance with supplier recommendations. Perform tests under direct supervision of the service technician. Reports certifying that instrument readings indicated are actual, acceptable methods were used, and unit performance was satisfactory shall be furnished.

END OF SECTION

**SECTION 11303**  
**LIQUID PHASE GRANULAR ACTIVATED CARBON (GAC) SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

A GAC system for the treatment of air/water separator effluent shall be installed at each of the Buildings 29 and 31 control areas. Each system will consist of 2 GAC canisters connected in series, 2 pressure gauges, a treated effluent holding tank, and piping. Water to the GAC system will be supplied by a transfer pump as specified in Section 15056. Treated water will be discharged intermittently to sanitary sewer connections at each control area.

**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-02, Manufacturer's Catalog Data**

- a. GAC unit specifications and product data.
- b. Holding tank specifications and product data.

**1.2.2 SD-10, Test Reports**

- a. Pressure drop and flowrate relationships,
- b. Carbon adsorption isotherms.

**1.2.3 SD-13, Certificates**

A written statement signed by an authorized official of the manufacturer of the GAC units, attesting that the GAC units conform to the requirements of this specification and will perform as intended.

**1.2.4 SD-19, Operation and Maintenance Manuals**

- a. Operating instructions,
- b. Monitoring requirements,
- c. Alarm conditions and procedures necessary to return to normal operation,
- d. Carbon changeout procedures,
- e. Trouble-shooting guidelines,
- f. Preventative maintenance and inspection procedures,

- g. A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delay.

**PART 2 PRODUCTS**

**2.1 CARBON**

**2.1.1 General**

Each GAC unit shall contain at least 175 pounds of granular activated carbon.

**2.1.2 Performance Requirements**

Representative influent water quality for the GAC systems is given in Table 1. Each GAC system must treat the system influent to attain 95% or better removal of hydrocarbon contaminants or to non-detect levels.

**TABLE 1**  
**INFLUENT CHARACTERISTICS FOR GAC SYSTEMS**  
 (µg/L)

Contaminant	Sample 1	Sample 2
TPHG	130	110
Benzene	3.1	ND
Toluene	2.3	2.3
Ethylbenzene	2.7	2.1
Xylenes	5.7	4.3
Trichloroethene	3J	3J
1,2-dichloroethene	9J	5J
1,2-dichloroethane	ND	ND

Notes:   TPHG     Total petroleum hydrocarbons as gasoline  
           ND        Not detected  
           J         Estimated value below detection limits

- 1) Detection limits at 10 µg/L for chlorinated solvents
- 2) Detection limits at 0.5 µg/L for BTEX compounds
- 3) Calcium approximately 150 to 200 mg/L
- 4) Magnesium approximately 40 to 70 mg/L
- 5) Total dissolved solids approximately 1000 mg/L
- 6) Temperature approximately 70° F

## 2.2 GAC UNITS

Each GAC unit shall be constructed as follows:

- a. Each vessel shall be suitable for outside use.
- b. Each vessel shall, to the extent practical, be fabricated, assembled, and tested in the factory to minimize installation and setup time in the field.
- c. Each GAC unit shall have nameplates indicating the manufacturers name, address, serial and model number, DOT classification, and pressure rating attached securely to vessel. The plate shall be located in an area readily accessible/visible by system operating personnel.
- d. Each unit shall be designed and installed to allow for carbon changeout and replacement.
- e. Special tools necessary for proper operation and maintenance of the GAC systems and associated equipment shall be furnished by the Vendor.

## 2.3 PIPING

Piping provided with the GAC canisters shall conform to Section 15080. Each GAC canister shall have threaded connections to allow for easy canister removal and reconnection.

## 2.4 PRESSURE GAUGES

Type A pressure gauges as specified in Section 15080, "Piping, Valves, and Appurtenances" shall be installed upstream of each GAC unit at each system. Gauge scales shall range from approximately 0 to 15 psig.

## 2.5 HOLDING TANKS

Each GAC system shall be plumbed to discharge treated effluent to a holding tank prior to discharge to the sanitary sewer. Holding tanks shall be vented, polyethylene tanks with 1,500 gallon capacities that are UV resistant and suitable for outdoor use. Each tank shall be equipped with a level switch, high-level alarm, and a ball valve on the drain line for manual release to the sanitary sewer. Each high-level alarm shall be configured to indicate alarm conditions when tanks are at 70 percent capacity. Each level switch shall be configured to automatically shut off the transfer pump when tank reaches 90 percent capacity. Level switches shall be field wired to the primary system PLC control panel.

## PART 3 EXECUTION

Not used

END OF SECTION

**SECTION 15011**  
**MECHANICAL GENERAL REQUIREMENTS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

**ASTM B 117                      1990 Salt Spray (Fog) Testing**

**CODE OF FEDERAL REGULATIONS (CFR)**

**29 CFR 1910.147              Control of Hazardous Energy (Lock Out/Tag Out)**

**SHEET METAL AND AIR CONDITIONING CONTRACTOR'S NATIONAL ASSOCIATION,  
INC. (SMACNA)**

**SMACNA GFSR              1991 Seismic Restraint Manual: Guidelines for Mechanical  
Systems**

**1.2 RELATED REQUIREMENTS**

This section applies to Division 2, "Site Work," and all sections of Division 15, "Mechanical," and Division 11, "Equipment," of this project specification unless specified otherwise in the individual section.

**1.3 QUALITY ASSURANCE**

**1.3.1 Material and Equipment Qualifications**

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design, and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

**1.3.2 Alternative Qualifications**

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment, which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.2 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 OPERATION AND MAINTENANCE MANUALS

Submit as required for each system and principal item of equipment in the technical sections for the use of the operation and maintenance personnel. The operating instruction shall include the following:

- a. System Descriptive Information: Wiring diagrams, control diagrams, piping diagrams, control sequence and operating points for each principal system and item of equipment. Post instructions where directed.
- b. Equipment Instructions: Attach or post adjacent to each principal item of equipment and include directions.
  1. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  2. Safety precautions, procedure in the event of equipment failure.
  3. Other areas as recommended by the manufacturer of each system or item of equipment.

Print or engrave and frame under glass or in laminated plastic.

Operating instructions exposed to the weather shall be made of weatherproof materials or enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

## 1.6 SAFETY REQUIREMENTS

### 1.6.1 Equipment Safety

Provide positive means of locking out equipment so that equipment cannot be accidentally started during maintenance procedures. High-temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of the type specified. Provide catwalks, maintenance platforms, and guardrails where required for safe operation and maintenance of equipment. Provide ladders or stairways to reach catwalks and maintenance platforms. Ensure that access openings leading to equipment are large enough to carry through routine maintenance items such as filters and tools.

### 1.6.2 Lockout of Energy Sources

Provide appropriate lockout devices for energy isolating valves and for machines or other equipment to prevent unexpected start-up or release of stored electrical, mechanical, hydraulic, pneumatic, thermal, chemical, or other energy in accordance with 29 CFR 1910.147. Lockout devices for valves shall provide a means of attachment to which, or through which, a lock can be affixed or shall have a locking mechanism built into it so that the valve cannot be moved from the lockout position until the lock is removed. Electrical isolation of machines or other equipment shall be in accordance with requirements of DIVISION 16, "Electrical."

## 1.7 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects, and contractors with their respective pieces of equipment. Motors, controllers, disconnects, and contractors shall conform to requirements of Section 16011, "Electrical General Requirements." Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contractors shall have a maximum of 120-volt control circuits, and shall have auxiliary contacts for use with the controls furnished.

## 1.8 SEISMIC RESTRAINTS

Provide seismic restraints for aboveground ductwork and piping in accordance with SMACNA GFSR. Seismic zone is 4.

## 1.9 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to Government personnel or designated representatives in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

## PART 2 PRODUCTS

Not used.

### PART 3 EXECUTION

#### 3.1 PAINTING OF NEW EQUIPMENT

Equipment painting, factory applied or shop applied, shall be as specified herein, and provided under each individual section.

##### 3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.1225 inch on either side of the scratch mark. The fill thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees Fahrenheit (°F), submit certifications that the manufacturer's standard factory painting system conforms to the heat resistance requirement in addition to other certifications.

##### 3.1.2 Shop Painting Systems for Metal Surfaces

Clean, protect, prime, and paint metal surfaces; aluminum surfaces need not be painted. Apply coatings to clean, dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil, and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120°F shall be cleaned to bare metal. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

Temperatures Less Than 120°F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120°F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

END OF SECTION

**SECTION 15056  
VAPOR EXTRACTION BLOWER SYSTEMS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

ASME PTC 9 (1970; Errata 1972, R 1992) Displacement Compressors,  
Vacuum Pumps and Blowers

**COMPRESSED AIR AND GAS INSTITUTE (CAGI)**

CAGI PNEUROP (1971) Test Code for the Measurement of Sound from  
Pneumatic Equipment

**CODE OF FEDERAL REGULATIONS (CFR)**

29 CFR 1910.219 Mechanical Power Transmission Apparatus

**COMPRESSED GAS ASSOCIATION, INC. (CGA)**

CGA G-7.1 (1989) Commodity Specification for Air

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)**

NEMA ICS 6 (1993) Control and Systems Enclosures

NEMA MG 1 (1993) Motors and Generators

**1.2 GENERAL REQUIREMENTS**

Section 15011, "Mechanical General Requirements," applies to this section except as specified herein.

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals".

**1.3.1 SD-02, Manufacturer's Catalog Data**

- a. Blowers
- b. Inlet air filters
- c. Inlet air filter enclosures
- d. Discharge line silencers
- e. Air/water separators

- f. Vacuum relief valves
  - g. Produced water pumps
  - h. Pressure and temperature gauges
  - i. Motor control equipment
- 1.3.2 SD-04, Drawings
- a. Motor control and instrument panel layout drawings.
  - b. Motor control and instrument panel wiring diagrams.
- 1.3.3 SD-08, Statements
- a. Factory test procedures
  - b. Factory testing certification
  - c. Field test procedures
  - d. Training material
- 1.3.4 SD-10, Test Reports
- a. Blower
  - b. Instrumentation
  - c. Sound level
- 1.3.5 SD-18, Records
- a. Posted operating instructions for blowers
- 1.3.6 SD-19, Operation and Maintenance Manuals
- a. Blower system
  - b. Air/water separator
  - c. Produced water pump
- 1.3.6.1 Equipment Data
- Submit the following data for equipment listed for "Operation and Maintenance Instructions, Parts and Testing".
- a. Name and address of authorized branch or service department.
  - b. Characteristic curves for make and model listed below.
  - c. Following applicable data completely filled in:

- d. Manufacturer and Model No. \_\_\_\_\_
- e. Capacity \_\_\_\_\_ (cfm) at pressure \_\_\_\_\_ (psi)
- f. Type and Adjustment of Drive \_\_\_\_\_
- g. Electric Motor: Manufacturer, Frame and Type \_\_\_\_\_
- h. Motor Speed \_\_\_\_\_ RPM
- i. Current Characteristics and HP of Motor \_\_\_\_\_
- j. Thermal Cut-out Switch: Manufacturer, Type and Model \_\_\_\_\_
- k. Starter: Manufacturer, Type and Model \_\_\_\_\_

#### 1.4 SAFETY PRECAUTIONS

##### 1.4.1 Rotating Equipment

Fully guard couplings, motor shafts, gears and other exposed rotating or rapidly moving parts in accordance with OSHA 29 CFR 1910.219. Provide rigid and suitably secured guard parts readily removable without disassembling guarded unit.

