CONSTRUCTION SSTANDARD SPECIFICATION

SECTION 13960

CARBON DIOXIDE FIRE DETECTION AND SUPPRESSION SYSTEM

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PART 1 - GENERAL

1.01 SUMMARY

This specification, in conjunction with the contract documents and drawings, indicates the materials and operations required for the design and installation of a certified and Factory Mutual (FM) approved centralized carbon dioxide (CO_2) fire detection/suppression. Requirements for the design and installation of fire protection systems shall include calculations, shop drawings, equipment, pipe, fittings, valves, alarm initiation and supervisory devices, control heads, discharge systems, operating instructions, maintenance manuals, identification, and tests.

The CO_2 fire detection and suppression systems shall be designed and installed to meet FM approval. After contract award the contractor shall provide Sandia National Laboratories (SNL) with a detailed design and construction schedule that coordinates contractor activities.

The CO_2 supply shall be a centralized system consisting of a bank of high-pressure cylinders supplying multiple systems. The centralized CO_2 supply shall have a same-sized back-up reserve.

Visual and audible alarms for system discharge activation shall be provided. The control panel shall energize a set of contacts when the system discharges and a separate set of contacts when the system is not functioning normally or is in a "trouble" state. These contacts shall monitor the system through the SNL Notifier Alarm Control Panel.

Any variation, clarification or apparent conflict from within this specification shall be submitted to the Sandia Delegated Representative (SDR).

1.02 REFERENCES

A. SNL Standard Construction Specification 01330, "Submittal Procedures"

B. Factory Mutual Research Corporation (FM) Approval Guide

C. National Fire Protection Association (NFPA) Standards and Recommended Practices

12 Standard on Carbon Dioxide Extinguishing Systems
70 National Electrical Code®
72 National Fire Alarm Code®
318 Standard for the Protection of Semiconductor Fabrication Facilities

For interpretation of the above NFPA Standards and this document, the "Authorities Having Jurisdiction" referred to in the Standards shall be the Sandia Delegated Representative (SDR), or the designated representative of SNL Fire Protection Engineering.

D. Underwriters' Laboratories, Inc. (UL) Fire Protection Equipment Directory

E. American Society for Testing and Materials (ASTM)
A269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A370 Standard Methods and Definitions for Mechanical Testing of Steel Products
A632 Seamless and Welded Austenitic Stainless Steel Tubing, (Small Diameter) for General Service
A-262 Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
E-112 Standard Test Method for Determining Average Grain Size

F. American National Standards Institute (ANSI)
B31.1 Code for Pressure Piping, Chemical Plant and Petroleum Refinery Piping
B46.1 Surface Texture, Surface Roughness, Waviness and Lay

G. American Society of Mechanical Engineers (ASME)
Section IX, Welding Qualifications

1.03 SYSTEM DESCRIPTION

A. Design

1. The designer of the fire protection systems shall meet one of the requirements below.

a. A registered Professional Fire Protection Engineer in the State of New Mexico. The registered Professional Engineer shall stamp all plans. The contractor is responsible for the design and installation of the fire protection system, including seismic supports, in accordance with these specifications and the contract drawings. The contractor shall coordinate with architectural, civil, mechanical, and electrical, design and construction documents, to ascertain the required information, to affect a properly designed carbon dioxide fire protection system.

b. National Institute for Certification in Engineering Technologies (NICET) Level IV for Special hazards Systems. Where NICET design is used, copies of the designer's certificates from NICET shall be submitted along

with the drawings for approval. The registered Professional Engineer shall stamp all other plans.

2. The design of the carbon dioxide fire protection system shall be complete with all necessary accessories for proper operation. System design and installation shall reflect high quality professional work that properly accounts for practical maintenance concerns and aesthetic concerns, as well as meets the design density requirements.

3. The fire protection supply tubing, controlling devices, protective devices, alarm systems, supervisory devices, and related equipment shall be compatible so that all equipment shall function together as specified.

4. The design shall comply with all mandatory, advisory interpretations, and recommended applicable rules of the latest editions of the referenced codes and standards in Part 1.02, "References," except where otherwise noted on the drawings or specified herein.

