

Specification

PROJECT FILE NO. 021052

Backhoe Modifications – Fire Suppression for the OU 7-10 Glovebox Excavator Method Project

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho



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ACRONYMS

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| ANSI | American National Standards Institute |
| ASTM | American Society of Testing and Materials |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| MSDS | material safety data sheet |
| NFPA | National Fire Protection Association |
| OSHA | Occupational Safety and Health Administration |
| OU | operable unit |
| SAE | Society of Automotive Engineers |

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1. SUMMARY

1.1 General

The Idaho National Engineering and Environmental Laboratory (INEEL), a U.S. Department of Energy national laboratory operated by Bechtel BWXT Idaho, LLC, will procure a backhoe excavation system. The backhoe excavation system incorporates a modified CAT 446B backhoe loader and associated end effectors. The backhoe loader will be the primary instrument used in the retrieval of radioactively contaminated waste in the Operable Unit (OU) 7-10 Glovebox Excavator Method Project.

The CAT 446B backhoe used in this project shall incorporate two forms of fire suppression. First, all hydraulic fluid shall be purged from the backhoe and replaced with fire-resistant hydraulic fluid. Second, a fire suppression system shall be incorporated throughout the engine compartment of the backhoe.

1.1.1 Fire-Resistant Hydraulic Fluid

The American Chemical Technologies EcoSafe FR-46 is a nonaqueous, polyalkylene glycol, fire-resistant hydraulic fluid, with a Factory Mutual II fire resistance rating. As a point of reference, commonly used mineral oil-based hydraulic fluid will typically have a Factory Mutual III fire resistance rating (the least fire-resistant rating level).

Depending on the level of fire resistance required by regulation and by insurers, polyalkylene glycol products such as EcoSafe FR fluids, typically provide improved wear characteristics over the water or glycol products, and in many cases may provide wear characteristics equivalent to or better than the mineral-based hydraulic oil. The polyalkylene glycol products typically provide a level of fire protection between normal mineral based hydraulic fluids and water- or glycol-based hydraulic fluids.

Because of the improved fire resistance of the polyalkylene glycol hydraulic fluid (EcoSafe FR-46) and minimal backhoe modifications to accommodate such a fluid, the EcoSafe FR-46 fluid was chosen as the optimum fire-resistant hydraulic fluid to be incorporated into the CAT 446B backhoe.

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1.1.2 Fire Suppression System

Simplex Grinnel is the recommended fire suppression company who will supply the pre-engineered fire suppression system for the CAT 446B backhoe. Simplex is a company based in Pocatello, Idaho, that distributes ANSUL brand fire suppression systems. Based on conversations, drawings, and interface with Simplex Grinnel by Caterpillar Incorporated, an ANSUL LTA-101-30 pre-engineered fire suppression system was recommended.

The subcontractor shall install cable detectors throughout the engine compartment of the CAT 446B and connect the system back to a pneumatic actuator. A secondary operator-actuated switch shall be mounted in the cab of the backhoe. The distribution-piping (hose) network shall be designed to properly distribute the dry chemical to the nozzles located in strategic positions throughout the backhoe.

The system shall be capable of automatic detection and actuation and remote manual actuation. When a fire is detected, the LTA-101-30 system is actuated either manually or automatically, which operates the pneumatic actuator. The pneumatic actuator ruptures a seal disc in the expellant gas cartridge. This pressurizes and fluidizes the dry chemical extinguishing agent in the agent storage tank. When the agent storage tank reaches a specific pressure, it ruptures a burst disc and propels the dry chemical through the network of distribution hoses. The dry chemical is discharged through fixed nozzles and into the protected areas, suppressing the fire.

The automatic detection portion of the fire suppression system shall incorporate electric detection through the use of a linear detection wire.

The fire suppression system shall be capable of providing total flooding or local application hazard protection for mobile equipment and industrial hazards.

The basic system consists of the following:

- Dry chemical agent storage tank(s)
- Expellant gas cartridge
- Distribution piping (hose) and nozzles
- Manual and automatic actuator
- Automatic detection system, and accessories (see Figure 1).