#### 1.5 ELECTRICAL REQUIREMENTS

Comply with the requirements of Section 16011, "Electrical General Requirements," Section 16402, "Wiring Systems," and Section 16900, "Controls and Instrumentation."

#### 1.6 SUPERVISION

The Contractor shall obtain the services of a qualified engineer or technician from the compressor manufacturer to supervise installation, start-up, and testing of the unit. After satisfactory installation of the equipment, the engineer or technician shall provide a signed certification that the equipment is installed in accordance with the manufacturer's recommendations.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

Materials and equipment complete with accessories shall be selected by the Contractor for performance compatibility.

#### 2.2 BLOWER SYSTEMS

Provide two (2) skid-mounted vapor extraction blower systems capable of operating under the specified conditions. Each unit shall consist of an air/water separator, three (3) manifolded extraction blowers, motor control panel, and produced water pump, as shown in the drawings.

## 2.3 BLOWERS

Each blower shall be provided with totally-enclosed, fan-cooled electric motor, and shall come complete with starter, inlet and discharge accessories, and instrument panel.

### 2.3.1 Normal Operating Conditions

	Unit 1 (Bldg. 29)	Unit 2 (Bldg. 31)
Individual Blower Capacity:	500 scfm	300 scfm
Suction Vacuum:	10 in. Hg	10 in. Hg
Discharge Pressure:	2 psig	2 psig

Provide sheaves to adjust the Building 29 area blower capacities to 300 and 400 scfm and to adjust the Building 31 area blower capacities to 200 scfm.

### 2.3.2 Ambient and Inlet Conditions Operating Ranges

Allowing for rational engineering performance adjustments due to variations in ambient and inlet conditions, the blower shall be designed, equipped, and furnished to be fully operational without abnormal wear throughout the entire range between and including the limits of the winter and summer design conditions specified.

#### a. Summer design conditions:

Inlet air: 66 degrees F high monthly average dry bulb temperature, 95 percent relative humidity, Ambient temperature: 66 degrees F, Barometric pressure: 14.7 psia

#### b. Winter design conditions:

Inlet air: 50 degrees F low monthly average dry bulb temperature, 90 percent relative humidity, Ambient temperature: 50 degrees F, Barometric pressure: 14.7 psia.

### 2.3.3 Control System

Control unit panel shall conform to NEMA ICS 6, floor or frame mounted, factory designed, and assembled, and shall be provided complete with all motor control devices fully prewired to power and control terminal blocks for field wiring connections. The panel shall be fabricated of formed stretcher leveled sheet steel, reinforced, and assembled into a rigid unit. Gasketed access doors shall be provided as required. Panel shall be factory finish painted.

Motor control enclosure shall be rated NEMA 4 and contain all starters, running time meters for each motor, and auxiliary control components.

Provide H-O-R control selector switches mounted on the enclosure door. Contact assemblies for each switch shall be provided with two remote and two hand position contacts and shall be prewired per the instrument wiring diagrams.

Provide motor run status lamps and elapsed time meters for each motor on the enclosure door.

Motor starters shall be provided as follows:

- a. Full voltage across-the-line, magnetic starters with undervoltage release and Class 10 thermal magnetic protection, trip free type, in each ungrounded conductor with manual reset.
- b. Provide two spare auxiliary contacts prewired to a terminal strip for field wiring by others for remote status.

Electric service shall be provide to main incoming terminals in the motor control enclosure as follows:

- a. Building 29 areas: 208 volt, three-phase power, 500 amp feeder. Two (2) parallel runs of 250 kcmil copper shall be terminated on incoming power lugs. A 20 amp 120 volt control circuit will be run to the enclosure.
- b. Building 31 area: 208 volt, three-phase power, 300 amp feeder. Two (2) parallel runs of 2/0 copper shall be terminated on incoming power lugs. A 20 amp 120 volt control circuit will be run to the enclosure.

#### 2.3.4 Accessories

Provide each blower suction with the following, in the order shown in the drawings:

- a. Expansion joint
- b. Inlet filter
- c. Pressure gauge
- c. Isolation gate valve

Provide each blower discharge with the following, in the order shown in the drawings:

- a. Flexible hose outlet
- b. Adjustable pressure relief valve
- c. Discharge silencer
- d. Check valve
- e. Pressure gauge
- f. Temperature gauge
- g. Isolation gate valve

##### 2.3.4.1 Inlet Air Filters

Filter media shall be rated and listed UL Class 2. Filter efficiencies shall be based on National Bureau of Standards (NBS) type discoloration gravimetric test method using atmospheric dust.

##### 2.3.4.2 Blower Air Outlets

Blower air outlet flexible hose with camlock ends.

2.3.4.3 Discharge Silencers

A discharge line silencer shall be furnished with each blower as selected by blower manufacturer for sufficient noise attenuation to meet OSHA sound level criteria but not greater than 84 dBA measured at an elevation of 1.50 meters (5 feet), and 3 meters (10 feet) horizontally from silencer.

2.3.4.4 Valves

All valves associated with the blower systems shall comply with requirements of Section 15080, "Piping, Valves, and Appurtenances."

2.3.4.5 Pressure Gauges

Provide the following pressure gauges for each blower:

Blower suction: Type C, range 0 - 160 in. WC vacuum

Blower discharge: Type A, range 0 - 5 psig

All pressure gauges shall conform to requirements outlined in Section 15080, "Piping, Valves, and Appurtenances."

2.3.4.6 Temperature Gauges

Temperature gauges shall have scale ranges of 50°F to 300°F and shall conform to the requirements outlined in Section 15080, "Piping, Valves, and Appurtenances."

2.3.7 Sound Attenuating Enclosure

The blowers, including the driver motors, shall be contained within a noise reducing enclosure. Design of the enclosure shall be such as to limit noise transmission to 84 dBA or less at a distance of one meter from the compressor in any direction.

Fan(s) and sound baffled ventilation grilles shall be provided as part of the enclosure. Ventilation shall be sufficient to limit interior temperature to that required for cooling the motor.

2.4 AIR/WATER SEPARATOR

Provide an air/water separator upstream of each blower manifold to remove entrained water droplets in extracted vapors.

Each separator shall have a minimum liquid reservoir of 60 gallons and shall be equipped with level controls as shown on the drawings and specified in Section 16900, "Controls and Instrumentation." The separators shall also be equipped with mist eliminators, adjustable vacuum relief valves, and manual drain valves.

2.4.1 Operating Conditions

	Unit 1 (Bldg. 29)	Unit 2 (Bldg. 31)
Separator Capacity:	1,400 scfm	850 scfm

Operating Pressure:	10 in. Hg Vacuum	10 in. Hg Vacuum
Operating Temperature:	60°F +/- 10°F	60°F +/- 10°F

## 2.6 PRODUCED WATER PUMP

The produced water pump shall be centrifugal pump with a design flow rate of 5 gallons per minute and a discharge pressure of 10 psig. The pump shall operate in conjunction with air/water separator controls as shown on the drawings.

## 2.7 SKID UNIT

Extraction blower systems shall be mounted on a painted steel skid unit with handles and bolt downs. All system piping shall be in accordance with Section 15080, "Piping, Valves, and Appurtenances."

All skid mounted electrical equipment shall be fully piped using rigid galvanized steel conduit. Conduits shall be properly supported and be routed to a convenient point for connection to raceway system extensions to the system motor control and instrument panel. These extensions will be provided by others.

All skid mounted electrical equipment shall be rated and installed to meet the NEC requirements for a Class I, Division 2 hazardous area.

## 2.8 CONTROLS AND INSTRUMENTATION

Provide blower suction vacuum switches and safety controls to shut the blower motor down for low inlet pressure. Switch shall have two SPDT switches. The system shall be configured to enable control of suction vacuum with atmospheric bleed, as shown in the drawings. Vacuum switches shall be rated for a Class I, Division 2 area.

## 2.9 AIR FLOW RATE AND PRESSURE RECORDER MEASUREMENT

## 2.10 SOURCE QUALITY CONTROL

### 2.10.1 Factory Test Procedures

The completely assembled system including the actual contract drive motor, lubrication system, and control panel shall be subjected to performance tests and sound level and run-in tests. Unit shall comply with guarantee requirements applying engineering adjustments to guarantee conditions. Test shall be certified by the manufacturer. Test may be run on the manufacturer's test stand using driver for this contract. Tests shall be in accordance with ASME PTC 9 format. Full-range performance tests shall indicate performance at maximum rated flow, rating point, and unloaded conditions. All accessory performance conditions shall be reported. Completed unit shall be factory tested with sound meters in accordance with CAGI PNEUROP. Location shall be one horizontal meter from unit at 1.5 meters above the floor. Test shall include readings at each octave band midpoint and the "A" scale, and shall not exceed 84 dBA and 90 decibels at any octave band. Results of test shall be included in the factory test report on the CAGI PNEUROP format. Factory test data may be corrected to the levels of an equivalent background noise level of 60 dBA showing calculations for reference use.

**2.10.2 Supervision of Testing**

System and components testing shall be conducted or supervised by either a designated authorized and factory trained representative of the manufacturer supplying the blowers or a registered Mechanical Engineer experienced in such work.

**2.10.3 System Test**

Testing of system shall conform to requirements outlined.

**2.10.4 Approval of Testing Procedure**

Proposed testing procedure shall be approved by the Contracting Officer and the individual in charge of testing prior to conducting tests.

**2.10.5 Certification of Performance Tests**

The test supervisor shall certify performance by testing to be in compliance with specifications.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

The Contractor shall install the vapor extraction units in accordance with manufacturer's recommendations and as indicated on the drawings. The skids shall be anchored to the respective treatment area concrete pads. Install the system under the direct supervision of an authorized representative of the manufacturers.

**3.2 GENERAL INSTALLATION REQUIREMENTS**

Vapor extraction systems with contract motor and accessories shall be factory assembled, run in, and tested complete before shipment to job site.

**3.2.2 Start-Up Services**

The Contractor shall furnish the services of a manufacturer's authorized representative to supervise prestart checkout, initial start-up, performance testing, and operator instruction. Time available shall be as required to properly start up.