5. The contractor shall produce design drawings (design files) that indicate the extent and arrangement of the fire protection systems. Submit “first draft” design/installation drawings fully detailing the detection and suppression system installation. These drawings shall be detailed enough for Sandia National Laboratories to evaluate and provide comments on the design. Submit subsequent sets of design/installation drawings fully detailing the detection and suppression system installation. These drawings sheets shall be required until Sandia National Laboratories and FM give final approval for the design. Design documents shall also require design calculations, flow calculations, power calculations, and data sheets as a minimum.

6. Unless indicated in the contract, drawing(s) refers to the plotted hard copy document or print and the electronic computer aided drafting design (CADD) file.

7. The designer shall coordinate location of all utility penetrations through waffle pop-outs with the SDR during the design and construction process.

1.04 SUBMITTALS

Provide as required by Section 01330, “Submittal Procedures”.

A. As soon as practicable after award of contract and prior to fabrication, the Contractor shall submit to the SDR for approval, complete design submittals. Design submittals package shall include:

2. Paper copies and electronic (if available) of manufacturers' catalog data, system and component operating instructions, and paper and electronic copies of calculations, and seismic calculations, etc.

3. Paper copies and electronic copies of graphic design drawings (CADD files) indicating detailed layout of system, locating each component. Include control diagrams, wiring diagrams, written sequence of operation, internal tubing, and wiring details and any other graphic drawings to clearly delineate the design.

4. If welded joints are to be used in the system installation, then the Contractor shall provide a paper copy and electronic (if available) of the welding procedure to be used, the quality assurance procedure and the welder's qualifications.

B. No installation shall be permitted prior to SNL approval of the complete shop drawings, calculations, and materials submittal. This applies to all jobs, regardless of size or scope.

C. Electronic Design Submittal

1. All manufacturers' catalog data, system and component operating instructions, design drawings, and calculations (hydraulic and seismic) for the fire protection system shall be included in the deliverable file package as follows. The fire protection deliverable package, both CADD and non-CADD shall be delivered to Sandia in printed format (hard copy), quantity to be determined by SDR, in addition to one electronic copy. Microsoft Word, Microsoft PowerPoint, Microsoft Project, Microsoft Access, and Bentley Microstation are the required software (versions suitable for Windows) to be used. In addition to electronic copies of the bond (paper) documentation, the contractor shall provide electronic copies of all engineered calculated project software in the format originally generated (i.e., FireAcad, HASS, Hydronics, HyperCalc, etc.). Where these software packaged cannot be used, the contractor shall produce the documents in portable document file (PDF) format, or scanned image in *.jpg or *.bmp format. All files shall be returned with the file name, description/content, software and software version requirements listed. All deliverable data, designs, records, graphics, and supporting tools are the property of SNL. SNL also has the right to provide any of this information to others, as it deems appropriate.

2. All graphic design drawings shall be plotted CADD files. CADD files shall follow SNL File Naming conventions, and utilize a SNL border title block.

3. Floor Plans

a. All fire protection floor plans shall reference architectural floor plans.

b. Files shall be completed at a one-to-one scale.

c. Each floor shall be a single file (i.e., MicroStation – Master Floor Plan, or AutoCAD – Model File).

d. Orientation of North, key play breakout shall match architectural construction of floor plans.

e. Unless otherwise specified, new floor plans and full height cross sections shall be plotted at ¼"=1' 0".

4. All requirements listed under submittals apply regardless of use of MicroStation or AutoCAD.

D. MicroStation V8: SNL Facilities maintains MicroStation V8 for Windows/2000, as its standard CADD software. To maximize efficiency, SNL will provide a custom MicroStation V8 workspace environment, which includes toolboxes, tool frames,

macros, MicroStation Development Language (MDL) application, user commands, help routines, and menu bars to help in the production of facilities CADD files.

AutoCAD 2000 may be used in lieu of MicroStation V8 under the condition that the following requirements shall be met:

1. The translated MicroStation architectural floor plan must be referenced into AutoCAD model. Each AutoCAD model shall show the Fire Protection Design for a given floor. The model shall include all required design information from NFPA 12.

2. The SNL Fire Protection border files must be copied into all project sheets (layout tabs). Each layout tab shall contain border, keyed notes, general notes, details, and title block information. Each layout tab shall be identified (labeled) with correct SNL plotted file name.

3. All data, designs, records, graphics and supporting tools generated during project creation shall be included in the deliverable file package.

4. Any fonts, line styles, or blocks used to generate these files that are not AutoCAD 2000 standard must be submitted as part of the deliverable package.