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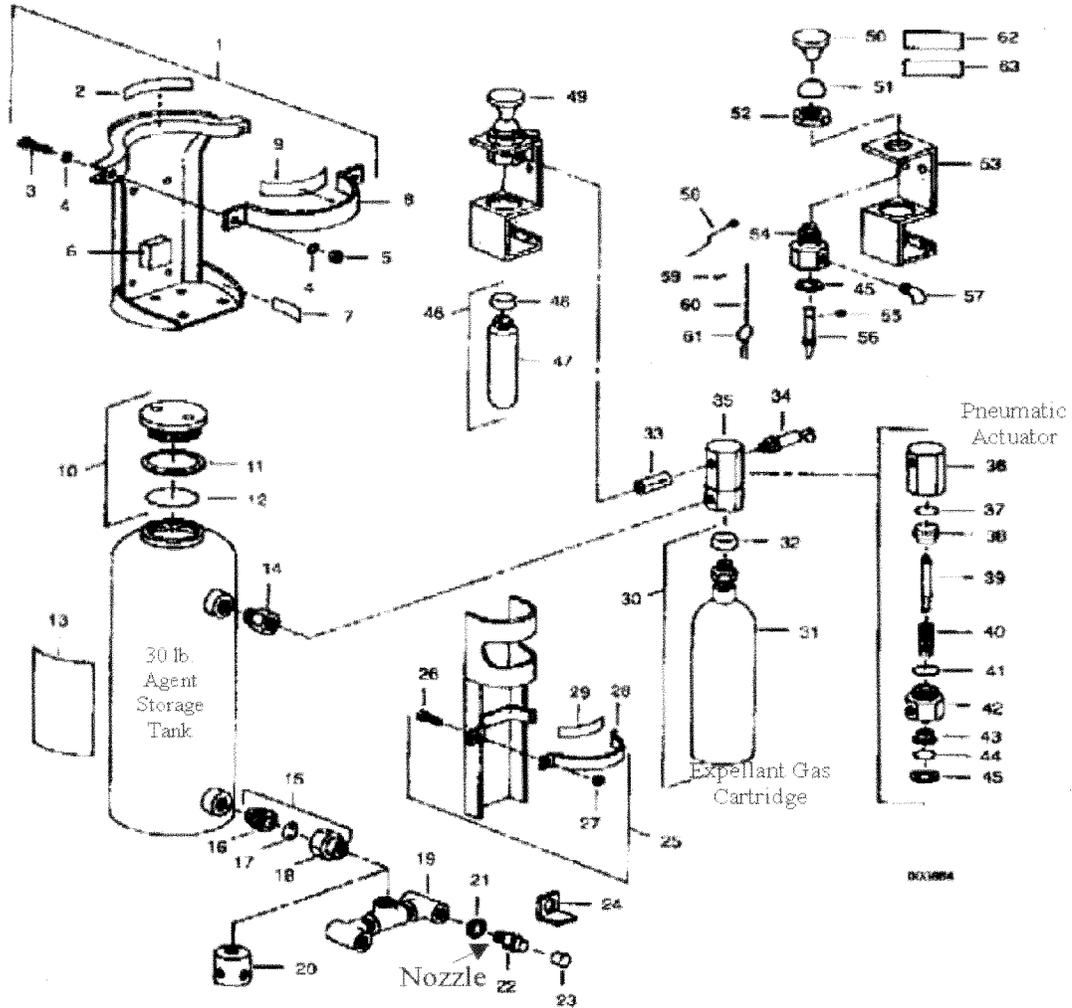


Figure 1. ANSUL brand LTA-101-30 fire suppression system.

1.2 Work Included

This specification covers requirements of the subcontractor and equipment supplier for the design, fabrication, assembly, and installation of a fire suppression system that incorporates replacing the hydraulic fluid with EcoSafe FR-46 and installation of an LTA-101-30 fire suppression system. It is not the intent of this specification to completely define all details of installation. Equipment shall be designed, fabricated, assembled, and installed in accordance with this specification and standard practices of the equipment suppliers and subcontractor when such practices do not conflict with this specification.

The fire suppression system and all associated hardware shall be completely assembled and installed into the CAT 446B backhoe at the subcontractor facility.

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The following shall be delivered to the INEEL:

1. A complete and fully integrated design of the LTA-101-30 fire suppression system on a CAT 446B backhoe
2. A CAT 446B backhoe incorporating EcoSafe FR-46 hydraulic fluid in all hydraulic functions
3. Vendor data submittals in accordance with vendor data schedule and this specification.

1.3 Work Not Included

None identified.

1.4 INEEL-Furnished Materials, Equipment, and Services

The INEEL will furnish the CAT 446B backhoe loader.