**3.3 FIELD QUALITY CONTROL**

**3.3.1 Field Test Procedures**

Complete field performance testing of the total system shall be performed by the Contractor and witnessed by the Contracting Officer. System testing shall be conducted by either a compressor manufacturer's factory trained and authorized representative approved by the

Contracting Officer or a qualified registered Mechanical Engineer. Test shall include operation at rated capacity for not less than 4 hours with atmospheric bleed fully open.

#### 3.3.1.1 Performance Tests

Complete performance test shall be run at maximum load, rated load, at point of unload but prior to unload, and unloaded condition. Data shall be recorded listing:

- a. Air flow, inlet pressure and temperature, humidity; discharge pressure and temperature.
- b. Electrical load in volts and amperes for blower motor (loaded and unloaded) and auxiliaries.
- c. Intake filter pressure differential (clean).
- d. Start-up sequence, alarm signals and automatic system shutdown.
- e. Test blower intake and discharge for conformance to CGA G-7.1. Blower discharge shall show no increase in contaminants.

#### 3.3.1.2 Instrumentation Test

The testing procedure and instrumentation shall be submitted to the Contracting Officer for approval prior to conducting tests. The format of ASME PTC 9 is required. It is intended that a full field test be performed. Test data, such as air intake temperature and humidity, shall be mathematically corrected to performance test requirement levels.

#### 3.3.1.3 Sound Level Tests

Sound level tests shall be conducted concurrently. Broad Band "A" scale readings and Octave Band readings shall be taken and recorded at the same positions as on the factory testing. Maximum permissible level shall be 84 decibels one horizontal meter from the compressor and 1.5 meters above the floor, with unit in operation and all other significant equipment not required for test within the same building bay shutdown at the same location previously described. A background noise correction to 60 decibels is permissible.

#### 3.3.1.4 Operational Deficiencies

Any operational deficiencies noted in the tests shall be promptly corrected and affected portions of the test rerun.

#### 3.3.1.5 Field Test Tolerances

A tolerance of plus or minus 2 percent on flow, plus or minus 4 percent on power, or plus or minus 5 percent on any other variable for each item of equipment or fluid with all others conforming is permissible on field test results when compared to factory test data and to guarantee performance data except that air flow, discharge pressure, and motor power shall be met.

3.3.2 Approval of Testing Procedure

Proposed testing procedure shall be approved by the Contracting Officer and the individual in charge of testing prior to conducting tests.

3.4 TRAINING OF GOVERNMENT PERSONNEL

During start-up and field testing, train Government station personnel or designated representatives in the operation and maintenance of the vapor extraction systems. Training shall not commence until equipment is operational and station personnel are in attendance.

END OF SECTION

**SECTION 15080**  
**PIPING, VALVES, AND APPURTENANCES**

**PART 1 GENERAL**

**1.1 WORK INCLUDED**

This Section specifies the requirements for materials, fabrication, and installation of process piping systems.

**1.2 REFERENCES**

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)**

AISC M011 (1989) Manual of Steel Construction, Ninth Edition

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

ASME B16.11 Forged Fittings, Socket-Welding and Threaded

ASME B31.3 (1990) Chemical Plant and Petroleum Refinery Piping

ANSI/ASME B40.1 1991 (Special Notice 1992) Gauges - Pressure Indicating Dial Type - Elastic Element

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM A53 (1993) Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless

ASTM A307 (1992, Rev. A) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM D1785 (1994) Specification for Poly (Vinyl Chloride) (PVC), Schedule 40, 80, 120 Pressure-Related Pipe

ASTM D2466 (1994) Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2467 (1994) Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2564 (1993) Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D2855 (1993) Recommended Practice for Making Solvent Cemented Joints With Polyvinyl Chloride Plastic Pipe and Fittings.

MANUFACTURERS' STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY (MSS)

MSS SP-58 (1988) Pipe Hangers and Supports - Materials, Design, and Manufacture

MSS SP-69 (1991) Pipe Hangers and Supports - Selection and Application

MSS SP-80 (1987) Bronze Gate, Globe, Angle, and Check Valves

1.3 SUBMITTALS

Submit the following in accordance with Section 01300 - Submittals.

1.3.1 SD-02, Manufacturer's Catalog Data

- a. Pipe and fittings
- b. Joints and couplings
- c. Valves

PART 2 PRODUCTS

2.1 PIPE, VALVES, AND FITTINGS

Material requirements are specified in the Pipe Class Specification Sheets provided at the end of this Section.

2.2 SOLVENT CEMENT

ASTM D2564. Viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility.

2.3 PIPE SUPPORTS

Provide pipe hangers and supports conforming to MSS SP-58, MSS SP-69, and ASME B31.1.

2.4 MECHANICAL MONITORING EQUIPMENT

2.4.1 Temperature Gauges

Industrial-grade bimetal thermometers. Single Scale with back connected dial.

2.4.2 Pressure Gauges

- Type A Bourdon tube-type, suitable for outside use.
- Type B ANSI/ASME B40.1, Accuracy Grade A, for air and nonshatterable safety glass, and a pressure blowout back to prevent glass from flying out in case of an explosion. Stainless steel, glycerin filled. Minimum dial diameter 3 1/2-inch.
- Type C Diaphragm actuated with an accuracy +/- 2 percent of full scale. Minimum dial diameter 2-1/2 inches.

2.4.3 Flow Meters

- Type A Serviceable rotameter, equipped with needle valve for flow control and suitable for outdoor service. Accuracy +/- 10 percent. Flow display shall be readable from a 1 foot distance.
- Type B Pitot tube type suitable for outside use. Accuracy +/- 5 percent for flow ranges 10 to 130 scfm. Displays shall be calibrated in cfm with a minimum dial diameter 3-1/2 inches. The pitot tube shall also be connected to a flow transmitter as specified in Division 16.

PART 3 EXECUTION

3.1 PIPE HANDLING

Handle pipe and accessories in a manner to ensure delivery to the work site in an undamaged condition. Piping materials shall be delivered in a clean and protected condition. End caps, flange covers, valve covers, and similar protection shall not be removed until necessary for fabrication or erection.

Inspect all pipe for defects and damage upon delivery to the work site. Promptly remove defective and damaged material from the work site. Replace all defective and damaged material with new clean material at no additional cost to the government.

Exercise reasonable care to prevent damage to the pipe when using fork lifts or other handling equipment. Practices such as dragging pipe over rough ground, or sharp projections, or throwing it from trucks shall be avoided.

Exercise reasonable care to protect all equipment, apparatus, materials, devices, and accessories at the work site from damage during the course of construction. Damages resulting from negligence or the lack of adequate protection shall be corrected at no additional cost to the government.

Cut pipe in a manner that will not cause damage to the pipe. Use wheel cutters when practical. Remove fins and burrs from pipe and fittings.

## 3.2 PIPE LAYING AND JOINING

### 3.2.1 GENERAL

Do all piping work shown on the drawings and as otherwise required to make a complete, workable and neat job. Cut, make up, and install all pipe in accordance with the pipe manufacturer's recommendations. Include provisions for expansion, contraction, drainage, and application of cover material during installation.

Unions or flanges shall be provided in conjunction with all equipment, pumps, coils, automatic valves and specialties, and at all points necessary to provide reasonable access to the piping systems. Piping shall not interfere with access to valves or equipment, and shall not obstruct passage ways of any kind.

Where connections are made between new work and existing mains, the connections shall be made by using special sections and fittings to suit the actual conditions.

Cap or plug open ends of pipe, fittings, and valves immediately after placement to prevent foreign material from entering the pipes and fittings until equipment is installed. Clean the interior of all pipe and accessories installation, and maintain in a clean condition during installation.

Below grade shall be placed so that the full length of each section of pipe rests solidly upon the pipe bed, with recesses excavated to accommodate couplings and joints. Thrust joints should be provided at changes in direction, tees, dead ends, and valves. Do not lay pipe in water or when trench conditions are unsuitable for the work.

### 3.2.2 PLASTIC PIPE

Schedule 40 plastic pipe shall not be threaded. Schedule 80 threaded nipples shall be used where necessary to connect to threaded valves or fittings.

Solvent weld in accordance with ASTM D2855.

Solvent welding and joining shall not be done when the air temperature is below 40 degrees F, or above 90 degrees F if under direct exposure to sunlight.

If the air temperature is above 90 degrees F, the following precautions shall be used to avoid excessive evaporation of the solvent from the cement:

1. Shade joint surfaces from sunlight for a period of at least one hour before joining.
2. Make joints as quickly as possible after applying cement.

If the air temperature is below 40 degrees F, joints shall be prefabricated in a heated space, or a temporary heated enclosure shall be provided during the entire joining period and for two hours after the joint is made up.

### 3.3 PIPE SUPPORTS

All pipe anchors, guides, and auxiliary steel shall be of welded construction and shall conform to MSS SP-69.

Pipe supports shall be capable of supporting a minimum of 150 pounds, and shall withstand all static and dynamic load conditions and limitations imposed by the piping and equipment.

Anchors and guides or expansion loops shall be used wherever required to prevent excessive forces on equipment caused by thermal expansion of pipe. Pipe slides shall be used between expansion loops or expansion joints. Adequate guides shall be provided on both sides of expansion joints and loops.

Support spacing shall not exceed that required by ASME B31.3 unless otherwise shown on the drawings.

Pipe supports shall be provided at or near changes in direction and branch connections. Where practical, riser piping shall be supported independently of the connected horizontal piping.

### 3.4 PIPE TRENCH BACKFILL

Pipe trench backfill shall be in accordance with Section 02220.

### 3.5 INSTRUMENT INSTALLATION

Install per manufacturer requirements.

### 3.6 TESTING

#### 3.6.1 Piping

All piping shall be leak tested with compressed air and found tight. Insulated or otherwise concealed pipe shall be tested before being covered. All leaking joints shall be corrected, retested, and found tight.

Subject newly laid piping or any valved section of piping to 75 psi of air pressure. Once initial pressure has equilibrated to a stable gauge value, monitor the piping system for at least 5 minutes to ensure no observable pressure loss. Conduct test after the pipe is laid, the joints completed, and the trench partially backfilled, leaving the joints exposed for examination. Open and close each valve several times during the test. Carefully examine exposed pipe, joints, fittings, and valves during the test. Remove and replace pipe, mechanical joints, fittings, or valves discovered to be cracked or defective as a consequence of the test with sound material. Repeat the test until test results are approved.

All necessary precautions shall be taken to prevent damage to equipment and piping as a result of these tests. All specialties and equipment unable to withstand the test pressures shall be bypassed or otherwise safeguarded.

All equipment necessary for conducting these tests, including pumps, instruments, protective devices, piping, connections and appurtenances, shall be provided by the subcontractor. These tests shall not relieve the subcontractor from responsibility for leaks that may develop after the tests have been completed.