5. All Fire Protection Layers shall follow CAD Layer Guidelines, 2nd edition or newer, established by the American Institute of Architects.

6. A table, listing all line, text, and block information shall be created within each design file just outside of the plotted area. Information to include: layer names, color, pen width association, line style, description, text size, block names and identification of frozen layers.

7. Any blocks used that do not match the SNL provided symbols, located on the Fire Protection Borders File, must have written prior approval from the SDR and be reflected in the files border legend.

E. Graphic Design Presentation

1. Drawings shall show all details required or recommended by NFPA 12, for "Working Plans" in addition to the following:

   a. Name and room number shall appear in each room.

   b. Building column, grid lines and grid labels.

   c. New construction shall be clearly delineated on the drawing. Use SNL ballooning process.

   d. All lines and details shall be shown. Specifying "opposite hand" is not acceptable.

   e. Pipe lengths shall be shown, center-to-center of fittings.

   f. Where more than one type of pipe is used, each piece of pipe shall be identified as to type on the drawing file.

g. No lettering shall be smaller than 1/8" plotted height.

2. Files shall be laid-out and plotted to be identical, (i.e., sheet breakout, size, scale, orientation, key plan, column grids, room names and numbers and project title), to the original building construction contract drawings.

F. As-Built Drawings:

1. Upon completion of the installation, the Contractor shall revise all Fire Protection Design files, calculations, manuals, operating instructions to agree with the construction as actually accomplished. The notation "As-Built" shall be entered in the revision block, dated and initialed. All as-built records shall follow the requirements listed under 1.05 Submittals.

2. Fire Protection Design files must be requested from SNL prior to as-builts. As-builts shall be reflected on the existing design file records.

3. The as-built files, whether on new or original contract shall show the entire CO2 system, existing and new construction, as it exists at the completion of the contract work. Delete all references to "new work," "existing," "NIC," etc.

4. As-built submittals shall be submitted to the SDR prior to the final acceptance testing. This delivery shall include BOTH electronic and hard copies.

5. Final calculations shall reflect the "As-Built" condition. These calculations must be submitted before final acceptance testing by SNL.

1.05 QUALITY ASSURANCE

A. General: Where specific manufacturers or model numbers are mentioned in these specifications, proposed substitutions shall be included in the submittal package furnished to the Sandia Delegated Representative (SDR) for approval after contract award and before installation.

B. Warranty: All system components furnished under this contract shall be guaranteed against defective design, materials, and workmanship for the full warranty time, which is standard with the manufacturer and/or supplier. Refer to contract requirements. In no case shall the warranty be less than one year from the date of system acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

Only UL-listed or FM-approved equipment and devices shall be used in the fire suppression system. Furnish all components necessary for a complete and operational fire detection and suppression system, including but not limited to suppression nozzles, tubing and fittings, electrical and control wiring, valves, regulators, fully-charged suppression cylinders, and any other components, fittings, or connecting hardware necessary for a fully-functional fire detection and suppression system. Provide an intelligent fire suppression control panel loaded with all software and programming necessary to operate the fire detection and suppression system. The intelligent fire suppression control panel shall also be provided with two contacts, one to signal when

the system is not functioning normally and one to signal when the system has received an alarm and is firing. The contractor shall design connection of these contacts to monitor the system through the SNL communications network back to the Emergency Control Station located in the MESA Emergency Response Center (MERC) room.

2.02 PIPE

All pipe and fittings shall be installed in accordance with the current requirements of the NFPA Standard No. 12, ANSI B31.1, the Authority Having Jurisdiction, and the manufacturer's requirements. Piping shall be stainless steel pipe or tubing, designed for high-pressure supply and selected based upon a minimum internal pressure of 2,800 psi. Stainless steel tubing shall be seamless type 316.

2.03 PIPE FITTINGS

Suitable screwed, flared, or compression-type (Swagelok or Ferulok) stainless steel fittings shall be used. They shall be designed for high-pressure supply and selected upon a minimum internal pressure of 2,800 psi. All fittings shall be in accordance with ANSI B16.11 or ANSI B16.3. No bushings shall be used for the reduction of pipe size. Use only concentric reducing fittings.

2.04 PIPE HANGERS, SUPPORTS AND SEISMIC BRACING

A. The components of a hanger assembly that directly attach to the pipe or to the structure shall be UL listed or FM approved.