2. APPLICABLE CODES, PROCEDURES, AND REFERENCES

The following documents form a part of this specification to the extent specified herein and as applicable. Unless otherwise specified, the issue in effect on the date of invitation to bid shall apply. In case of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.1 National and Local Codes

Occupational Safety and Health Administration (OSHA)

29 CFR 1910, Occupational Safety and Health Standards

29 CFR 1926, Safety and Health Regulations for Construction

2.2 Industry Standards and U.S. Department of Energy Orders

American National Standards Institute (ANSI)/National Fire Protection Association (NFPA)

ANSI/NFPA 70, 2002 National Electrical Code

ANSI/NFPA 17, Standard for Dry Chemical Extinguishing System

ANSI/NFPA 121, Standard on Fire Protection for Self-Propelled and Mobile Surface Mining Equipment

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American Institute of Steel Construction, LRFD Manual of Steel Construction

American Society of Mechanical Engineers, ASME Boiler and Pressure Vessel Code, Section V

American Society of Testing and Materials (ASTM)

ASTM A36, Standard Specification for Carbon Structural Steel

ASTM A570, Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled

ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength

Society of Automotive Engineers (SAE)

SAE J31, Hydraulic Backhoe Lift Capacity

SAE J1097, Hydraulic Excavator Lift Capacity Calculation and Test Procedure

SAE J1177, Hydraulic Excavator Operator Controls (This specification is provided for reference only. It is not a requirement.)

SAE J1179, Hydraulic Excavator Digging Forces (This specification is provided for reference only. It is not a requirement.)

SAE J1336, Hydraulic Cylinder Leakage Test (This specification is provided for reference only. It is not a requirement.)

2.3 Military (National) Specification

Not applicable.

2.4 Related Specifications

Not applicable.

2.5 References

Not applicable.

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3. TECHNICAL REQUIREMENTS

3.1 General

The fire suppression system shall be designed by the equipment supplier to provide for a fully functional system and to perform as specified in a safe and efficient manner. This section defines the design requirements for the fire suppression system.

3.1.1 CAT 446B Backhoe Fire Suppression System

- A. Shall be a Simplex Grinnel ANSUL LTA-101-30 pre-engineered fire suppression system
- B. Shall provide fire suppression for a wide range of fuel sources
- C. Temperature range shall be between -54 and 99°C (-65 and 210°F)
- D. Shall be capable of automatic or manual activation.

3.2 Restrictions

None identified.

3.3 Performance Requirements

3.3.1 Fire Resistant Hydraulic Fluid

- A. Nonaqueous, polyether polyol hydraulic fluid
- B. Hydraulic fluid approved by Factory Mutual Research as Group II
- C. Fluid supplier shall provide the recommended change-out procedure for switching from a conventional hydraulic fluid to the polyether polyol hydraulic fluid
- D. Hydraulic fluid shall not adversely affect sealing surfaced within the backhoe hydraulic system.

3.3.2 Fire Suppression System

- A. Fire protection system shall be a pre-engineered system with the distribution-piping (hose) network designed to properly distribute dry chemical to nozzles located in strategic positions throughout the backhoe engine compartment

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- B. Cable detectors shall be run throughout the engine compartment of the backhoe and tie the system back to a pneumatic actuator
- C. A secondary operator actuated switch shall be mounted in the cab of the backhoe
- D. The system shall be capable of automatic detection and actuation and remote manual actuation.
- E. The automatic detection portion of the fire suppression system shall incorporate electric detection through the use of a linear detection wire
- F. The fire suppression system shall be capable of providing total flooding or local application hazard protection for mobile equipment and industrial hazards
- G. The agent storage tank shall be designed for temperatures from 0 to 49°C (32 to 120°F)
- H. Nitrogen gas shall be selected for the expelling gas.
- I. A 30-lb agent tank containing 25 lb of monoammonium phosphate base (multipurpose dry chemical) shall be provided
- J. The fire suppression system shall consist of the following components:
 - Tank-mounted bracket
 - Installation manual
 - N₂ cartridge
 - Cartridge bracket
 - Pneumatic actuator
 - Transfer lines and nozzles.
 - Temperature-sensitive linear wire detectors
 - Total flooding capacity of 1,000 ft³.

3.4 Software

Not applicable.

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3.5 Registered Professional Engineer Certification

Not applicable.