3.6.2 Instrumentation

All instruments shall be tested in accordance with manufacturer recommendations. All piping systems shall be tested with instruments installed on pipes.

END OF SECTION

**PIPE CLASS SPECIFICATION SHEET**

Pipe Class: PV1  
Rating: 100 psi at 115 degrees F  
Pipe: PVC, Schedule 40, ASTM D1785  
Fittings: Socket weld, PVC, Schedule 40, ASTM D2466  
Flanges: Socket weld, PVC, Class 125, ASTM D2466  
Unions: Socket weld, PVC per ASTM D2466  
Bolting: Machine bolts, ASTM A307 Gr. B with heavy hex nuts, plated  
Gaskets: Full face, 1/8", Teflon, Class 125

Valves:	TYPE	SIZE	SPECIFICATION
	Gate	1/2 to 2	Socket ends, 150 psig maximum pressure rating, polypropylene plug, PVC body
		2" to 4"	Flanged ends, 150 psig maximum pressure rating, polypropylene plug, PVC body.
	Globe	1/2" to 4"	Socket ends, 150 psig maximum pressure rating, polypropylene disk, Viton seals, PVC body
	Ball	1/2" to 4"	Socket ends, PVC union body with Viton O-rings, 150 psig maximum pressure rating, Teflon seats and seals
	Check	1/2" to 4"	Socket ends, PVC union body with Viton O-rings, 150 psig maximum pressure rating, Teflon ball seal
	Butterfly	2" to 4"	Wafer type, Flanged ends, PVC body and disk, 150 psig maximum pressure rating, Viton seats and flange ring

**PIPE CLASS SPECIFICATION SHEET**

Pipe Class: PV2  
Rating: 100 psi at 115 degrees F  
Pipe: Schedule 80 PVC per ASTM D1785  
Fittings: Socket weld, Schedule 80, PVC per ASTM D2467  
Flanges: Socket weld, Class 125, PVC per ASTM D2467  
Unions: Socket weld, PVC per ASTM D2467  
Bolting: Machine bolts, ASTM A307 Gr. B with heavy hex nuts, plated  
Gaskets: Full face, 1/8", Teflon, Class 125

Valves:	TYPE	SIZE	SPECIFICATION
	Gate	1/2" to 2" 2" to 4"	Socket ends, 150 psig maximum pressure rating, polypropylene plug, PVC body Flanged ends, 150 psig maximum pressure rating, polypropylene plug, PVC body.
	Globe	1/2" to 4"	Socket ends, 150 psig maximum pressure rating, polypropylene disk, PVC body
	Ball	1/2" to 4"	Socket ends, PVC union body with Viton O-rings, 150 psig maximum pressure rating, Teflon seats and seals
	Check	1/2" to 4"	Socket ends, PVC union body with Viton O-rings, 150 psig maximum pressure rating, Teflon ball seal
	Butterfly	2" to 4"	Wafer type, Flanged ends, PVC body and disk, 150 psig maximum pressure rating, Viton seats and flange ring

**PIPE CLASS SPECIFICATION SHEET**

Pipe Class: GS

Rating: 100 psi at 115 degrees F

Pipe: Schedule 40, ASTM A 53 Seamless Grade B, Galvanized

Fittings: Socket weld, Schedule 40, Forged Carbon Steel per ANSI B16.11, hot dip galvanized per ASTM A153

Flanges: Socket weld, Schedule 40, Forged Carbon Steel per ANSI B16.11, hot dip galvanized per ASTM A153

Unions: Socket weld, Schedule 40, Forged Carbon Steel per ANSI B16.11, hot dip galvanized per ASTM A153

Bolting: Machine bolts, ASTM A307 Gr. B with heavy hex nuts, plated

Gaskets: Full face, 1/8", Teflon, Class 125

**SECTION 15488  
AIR COMPRESSOR SYSTEMS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

ASME B31.1	1992 Power Piping
ANSI/ASME B40.1	1991 (Special Notice 1992) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPVC SEC VIII D1	1992 (Addenda 1992) Boiler and Pressure Vessel Code: Section VIII Pressure Vessels, Division 1
ASME BPVC SEC IX	1992 (Addenda 1992) Boiler and Pressure Vessel Code: Section IX Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators

**CODE OF FEDERAL REGULATIONS (CFR)**

29 CFR 1910.219	Mechanical Power Transmission Apparatus
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**1.2 SUBMITTALS**

Submit the following in accordance with Section 01300, "Submittals."

**1.2.1 SD-02 Manufacturer's Catalog Data**

- a. Air compressor
- b. Air receiver
- c. Pipe
- d. Fittings
- e. Valves
- f. Pressure gauges and switches
- g. Hangers and supports

1.2.2. SD-04, Drawings

- a. Motor control panel wiring diagrams

1.2.3 SD-05, Design Data

- a. Seismic tiedowns

Provide calculations and detailed drawings demonstrating the ability of the tiedowns to restrain the tank during a seismic event. The calculations and detailed drawings shall be prepared and sealed by a California licensed Civil or Structural Engineer.

1.2.4 SD-06, Instruction

- a. Air receiver

Include manufacturer's recommended certification test procedure and recommended procedure for cleaning, external painting, and delivery preparation.

1.2.5 SD-10, Test Reports

- a. Air compressor
- b. Air receiver
- c. Hydrostatic tests
- d. Leak tightness tests

1.2.6 SD-18, Records

- a. Posted operating instructions for air compressor

1.2.7 SD-19, Operation and Maintenance Manuals

- a. Air compressor
- b. Motor control equipment

1.2.7.1 Equipment Data

Submit the following data for equipment listed for "Operation and Maintenance Instructions, Parts and Testing".

- a. Name and address of authorized branch or service department.
- b. Characteristic curves for make and model listed below.

c. Following applicable data completely filled in:

Manufacturer and Model No. \_\_\_\_\_

Capacity \_\_\_\_\_ (CFM) at pressure\_\_\_\_(psi)

Type of Bearings in Unit \_\_\_\_\_

Type of Lubrication \_\_\_\_\_

Type and Adjustment of Drive \_\_\_\_\_

Capacity of Tank \_\_\_\_\_

Electric Motor: Manufacturer, Frame and Type \_\_\_\_\_

Motor Speed \_\_\_\_\_ RPM

Current Characteristics and HP of Motor \_\_\_\_\_

Thermal Cut-out Switch: Manufacturer, Type and Model \_\_\_\_\_

Starter: Manufacturer, Type and Model \_\_\_\_\_

1.3 QUALITY ASSURANCE

Design, fabrication, installation, and testing of compressed air systems shall conform to ASME B31.1, ASME BPVC SEC VIII D1, and ASME BPVC SEC IX, except as specified otherwise. In ASME B31.1, ASME BPVC SEC VIII D1, and ASME BPVC SEC IX, the advisory provisions shall be considered mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" and "owner" shall be interpreted to mean the Contracting Officer.

1.3.1 Qualification of Pressure Vessel (receiver) Inspectors

State Certification of Competency and active commission from the National Board of Boiler and Pressure Vessel Inspectors (NBBI), Columbus, Ohio.

1.4 SAFETY PRECAUTIONS

1.4.1 Rotating Equipment

Fully guard couplings, motor shafts, gears and other exposed rotating or rapidly moving parts in accordance with OSHA 29 CFR 1910.219. Provide rigid and suitably secured guard parts readily removable without disassembling guarded unit.

## PART 2 PRODUCTS

### 2.1 LOW PRESSURE AIR COMPRESSOR UNITS

#### 2.1.1 Oil-free Compressors

The air compressors shall be rotary screw, continuous duty-rated "oil-free" air compressors that require no petroleum-based oil for operation. The air compressors shall be tank mounted, packaged units complete with inlet air filter/silencer(s), electric motors, motor starters, instrument panels with hourmeters, filters to remove any residual lubricants from compressed air, and aftercooler/cooling system(s). All of the above shall be mounted on heavy duty, structural steel support frames with integrally mounted, ASME coded, horizontal air receivers. The compressor systems shall be built for outdoor service or the Contractor shall provide an enclosure to protect the systems from weather. Aftercoolers or cooling systems shall be capable of producing compressed air at temperatures below 125°F.

The air compressors shall meet the following specifications:

Building 29 Area Compressor - 115 to 125 scfm at 40 psi.

Building 31 Area Compressor - 45 to 50 scfm at 40 psi.

#### 2.1.2 Nameplate

Metal, securely fastened to equipment or base, listing:

Manufacturer's name and address  
Model and serial numbers  
Compressor operating data and rating.

#### 2.1.3 Receiver

ASME BPVC SEC VIII D1 and ASME BPVC SEC IX stamp. Provide service valve, pressure gage, and ASME BPVC SEC VIII D1 and ASME BPVC SEC IX code safety valve.

#### 2.1.4 Noise

90 dBA maximum sound level one meter from compressor unit.

#### 2.1.5 Motor Control Enclosure

Motor control enclosure shall be rated NEMA 4 and contain all starters, running time meters for each motor, and auxiliary control components.

Provide H-O-R control selector switches mounted on the enclosure door. Contact assemblies for each switch shall be provided with two remote and two hand position contacts and shall be prewired per the instrument wiring diagrams.

Provide motor run status lamps and elapsed time meters for each motor on the enclosure door.

Motor starters shall be provided as follows:

- a. Full voltage across-the-line, magnetic starters with undervoltage release and Class 10 thermal magnetic protection, trip free type, in each ungrounded conductor with manual reset.
- b. Provide two spare auxiliary contact prewired to a terminal strip for field wiring by others for remote status.

Electric service shall be provided to main incoming terminals in the motor control enclosure.

## 2.2 LOW PRESSURE AIR RECEIVER

ASME BPVC SEC VIII D1, labeled and rated for 125 psig, equipped with required valves and trimmings, including pressure gage and automatic drain valve and ASME BPVC SEC VIII D1 and ASME BPVC SEC IX pressure safety relief valve. Automatic condensate drain valves shall be fitted with filters to remove any residual lubricants prior to discharge. Exterior finish shall be standard factory finish.

## 2.3 LOW PRESSURE COMPRESSED AIR ACCESSORIES

### 2.3.1 Pressure Gages

Type B gauges as specified in Section 15080, "Pipe, Valves, and Fittings," to be installed downstream of the pressure regulator. Range 0 to 50 psig.

### 2.3.2 Pressure Regulators

Pressure regulators shall be installed downstream of the receiving tanks and upstream of air flow meters and pressure gauges at each system.

### 2.3.3 Air Flow Meters

Flow meters shall conform to the requirements for Type A meters outlined in Section 15080, "Pipe, Valves, and Fittings," and shall be capable of operating at the compressor discharge pressure. Scale shall range from 10 to 130 scfm at the Building 29 system and from 5 to 60 scfm at the Building 31 system.