B. C-clamps and beam clamps shall have lock nuts and retaining straps, or clips, and pipe rings shall be of the solid-band adjustable swivel type.

C. Provide rod ceiling plates at finished ceilings for coach screw rods, expansion shields, and toggle hangers.

D. All seismic bracing devices and flexible couplings shall be specifically UL listed or FM approved and installed per their listing or approval.

E. A purlin clamp with retaining strap shall be used when fastening hangars to purlins. Other means of attaching hangers to purlins shall be permitted only at the discretion of the designated SNL Fire Protection Engineering representative.

F. All seismic brace members shall be continuous. Under no circumstances shall members be spliced or offset.

G. Tension-only seismic bracing systems shall meet the following.

1. The tension-only system shall be UL listed or FM approved for seismic service, and installed in accordance with listing limitations and installation instructions.

2. A means to prevent vertical motion due to seismic forces shall be installed at the brace location. Two tension only braces shall be installed in opposing directions at each brace location.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Responsibilities

1. The Contractor is responsible for the installation of the system in accordance with these specifications and the contract drawings. The Contractor shall coordinate with architectural, mechanical, and electrical, design and construction documents, to ascertain the required information, to affect a properly designed and installed system. The installation shall reflect high quality professional work that properly accounts for practical maintenance concerns and aesthetics.

2. The installation of the system shall be complete with all necessary accessories for proper operation and shall be accomplished by a licensed contractor or licensed company regularly engaged in this type of work, and in accordance with requirements of the National Fire Protection Association Standards (NFPA).

3. The fire protection system installation shall be coordinated with the other trades (mechanical, electrical and structural, etc.). All utility routing shall be installed in accordance with Designated Mechanical Zones (DMZ) as indicated in the contract drawings.

4. The installation shall comply with all mandatory, advisory interpretations, and recommended applicable rules of the latest editions of the standards listed in Part 1.02 of this document, except where otherwise noted on the drawings or specified herein.

B. Contamination and Obstruction Prevention. Pipe interiors shall be kept free of debris.

C. Pipe and Fittings

1. Pipe, fittings, and hangers shall be installed where shown on the drawings and in accordance with the requirements of NFPA 12. All interior piping shall be accessible, no fittings shall be incased in a wall or partition.

2. All piping shall be substantially supported from building structure and only UL listed or FM approved type hangers shall be used. Supply lines under ducts shall not be supported from ductwork but shall be supported from building structure (with trapeze hangers where necessary), or from steel angles supporting ductwork in accordance with NFPA 12.

3. Pipe Hangers and Anchors

a. Offsets in hanger rods shall not be permitted.

b. Concrete anchors shall be installed by drilling and installing a UL listed or FM approved anchor. Explosive driven fasteners as a method of installing anchors or hangers shall not be permitted.

c. Supports, hangers, braces, etc., shall be attached to the building primary structural members only.

d. All piping larger than 4 inches in diameter shall be supported from a minimum of two-bar joists when run parallel to a bar joist.

4. Welded joints: Welded joints are acceptable when shop fabricated in conformance to provisions of NFPA 12.

5. Screwed joints: Teflon paste and tape shall be used as pipe-joint compound at screwed joints. (Tape for screwed joints shall be 3 mil. ½-inch wide).

6. Bushings: Bushings are not permitted.

7. Floor Penetrations: All penetrations through waffle slab pop-outs shall be in accordance with Specification 0710S.

3.02 TESTING

A. Tests: Prior to acceptance of the installation, the Contractor shall, in the presence of the SDR, subject the system to the tests required by NFPA 12 including Appendices.

1. Upon completion of installation, the system shall be thoroughly tested for correct operation and function. Test shall include actual operation of all mechanical and electrical equipment including interlocks and reporting circuitry (fire alarm) etc. and careful inspection of all piping and nozzles. Carbon dioxide shall be discharged into all hazards during the test period. A full CO_2 discharge and concentration test shall be made for typical or similar total flooding hazards, using a carbon dioxide meter to determine the concentration. A full CO_2 discharge test shall be conducted for each installation. For hazards involving local application, carbon dioxide discharge tests shall be made to verify operation and nozzle performance. Testing shall be performed under the supervision of an experienced manufacturer's field engineer. The contractor shall furnish all carbon dioxide, instruments, personnel, appliances, and equipment for all testing including fill of the storage units.

- End of Section -