## 2.4 SOURCE QUALITY CONTROL

Test air compressors at the factory to assure proper operation. Certify satisfactory accomplishment of tests.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with the manufacturer's recommendations.

3.1.1 Air Flow Meters

Install meter according to manufacturers recommendations. Place scale or display so that readings are easily obtained.

3.1.2 Attachment to Concrete Foundation

The air compressor system shall be bolted into concrete as indicated on the Drawings. Use suitable expansion anchors to anchor bolts into existing concrete. Equipment vibration shall be maintained within acceptable limits, and shall be suitably dampened and isolated.

3.1.3 Equipment Installation

Install equipment strictly in accordance with these specifications, and the manufacturers' installation instructions. Grout equipment mounted on concrete foundations before piping is installed.

3.1.4 Cleaning of System

Clean the various system components before final closing as the installations are completed. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests will not be permitted until the cleaning is approved by the Contracting Officer.

3.2 FIELD QUALITY CONTROL

3.2.1 Testing

3.2.1.1 General Requirements, Testing

Perform testing after cleaning. Contractor shall provide everything required for tests. Tests shall be subject to the approval of the Contracting Officer.

3.2.1.2 Leak Tightness Tests

a. Compressed Air Leak Test

Test with clean, dry air at design working pressure. Brush joints with soapy water solution to check for leaks. Install a calibrated test pressure gage in piping system to observe any loss in pressure. Maintain required test pressure for a sufficient length of time to enable an inspection of joints and connections.

3.2.1.3 Field Equipment Test

After installation of the compressed air system is complete, an operating test shall be conducted by the Contractor to ensure that the system operates properly. The entire system shall be given a running field test for a minimum of 72 hours. If any deficiencies are revealed during the test, such deficiencies shall be corrected by the Contractor and the test shall be repeated.

3.3 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors to give full instruction to Government personnel or designated representatives in the adjustment, operation, and maintenance of the air compressor system and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation.

END OF SECTION

**SECTION 16011**  
**ELECTRICAL GENERAL REQUIREMENTS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

**ANSI C2 (1993) National Electrical Safety Code**

**CODE OF FEDERAL REGULATIONS (CFR)**

**29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)**

**INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)**

**IEEE 100 (1992) Dictionary of Electrical and Electronics Terms**

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)**

**NEMA ICS 6 (1993) Enclosures for Industrial Control and Systems**

**NEMA MG 1 (1993) Motors and Generators**

**NEMA MG 10 (1983; R 1988) Energy Management Guide for Selection and Use of Polyphase Motors**

**NEMA MG 11 (1977; R 1992) Energy Management Guide of Selection and Use of Single-Phase Motors**

**NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

**NFPA 70 (1993) National Electrical Code**

**1.2 RELATED REQUIREMENTS**

This section applies to certain sections of Division 2, "Site Work," Division 11, "Equipment," Division 15, and "Mechanical Systems". This section applies to all sections of Division 16, "Electrical," of this project specification unless specified otherwise in the individual sections.

**1.3 DEFINITIONS**

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

#### 1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 208/120 volts secondary, three-phase, four wire. Final connections to the power distribution system at the existing buildings shall be made by the Contractor indicated on the drawings and as directed by the Contracting Officer.

#### 1.5 SUBMITTALS

Submittals required in the sections which refer to this section shall conform to the requirements of Section 01300, "Submittals" and to the following additional requirements. Submittals shall include the manufacturer's name, trade name, place of manufacture, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and technical paragraph reference. Submittals shall also include applicable federal, military, industry, and technical society publication references, and years of satisfactory service, and other information necessary to establish contract compliance of each item to be provided. Photographs of existing installations are unacceptable and will be returned without approval.

##### 1.5.1 SD-02, Manufacturer's Catalog Data

Submittals for each manufactured item shall be current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Handwritten and typed modifications and other notations not part of the manufacturer's preprinted data will result in the rejection of the submittal. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for certificates of compliance.

##### 1.5.2 SD-04, Drawings

Submit drawings a minimum of 355 by 510 mm (14 inches by 20 inches) in size using a minimum scale of 3 mm per 300 mm (1/8 inch per foot), except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.5.3 SD-06, Instructions

Where installation procedures or part of the installation procedures are required to be in accordance with manufacturer's instructions, submit printed copies of those instructions prior to installation. Installation of the item shall not proceed until manufacturer's instructions are received. Failure to submit manufacturer's instructions shall be cause for rejection of the equipment or material.

1.5.4 SD-13, Certificates

Submit manufacturer's certifications as required for products, materials, finishes, and equipment as specified in the technical sections. Certificates from material suppliers are not acceptable. Preprinted certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance.

1.5.4.1 Reference Standard Compliance

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), Underwriters Laboratories Inc. (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

1.5.4.2 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.5 SD-19, Operation and Maintenance Manuals

Comply with the requirements of Section 01730 and the technical sections.

1.5.5.1 Operating Instructions

Submit text of posted operating instructions for each system and principal item of equipment as specified in the technical sections.

1.6 QUALITY ASSURANCE

1.6.1 Material and Equipment Qualifications

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.6.2 Regulatory Requirements

Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70.

1.6.3 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.4 Service Support

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.5 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.6.6 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

1.7 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Install operating instructions in a pocket on the door of the main control panel. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

## 1.8 NAMEPLATES

Provide laminated plastic nameplates for each panelboard, equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm (0.125 inch) thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm (one by 2.5 inches). Lettering shall be a minimum of 6.35 mm (0.25 inch) high normal block style.

## 1.9 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, transformers, generators, and switchgear having a nominal rating exceeding 600 volts. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 355 by 255 mm (14 inches by 10 inches) with the legend "DANGER HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 75-mm (3-inch) high white letters on a red and black field.

## 1.10 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to ANSI C2, NFPA 70, and requirements specified herein.

### 1.10.1 Motors and Equipment

Provide motors, controllers, and contactors with their respective pieces of equipment. Motors, controllers, integral disconnects, and contactors shall conform to Section 16402, "Interior Wiring Systems". Control voltage for controllers and contactors shall not exceed 120 volts nominal. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

1.10.2 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment under Section 16402, "Interior Wiring Systems." Power wiring and conduit shall conform to Section 16402, "Interior Wiring Systems." Control wiring and conduit shall be provided under, and conform to the requirements of the section specifying the associated equipment.

1.10.3 High Efficiency Motors

1.10.3.1 High Efficiency Single-Phase Motors

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

1.10.3.2 High Efficiency Polyphase Motors

Unless otherwise specified, polyphase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

1.11 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

1.12 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 15, "Mechanical."

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PAINTING OF EQUIPMENT

3.1.1 Factory Applied

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test and the additional requirements specified in the technical sections.

3.1.2 Field Applied

Paint electrical equipment as required to match finish of adjacent surface or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09900, "Painting".

3.2 NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 9 meters (30 feet) apart.

3.4 CABLE TAG INSTALLATION

Install cable tags in each manhole, handhole, and vault as specified, including each splice. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

END OF SECTION

**SECTION 16402**  
**WIRING SYSTEMS**

**PART 1 GENERAL**

**1.1 REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

**ANSI C80.1 (1990) Rigid Steel Conduit - Zinc Coated**

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

**ASTM B 1 (1990) Hard-Drawn Copper Wire**

**ASTM B 8 (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft**

**NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)**

**NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches**

**NEMA FU 1 (1986) Low Voltage Cartridge Fuses**

**NEMA ICS 1 (1993) Industrial Control and Systems**

**NEMA ICS 2 (1993) Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC**

**NEMA ICS 4 (1993) Terminal Blocks**

**NEMA ICS 6 (1993) Industrial Control and Systems Enclosures**

**NEMA KS 1 (1990) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)**

**NEMA MG 1 (1993, Rev. 1) Motors and Generators**

**NEMA MG 10 (1983; R 1988) Energy Management Guide for Selection and Use of Polyphase Motors**

**NEMA MG 11 (1977; R 1992) Energy Management Guide of Selection and Use of Single-Phase Motors**

- NEMA RN 1 (1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- NEMA ST 20 (1992) Dry-Type Transformers for General Applications
- NEMA TC 2 (1990) Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
- NEMA TC 3 (1990) PVC Fittings for Use with Rigid PVC Conduit and Tubing
- NEMA TC 13 (1993) Electrical Nonmetallic Tubing
- NEMA TC 14 (1984; R 1986) Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings
- NEMA VE 1 (1991) Metallic Cable Tray Systems
- NEMA WD 1 (1983; R 1989) Wiring Devices
- NEMA WD 6 (1988) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (1993) National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)

- UL 1 (1993; R 1993, Bul. 1994) Flexible Metal Conduit
- UL 4 (1986; Bul. 1993, R 1995) Armored Cable
- UL 5 (1985; R 1990, Bul. 1990) Surface Metal Raceways and Fittings
- UL 5A (1994) Nonmetallic Surface Raceways and Fittings
- UL 6 (1993; Bul. 1993) Rigid Metal Conduit
- UL 20 (1986; Errata 1988, R 1993, Bul. 1993) General-Use Snap Switches
- UL 44 (1991; Bul. 1993, 1994, and 1995, R 1994) Rubber-Insulated Wires and Cables
- UL 50 (1992; R 1994, Bul. 1993 and 1994) Safety Enclosures for Electrical Equipment
- UL 67 (1993; R 1994) Panelboards

UL 83	(1991; Bul. 1993, 1994, and 1995, R 1994) Thermoplastic-Insulated Wires and Cables
UL 198C	(1986; Bul. 1991, 1992, and 1993, R 1993) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198E	(1988; R 1988, Bul. 1991, 1992, and 1993) Class R Fuses
UL 198H	(1988; Bul. 1991, 1992, 1993, and 1994, R 1993) Class T Fuses
UL 360	(1986; Bul. 1991, R 1994) Liquid-Tight Flexible Steel Conduit
UL 467	(1993; Bul. 1994) Grounding and Bonding Equipment
UL 486A	(1991; Errata 1991 and 1992, R 1992, Bul. 1993 and 1994) Wire Connectors and Soldering Lugs for Use With Copper Conductors
UL 486B	(1991; Errata 1992, R 1992, Bul. 1994) Wire Connectors for Use with Aluminum Conductors
UL 486C	(1991; R 1992, Bul. 1994) Splicing Wire Connectors
UL 489	(1991; Bul. 1992, 1993, 1994, and 1995, R 1994) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 498	(1991; Bul. 1993, 1994, and 1995, R 1994) Attachment Plugs and Receptacles
UL 506	(1994; R 1994, Bul. 1994) Specialty Transformers
UL 508	(1993; Bul. 1993 and 1994, R 1994) Industrial Control Equipment
UL 510	(1994; R 1994) Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1991; R 1993, Bul. 1993 and 1994) Metallic Outlet Boxes
UL 514B	(1989; Errata 1991, R 1993, Bul. 1993 and 1994) Fittings for Conduit and Outlet Boxes
UL 514C	(1988; R 1989, Bul. 1993 and 1994) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 719	(1985; Bul. 1993 and 1994, R 1994) Nonmetallic-Sheathed Cable
UL 797	(1993; Bul. 1993) Electrical Metallic Tubing

- UL 845 (1995) Motor Control Centers
- UL 854 (1991; Bul. 1993, 1994, and 1995, R 1994) Service-Entrance Cables
- UL 857 (1994; R 1994) Busways and Associated Fittings
- UL 869 (1989; R 1991, Bul. 1992, 1993, and 1995) Service Equipment
- UL 870 (1991) Wireways, Auxiliary Gutters, and Associated Fittings
- UL 886 (1994; R 1994, Bul. 1994) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
- UL 943 (1993; Bul. 1993, 1994, and 1995, R 1995) Ground-Fault Circuit Interrupters
- UL 984 (1991) Hermetic Refrigerant Motor-Compressors
- UL 1010 (1991; R 1991, Bul. 1993 and 1994) Receptacle-Plug Combination for Use in Hazardous (Classified) Locations
- UL 1242 (1983; R 1993, Bul. 1993) Intermediate Metal Conduit
- UL 1561 (1994) Dry-Type General Purpose and Power Transformers
- UL 1569 (1983; Bul. 1991, 1993, 1994, and 1995, R 1994) Metal-Clad Cables
- UL 1660 (1994) Liquidtight Flexible Nonmetallic Conduit

1.2 RELATED REQUIREMENTS

Section 16011, "Electrical General Requirements," applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals".

1.3.1 SD-02, Manufacturer's Catalog Data

- a. Receptacles
- b. Circuit breakers
- c. Switches
- d. Transformers

- e. Enclosed circuit breakers
- f. Motor controllers

1.3.2 SD-04, Drawings

- a. Panelboards
- b. Transformers

1.3.3 SD-19, Operation and Maintenance Manuals

- a. Electrical Systems

1.3.3.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system. This shall include:

- a. Single line diagram of the "as-built" electrical system. Indicate point of attachment to existing building electrical system.
- b. Schematic diagram of electrical control system. Reference Section 16900, Controls and Instrumentation.
- c. Manufacturers' operating and maintenance manuals on active electrical equipment.

1.4 QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or words of similar meaning, to mean Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall be rigid steel (zinc-coated) conduit, rigid nonmetallic conduit, and liquid-tight flexible conduit, conforming to the following:

2.2.1 Rigid Steel Conduit (Zinc-Coated)

ANSI C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, in accordance with NEMA TC 2, or fiberglass conduit, in accordance with NEMA TC 14.

2.2.3 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.4 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.4.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.5 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3.

2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic. Provide outlet box with plastic cover and UL listed as raintight while in use.

2.4 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 1640 mL (100 cubic inches), UL 50, hot-dip, zinc-coated, if sheet steel.

2.5 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.5.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

### 2.5.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

### 2.5.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

### 2.5.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

- a. 208/120 volt, 3-phase
  - (1) Phase A - black
  - (2) Phase B - red
  - (3) Phase C - blue
- b. 480/277 volt, 3-phase
  - (1) Phase A - brown
  - (2) Phase B - orange
  - (3) Phase C - yellow
- c. 120/240 volt, single phase: Black and red

### 2.5.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83.

### 2.5.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

## 2.6 SPLICES AND TERMINATION COMPONENTS

UL 486A for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

## 2.7 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. Plates installed in wet locations shall be gasketed and UL listed as raintight while in use.

## 2.8 RECEPTACLES

UL 498 and NEMA WD 1, general grade, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory thermosetting plastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. Duplex receptacles shall be 15 amperes, 125 volts, No. 5242.

### 2.8.1 Weatherproof Receptacles

Receptacle shall be UL listed for use in "wet locations with plug in use."

### 2.8.2 Ground-Fault Circuit Interrupter (GFI) Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFI devices.

## 2.9 PANELBOARDS

UL 67 and UL 50. Panelboards for use as service disconnecting means shall additionally conform to UL 869. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated. Panelboard locks shall be keyed same. Directories shall indicate load served by each circuit of panelboard. Directories shall also indicate source of service (upstream panel, switchboard, motor control center, etc.) to panelboard. Type directories and mount in holder behind transparent protective covering.

### 2.9.1 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.10 MOTOR CIRCUIT PROTECTORS (MCP)

Motor circuit protectors; NEMA AB 1 and UL 489. MCPs shall consist of an adjustable instantaneous trip circuit breaker in conjunction with a combination motor controller which provides coordinated motor circuit overload and short circuit protection. MCPs shall be rated in accordance with NFPA 70.

2.11 TRANSFORMERS

NEMA ST 20, general purpose, dry-type, self-cooled, ventilated. Provide transformers in NEMA 3R enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

2.12 MOTORS

NEMA MG 1 hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of kW (HP), or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

2.12.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11.

2.12.2 High Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, polyphase squirrel-cage medium induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-6C of NEMA MG 1.

2.12.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided.

## 2.13 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

### 2.13.1 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. Provide fuses in each ungrounded primary feeder. One secondary lead shall be fused; other shall be grounded.

### 2.13.2 Enclosures for Motor Controllers

NEMA ICS 6.

## 2.14 TELEPHONE SYSTEM

Provide system of telephone wire-supporting structures, including: conduits with pull wires and other accessories for telephone service to the main control panel.

## 2.15 GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 19 mm (3/4 inch) and minimum length of 10 feet.

2.16 NAMEPLATES

Provide as specified in Section 16011, "Electrical General Requirements."

2.17 TRANSIENT VOLTAGE SURGE SUPPRESSOR

Surge Protector meeting ANSI/IEEE C62.41-1991 and UL 1449 Standards (Class B Category). Surge energy capability, 8/20 microsecond, per phase: 1520 joules minimum, multiple Metal Oxide Varistor design. NEMA 4 enclosure with phase status lamps indicating operation.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

3.1.1 Underground Service

Underground service feeder conductors and associated conduit to the treatment system main panelboard shall be continuous from the existing service entrance equipment located in the designated building.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit for all exposed wiring and PVC, rigid nonmetallic conduit for wiring below grade, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 16 mm (1/2 inch) in diameter for low voltage lighting and power circuits.

3.1.4 Conduit Installation

Run conduits as indicated on the plans. Minimum burial depth of 18".

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces.

3.1.6 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves.

3.1.7 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through walls using a firestopping material.

3.1.9 Grounding and Bonding

In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems.

3.1.10 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.2 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to system testing.

3.2.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.2.2 600-Volt Wiring Test

When, and if directed by the Contracting Officer, perform insulation resistance tests to wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.2.3 GFI Receptacle Test

Test GFI receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

END OF SECTION

**SECTION 16900  
CONTROLS AND INSTRUMENTATION**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- 1.1.1 This section covers the design, fabrication, assembly, testing, installation and placement into operation of the complete control and instrument system.
- 1.1.2 The control and instrumentation system shall be comprised of the individual sub-systems and components necessary to meet the functional requirements of the treatment process as specified in the operational plan. The control and instrument system unit processes are as follows:
  - a. Extraction piping system.
  - b. SVE/AS control system.
  - c. Catalytic Oxidizer.
  - d. Air sparge system.
- 1.1.3 The process instrument diagram indicates the functional requirements of the overall control system and the basic configuration of instruments. Process connections for field instruments and wiring not indicated on the diagrams or itemized herein are to be provided as required for complete operation of all control and instrument systems.
  - a. Provide all accessories not itemized but required to meet the operational plan of the control and instrumentation system.

**1.2 QUALITY ASSURANCE**

- 1.2.1 Equipment specified in this section shall be provided as a complete control and instrument system by one control supplier. The supplier shall be familiar with all related electrical systems and shall assume complete responsibility for engineering and furnishing the system, advising the contractor on technical matters and certifying the correctness of the installation. The supplier shall also be responsible for calibrating instruments, performing loop checks, testing, documenting and starting up the complete control and instrument system.
- 1.2.2 The control supplier shall be responsible for providing the programmable controller with all programming required to meet the operational plan. This responsibility shall also include the following:
  - a. Simulated factory testing of the program.
  - b. Field testing of the program.
  - c. Program documentation including a printed version and electronic file.
  - d. Training of the Owner in the use of the programmable controller.

- 1.2.3 The Contractor shall be ultimately responsible for a complete and coordinated control and instrument system which shall perform the specified functions. The Contractor shall coordinate work on this system with the control supplier such that the following are provided:
- a. All components provided under this section are properly installed according to the manufacturer's recommendations.
  - b. The proper type, size and number of control wires with their conduits are provided and installed.
  - c. Proper electric power circuits are provided for all components and systems.
- 1.2.4 Coordinate components specified in this Section with materials specified in Section 16920.

### 1.3 SUBMITTALS

#### 1.3.1 SD-02, Manufacturer's Catalog Data

Before any components are fabricated or integrated into panels to be wired or shipped to the site, furnish to the Engineer and receive his review of five copies of Shop Drawings including full details, catalog cut sheets and any such other descriptive matter as may be required to fully describe the equipment and to demonstrate its conformity to these Specifications.

#### 1.3.2 SD-04, Drawings

Shop Drawings as specified in this Section and Section 01340 shall include the following information to fully describe the systems.

- a. Catalog information with descriptive application literature on all major constituents of the control and instrument system as defined in this Specification.
- b. Specification data sheets on all components of the control and instrument system. Cite specific features for each component and assign it with a name tag designation.
- c. Fabrication drawings and catalog information for all control panels and enclosures.
- d. Elementary wiring diagrams of prewired panels and consoles indicating wiring to all instruments and electrical devices.
- e. Interconnecting wiring diagrams indicating all component and panel terminal board numbers. These diagrams are to be coordinated with the manufacturer supplied motor control center wiring diagrams for proper interface wiring.

Present Shop Drawings in a clear and thorough manner clearly marking each copy to identify pertinent products and models. Individually annotate catalog cut sheets to identify applicable items.

1.3.3 SD-19, Operation and Maintenance Manuals.

Submit complete Operation and Maintenance Manuals. Reference Section 01340.

PART 2 PRODUCTS

2.1 PRIMARY PLC CONTROL PANEL

2.1.1 Provide the primary system PLC control panel consisting of a single-door enclosure complete with all instrument and control components.

2.1.1.1 The enclosure shall be constructed from 14 gauge steel having continuously welded seams with body and door stiffeners from proper rigidity. The enclosure shall meet NEMA 4 requirements.

- a. Provide 12 gauge steel interior back panel for mounting all electrical equipment.
- b. Provide a cylinder-type lock with a t-type door handle.
- c. Following fabrication, the panel section shall be decreased, bonderized, finished smooth with epoxy filler, sanded and sprayed with a rust inhibiting alkyd primer.

2.1.2 Arrange components in the panel in a neat manner corresponding with status devices located on the enclosure door. Arrange components on the enclosure door as indicated on the drawings.

- a. All electrical wiring within the panels shall be suitable identified, bundled and bound with plastic slip lock straps terminated on numbered terminal strips.
- b. Use #16 AWG stranded control wires with 1/64 inch type MW thermoplastic insulation. All wires to be identified at both ends with Brady adhesive wraparound markers.
- c. Identify the terminal ends of control wires by number which shall conform to the wiring connections shown on the Shop Drawings. Terminate connections within the panel at the bottom of the panel on terminal blocks with all external connections properly identified for field connections.

2.2 PROGRAMMABLE CONTROLLERS

2.2.1 Provide programmable controller systems complete with power supply, processor, input/output interface, all mounting racks, cables, connectors and miscellaneous devices needed for complete functional assemblies.

- 2.2.1.1 All components shall be from a family of modular equipment exhibiting the following environmental characteristics.
  - a. Operational temperature: 0-60°C.
  - b. Operational humidity: 5-95% non-condensing.
  - c. EMI immunity per IEEE 472-1974.
  - d. Shock and vibration resistant.
  
- 2.2.2 Provide the PLC and I/O racks with power supplies exhibiting the following characteristics:
  - a. Primary power - 98-132 VAC, 47-63 Hz (nominal 120 VAC @ 60 Hz).
  - b. Internal constant voltage source capable of withstanding high voltage spikes and brownouts without external protection.
  - c. Provides all voltages required by controller and/or local rack mounted auxiliary devices and I/O.
  - d. Distribute power on local rack backplane bus.
  - e. Front mounted on/off switch, line fuse, and power on/status indicators.
  - f. Clearly identified and protected power terminals.
  
- 2.2.3 Provide the PLC with sufficient number of input/output modules to accommodate design requirements. Provide modules for system with the following characteristic:
  - a. Suitable for harsh environment, meet IEEE 472 surge standards.
  - b. Utilize high density modules wherever possible.
  - c. Front mounted point status indicators for each I/O point.
  - d. Provide 20 percent spare digital inputs and outputs with a minimum of four points of each type.
  - e. Provide two spare analog inputs and one spare analog output.
  - f. Locking tab or screw to prevent unintentional movement of module.
  - g. Removable screw terminal wiring connectors to ease in wiring modules.
  - h. Output models shall be provided with self contained fuses for overload and short circuit protection of the module. Modules shall have an indicator that shows fuse status.

- i. Isolation shall be used between all internal and external power circuits. This isolation shall meet the minimum specification of 1500 VRMS.
- j. I/O addressing shall be flexible and configured via software setup.

2.2.4 Provide the PLC with a mounting rack exhibiting the following characteristics:

- a. Mounting slots for the PLC, power supply and all I/O.
- b. Provide 10 percent spare slots per rack with a minimum of two slots.
- c. Capable of each slot being keyed, so as to allow only a single type of module to be inserted in any given slot.
- d. Compatible with all controllers, power supplies, I/O and auxiliary rack mounted devices.
- e. In multiple rack system, all racks are to be identical.

2.2.5 The programmable controller shall exhibit the following characteristics:

- a. 8K CMOS RAM memory, EEPROM backed completely.
- b. 16 bit word structure.
- c. Built-in real time clock calendar, 5 year lithium battery backed.
- d. Memory protect keyswitch.
- e. Two front mounted programming and interfacing ports.
- f. Front mounted LED's to indicate processor, remote I/O and battery status.
- g. Self-diagnostics and error checking.
- h. Address a minimum of 256 I/O.

2.2.5.1 Ability to connect to a data communication network via a leased line telephone modem.

- a. Hosted network, minimum 19.2k baud.
- b. Computer and/or graphics interface communications.
- c. Front mounted, easily accessible connections.
- d. Utilizing low cost reliable cabling.
- e. Minimum network length 1500 feet.

2.2.5.2 Ability to connect to a local operator interface panel with front mounted connections.

**2.2.5.3 Programming and execution.**

- a. User programmed in ladder logic, and predefined functions including:
  - 1) Relay logic.
  - 2) Timers.
  - 3) Counters.
  - 4) One shots.
  - 5) Latches.
  - 6) Math with minimum of addition, subtraction, multiplication, division and square root.
  - 7) Data conversion.
  - 8) Comparison: =, <, >.
  - 9) Data transfer.
  - 10) Sequencer functions.
  - 11) Subroutines.
  - 12) MCR functions.
  - 13) Word, table, and file instructions.
  - 14) PID control with up to 8 loops.
  - 15) Floating point math and word storage.
- b. Scan rate, typical 1 ms per K of user program.
- c. Programmable from either the PLC communication port or over dial-up telephone lines.

**2.2.6 Size system I/O requirements as necessary for system requirement. Refer to wiring diagrams. Use this only as a reference for minimum I/O requirements.**

**2.2.7 Accessories.**

**2.2.7.1 Constant voltage source for clean power to PLC I/O rack and I/O.**

- a. Provide a constant voltage source transformer, single-phase, sized to allow minimum 250 VA over nominal load for the PLC system.
- b. Manufacturer.
  - 1) Sola.

2.2.7.2 Provide a telephone modem which shall reside in the PLC control cabinet, two matching modems for use at the base maintenance office and a fourth modem for use by the Engineer. They shall all exhibit the following characteristics:

- a. Fully Hayes compatible
- b. Meets CCITT V.32 and Bell 212A & 203 standards.
- c. MNP Class 5 Data compression.
- d. Automatic Error detection, speed detection and fallback.
- e. Ability to communicate over dial-up and leased lines.
- f. Serial cable for connection to the PLC.

2.2.8 Documentation.

- a. Provide four complete sets of assembly and installation manuals for all equipment.
- b. Provide four complete sets of programming manuals for processor and intelligent I/O modules.

2.2.9 Provide a recommended spare parts list for complete system.

## 2.3 PROGRAMMABLE CONTROLLER PROGRAMMING SOFTWARE

2.3.1 Provide a software package used to program the PLC exhibiting the following characteristics:

2.3.1.1 Develop and edit program off-line and on-line using an IBM-AT compatible personal computer.

2.3.1.2 Complete ladder annotation.

- a. Minimum of 24 characters in 3 rows for description of each instruction.
- b. Rung description.
- c. Long detailed description.
- d. Page titles.
- e. Coil-rung cross references.

2.3.1.3 Complete cross reference report.

- a. Bit cross reference.
- b. Timer cross reference.

- c. Counter cross reference.
- d. Word cross reference.
- 2.3.1.4 Rack I/O location report.
- 2.3.1.5 Data table utilization report.
- 2.3.1.6 Undescribed instruction report.
- 2.3.1.7 Unused instruction report.
- 2.3.1.8 Ability to monitor and program over dial-up telephone line, using modems.
- 2.3.2 Provide all hardware, cards, cables, keys, manuals, etc. required to program, edit and monitor logic both on-line and off-line.
- 2.3.3 Provide one complete set of manuals and software to engineer within one week of shop drawing acceptance.
- 2.3.4 Provide complete and extensive operating and troubleshooting instructions pertaining to software use.
- 2.3.5 Provide three complete sets of manuals pertaining to the use of the programming and documentation software.
- 2.4 LOCAL OPERATOR INTERFACE PANEL
  - 2.4.1 Provide an industrial terminal with a CRT, integral key sealed membrane keypad, integral ten function key keypad that is directly compatible (no separate module between the terminal and modbus) with Modicon programmable controller.
    - 2.4.1.1 The terminal shall be NEMA 4X, panel mounted with sealed membrane data entry keypads and impact resistant Lexan CRT shield.
    - 2.4.1.2 Screen format.
      - a. 25 rows x 80 characters.
      - b. 5x7 characters in 8x10 cells.
    - 2.4.1.3 Character set.
      - a. Full ASCII character set.
      - b. Thin line and block graphics.
      - c. Large and small process graphic symbols.
    - 2.4.1.4 Serial interface.
      - a. Standard a synchronous RS-232C.
      - b. Baud rates: 300-19.2 k.

2.4.1.5 Miscellaneous.

- a. Tamper proof password security.
- b. Built-in self diagnostics.

2.4.1.6 Approved Manufacturers:

- 2.4.2 Provide all hardware, cards, cables, keys, manuals, etc. required to program, edit and monitor system.

2.5 PERSONAL COMPUTER MAINTENANCE OFFICE

- 2.5.1. Provide a DOS-based personal computer system exhibiting the following characteristics.

- a. Provide a Pentium processor with a clock speed not less than 75 MHz.
- b. Minimum 16 MB of RAM.
- c. 5¼" 1.2 MB floppy drive.
- d. 3½" 1.44 MB floppy drive.
- e. 1 GB hard drive.
- f. 240 MB external tape backup unit, Colorado Memory Systems Trakker 250 MB.
- g. 4 available I/O expansion slots.
- h. Real time clock with battery backup.
- i. Floppy and hard disk controllers.
- j. 220 watt power supply and fan.
- k. Minimum of two serial ports and two parallel ports and mouse port.
- l. 101 key enhanced keyboard.
- m. 17" VGA monitor with resolution of not less than 1024 x 728.
- n. VGA graphics adapter card supporting resolutions of not less than 1024 X 768 with 1 MB on board.
- o. Microsoft or compatible 2-button bus mouse.

- 2.5.2 Provide an alarm printer for the Operator Interface system meeting the following specifications.

- a. Supported with drivers by the specified Operator Interface software package.
- b. 24 pin dot matrix or inkjet type transfer.

- c. Print speed of no less than 200 cps in draft mode.
- d. Tractor feed (if applicable).
- e. Print up to 80 characters wide.
- f. Centronics parallel interface.
- g. Provide with printer stand and paper guiding rack.
- h. Provide with 2 years supply of ribbons or toner cartridges.
- i. Approved Manufacturer.
  - 1). Epson.
  - 2). Approved Equal.

2.5.3. Provide a report printer for the Operator Interface system meeting the following specifications.

- a. Supported with drivers by the specified Operator Interface software package.
- b. Color inkjet type transfer.
- c. Print speed of no less than 200 cps in draft mode.
- d. Single sheet feed, 200 sheet tray capacity minimum.
- e. Print up to 80 characters wide.
- f. Centronics parallel interface.
- g. Provide with 2 years supply of cartridges.
- h. Approved Manufacturer.
  - 1). Hewlett Packard.
  - 2). Canon.
  - 3). Approved Equal.

2.6 DATA ACQUISITION AND SUPERVISORY CONTROL

2.6.1 The data acquisition and process control software shall be an icon-based, mouse-driven, multitasking, MS-Windows compliant software system. The software shall have object-oriented graphics with a fully integrated Control Strategy builder and Runtime software packages which includes:

- a. Operator display builder.
- b. Configuration manager.
- c. Report generator/data logger.

- d. Alarm monitoring, supervising and logging.
- e. Dynamic real-time and historical trending.
- f. Connectivity and networking.

The software shall support the hardware selected. No additional programming beyond that which is already provided by the software vendor shall be required.

#### 2.6.2 Device Driver(s) / Communications Interfacing

The software package shall be provided with the necessary device drivers to provide high speed communications between the PLC and the computer. The device driver will most likely utilize the Windows DDE communications channel to bring the information into the operating environment for use by the interface package.

The device driver shall not require any high level programming. The driver shall only require an initial configuration to layout and define memory address locations within the PLC that are required for the interface software package. Once configured, the driver shall not require any further work other than that associated with adding or modifying tags or locations.

The operator interface software package shall communicate with the device driver to access the memory locations within the PLC and shall utilize that information to update the status of its own internal database for those tags or locations. The device driver and interface package shall together monitor the communications and in the event that communications is lost or not complete shall provide the system with status or alarm messages describing the fault or error.

The interface package and device driver combination shall be a combination that has been utilized successfully in similar applications. It shall be field proven and shall provide a high level of reliability. It shall be the responsibility of the Seller to provide project references where the combination of device driver/interface package has been utilized on no less than three other sites.

The device driver shall be the same or similar to that manufactured by Radisys for this type of application.

#### 2.6.3 Operator Display Builder

The operator display builder shall provide capabilities for creating custom displays, reports and recipes, specific to the applications. Object-oriented graphics capability is required.

The display builder must be compatible with the video monitors selected for the control system and must support mouse-driven operator interactions.

A minimum of 200 screens shall be provided. The display builder shall be capable of the following functions, as a minimum:

- a. Create custom symbols
- b. Color fills

- c. Display animation
- d. Trend variables
- e. Dynamic reports

The following minimum functions shall be available:

- a. Draw
- b. Erase
- c. Circle
- d. Rectangle
- e. Line
- f. Color fill
- g. Curve fitting
- h. Rotating
- i. Overlaying
- j. Dragging
- k. Copying
- l. Zooming
- m. Panning

The operator display builder shall have at least 100 levels of password security to provide selective access to system operations and control strategies configuration.

#### 2.6.4 Configuration Manager

The configuration manager shall allow the operator, with the proper level of password, to graphically create and edit data acquisition and control strategies as required.

An extensive algorithm, function block library or scripts shall be available in the software including:

- a. I/O / Tagname definition.
- b. Calculation (lead/lag, dead time, characterizer, filter).
- c. Boolean logic (AND, OR, exclusive OR, NAND, NOR, Pulse, Flip-Flop).
- d. Arithmetic operation (+, -, x, ÷).
- e. Integration and differentiation.

- f. Batch functions (ramp, sequencer, on-delay and off-delay timer, single shot, counter).
- g. String/variable manipulation.
- h. Report generator/data logger.

Database tagnames shall be defined in English with the capability to give meaningful names to tags. The tagnames shall be capable of names a minimum of 16 characters long.

A report generator/data logger shall allow a minimum of 100 tags to be logged, either in user-defined events or conditions, or in a long term historical collection file system. Logs shall be printed periodically, on demand, or upon event changes. The report generator/data logger shall produce reports in an ASCII or user-defined format.

The report files can be printed, displayed, stored on the disk or backup tape.

#### 2.6.5 Alarm Monitoring, Supervising and Logging

The alarm supervisor shall be capable of handling up to 500 alarms, depending on the available memory size. The alarm supervisor shall support analog and floating point, as well as digital alarms.

The alarm supervisor shall prioritize the alarm, allow the alarms to be masked during start-up, sort alarms by time and priority, group all alarms into user-defined alarm groups, alert the operator of alarm conditions, display the alarm condition and its message, display a summary of all active messages within a group, acknowledge and clear single alarms or alarm groups, log alarm in a historical file, and print alarm and the message.

#### 2.6.6 Dynamic Real-time and Historical Trending

Trending of user-defined analog or digital variables shall be provided on a real time and historical basis. The trending package shall allow trends of variables to be stored on a timed, interval-driven or on a triggered, event-driven basis. A minimum of five trended variables at a time shall be displayed on the video displays.

The time interval and sample rate shall be user-selectable for each trend. When displaying historical trends, different sets of data can be viewed by using function keys to "pan" horizontally through time or "zoom." Trending files shall manually be transferred to the tape drive for archiving the data alarm when available memory space is reached. The format of the trend or historical log files shall be Comma Delimited Format (CDF) or another format which is common and is importable into most popular spreadsheet and database packages.

#### 2.6.7 Connectivity & Networking

The supervisory control and data acquisition shall be 100% compatible with standard office type local area networks. The system shall allow access to the data, file transfer and alarm messages to be passed on to all video displays and devices in a network.

2.6.7 Interface to Windows-based Software

The supervisory control and data acquisition software shall be compatible with Microsoft Windows (latest release) and shall support third party Windows-based software, such as Microsoft Word, EXCEL and Lotus 1-2-3 via Dynamic Data Exchange (DDE).

2.7 GAGE PRESSURE TRANSMITTER

2.7.1 Provide sealed gage pressure transmitters for gage pressure measurement of a gas (air mixed with gasoline vapors). Transmitter measurement capsule shall consist of a thin-film metallic resistance sensing element and a diaphragm seal.

2.7.2 Gage pressure transmitters shall meet the following functional specifications.

- a. Power supply: 18-32 VDC, no-load
- b. Output: 4-20 mA d-c, two-wire
- c. Lightning suppression: 500 watts for 1 ms; 8.5 amp peak surge current at 1 ms; 36 volt minimum clamping voltage
- d. Approvals: FM approval Class 1, Division 1, groups B, C, and D. NEMA 4 housing.
- e. Span and Zero: continuously adjustable
- f. Operating temperature:  $-40^{\circ}$  to  $180^{\circ}$ F
- g. Turndown ratio: 3:1
- h. Accuracy:  $\pm 0.25\%$  of calculated span including the combined effects of linearity, hysteresis, and repeatability
- i. Range: reference instrument wiring diagrams

2.7.3 Gage pressure transmitters shall meet the following physical specifications:

- a. Construction materials: Electronic housing shall be 304 stainless steel. Process diaphragm shall be Hastelloy C-22. Process flange shall be stainless steel.
- b. Process connection:  $\frac{1}{2}$ " NPT with reducing bushing  $\frac{1}{2}$ " to  $\frac{1}{4}$ " NPT
- c. Electrical connection:  $\frac{1}{2}$ " conduit
- d. Tagging: stainless steel tag engraved to match PID designation

2.7.4 Provide gage pressure transmitters for the following instruments:

2.8 DIFFERENTIAL PRESSURE TRANSMITTER

2.8.1 Provide differential pressure transmitters for measuring the differential pressure of gases. Transmitter measurement capsule shall consist of two measuring diaphragms and a vapor filled thin-film metallic resistance element deposited on a flexing beam.

2.8.2 Differential pressure transmitters shall meet the following functional specifications.

- a. Power supply: 18-32 VDC, no-load
- b. Output: 4-20 mA d-c, two-wire
- c. Lightning suppression: 500 watts for 1 ms; 8.5 amp peak surge current at 1 ms; 36 volt minimum clamping voltage
- d. Approvals: FM approval Class 1, Division 1, groups B, C, and D. NEMA 4 housing.
- e. Span and Zero: continuously adjustable
- f. Operating temperature: -40° to 180°F
- g. Turndown ratio: 3:1
- h. Accuracy:  $\pm 0.25\%$  of calculated span including the combined effects of linearity, hysteresis, and repeatability
- i. Range: reference instrument wiring diagrams

2.8.3 Differential pressure transmitters shall meet the following physical specifications:

- a. Construction materials: Electronic housing shall be 304 stainless steel. Process diaphragm shall be Hastelloy C-22. Process flange shall be stainless steel.
- b. Process connection:  $\frac{1}{4}$ " NPT
- c. Electrical connection:  $\frac{1}{2}$ " conduit
- d. Tagging: stainless steel tag engraved to match PID designation

2.8.4 Provide differential pressure transmitters for the following instruments:

2.9 TEMPERATURE TRANSMITTERS

2.9.1 Provide RTD detectors, thermowells, detector heads, and temperature transmitters for the specified temperature ranges.

- 2.9.2 Provide coil-of-wire RTD detectors complete with thermowell for the specified piping configurations and temperature range.
- 2.9.3 Provide RTD temperature transmitters designed for mounting in the detector head. Transmitter shall meet with the following specifications.
  - a. Power: 11-42 VDC
  - b. Output: 4-20 mA d-c
  - c. Input: RTD 2W
  - d. Mounting: unit mounted with explosion proof Class 1, Division 1 enclosure
  - e. Input range: reference instrument wiring diagrams
- 2.9.4 Provide complete temperature transmitter assemblies for the following instruments:

## 2.10 PRESSURE SWITCH

- 2.10.1 Provide adjustable set point pressure switches with adjustable deadband with two (2) SPDT switches, 15 amp, 120 volt.
- 2.10.2 Reference the instrument panel wiring diagrams for the pressure switch operating range, the adjustable deadband range, and the switch enclosure rating.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- 3.1.1 Coordinate all equipment and services provided under this section with electrical equipment furnished under other sections of this Specification.
- 3.1.2 Install all components as listed in this Specification making all electrical connections in accordance with the Drawings and/or with accepted manufacturer's Shop Drawings, if they differ, at no extra cost.

### 3.2 TESTS

- 3.2.1 The control instrument supplier shall check the control instrument system components to verify proper installation and determine whether the systems are ready to operate as specified.
- 3.2.2 All setpoint settings shall be checked and tabulated and their operation demonstrated prior to a complete system check (e.g., contact closures, alarms, interlock functions).

3.2.3 A functional acceptance test shall be performed on a unit process basis by the control instrument supplier, and each function shall be demonstrated to the satisfaction of the Engineer.

- a. The control instrument supplier shall notify the Engineer at least two weeks prior to the functional acceptance test.
- b. The control instrument supplier shall prepare sheets for each unit process itemizing each component and check off each component's proper operation, installation, calibration setting, etc.

### 3.3 SYSTEM ACCEPTANCE

3.3.1 System acceptance shall be defined as follows:

- a. All submittals accepted and full documentation on all systems reviewed.
- b. Successful completion of all testing.
- c. Training program complete.

END OF SECTION