3.6 Human Factors

The design shall use human factor engineering principles and criteria such that all equipment is easily maintainable. The design shall provide access to each system component (located outside of the Retrieval Confinement Structure) for operation, cleaning, and maintenance.

3.7 Reliability and Maintainability

3.7.1 Reliability

All subcomponents of the fire suppression system shall be of a quality that the expected mean time between failure for this system shall not be less than 1,080 hours.

The automated fire suppression equipment bearings, fittings, and controls shall be sealed against moisture and damaging particle intrusion using standard industrial components to the extent practicable.

The fire suppression systems shall employ rugged, industrial, off-the-shelf equipment to the maximum extent practicable.

The fire suppression control system hardware and software shall be based on industry standard components that have been proven in similar systems.

3.7.2 Maintainability

The fire suppression system shall be designed and assembled to facilitate ease of inspecting, servicing, and maintaining equipment.

Standard replacement parts within the fire suppression systems, shown on manufacturer's recommendations, shall be readily available for routine maintenance activities.

3.8 Environmental Regulatory Requirements and/or Site and Operating Requirements

Not applicable.

3.9 Natural Phenomena Requirements

Not applicable.

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4. ENVIRONMENTAL, SAFETY, AND HEALTH REQUIREMENTS

4.1 Subcontractor Safety

The subcontractor shall work in accordance with applicable OSHA requirements as stated in 29 CFR 1910.

4.2 Personal Protective Equipment

The subcontractor shall determine and require use of appropriate personal protective equipment for all tasks performed.

4.3 Emergency Response

Not applicable.

4.4 Accident Investigation

Not applicable.

5. MANUFACTURING AND ASSEMBLY

5.1 General

5.1.1 Fire Resistant Hydraulic Fluid

Conversion of the CAT 446B hydraulic system to EcoSafe FR-46 hydraulic fluid shall be performed within the subcontractor shop to ensure proper conversion. The contractor technical representative (or alternate) will inspect the assembled final product. Operations shall be performed in a clean, dust-free area of the subcontractor facility.

5.1.2 Fire Suppression System

The fire suppression shall be assembled and installed on a CAT 446B backhoe, in the subcontractor shop, to ensure proper fit and operation. The contractor technical representative (or alternate) shall inspect the assembled final product. Assembly of the equipment shall be made in a clean, dust-free area of the subcontractor's facility.

5.2 Prohibitions

None identified.

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5.3 Material

Materials used shall be free from defects that would adversely affect the performance or maintainability of individual components or the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in standard commercial practices of the equipment manufacturer

5.4 Fabrication

Not applicable.

5.5 Equipment Tagging

Not applicable.

5.6 Cleaning, Painting, and Coating

Not applicable.

5.7 Spare Parts

Applicable standard quality requirements identified in the procurement package shall be cross referenced.

5.8 Other Processes

Not applicable.

6. SUBMITTALS

As a minimum, the subcontractor shall provide the contractor with the submittals referenced in this section. The subcontractor shall be responsible for all submittals that come from the equipment supplier. Additional submittal requirements are defined in the vendor data schedule and applicable contract documents. The quantities and submittal schedule is included in the attached vendor data schedule.

6.1 General Submittal Requirements

6.1.1 General Procedures

Vendor data, whether prepared by the subcontractor or subcontractor's subtier or supplier, shall be submitted as instruments of the subcontractor. Therefore, before submittal, the subcontractor shall ascertain that material and equipment covered by the submittal and the contents of the submittal itself meet all the requirements of the subcontract specifications.

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Each submittal shall contain (1) identification for each separable and separate piece of material or equipment and (2) literature with respect to the information provided in the specification and on the vendor data schedule. Submittals shall be numbered consecutively for each different submittal.

6.1.2 Vendor Data Schedule

Vendor data required by the specification sections are identified on the vendor data schedule. The vendor data schedule provides a tabular listing by item number, specification reference, and description of the item or service. The type of submittal is identified by a vendor-data code, and the time required to submit the item is identified by a when-to-submit code. An approval code specifies whether the submittal is for mandatory approval or for information only. One copy of routine paper or electronic file submittals is required. Additional copies may be required by the vendor data schedule. Electronic file submittals are preferred.

6.1.3 Vendor Data Transmittal and Disposition Form 431.13, “Construction Vendor Data Transmittal & Disposition Form”

All vendor data shall be submitted to the contractor using the Form 431.13. This form provides a method for the subcontractor to submit vendor data and a means for the contractor to disposition the submittal. The subcontractor shall list the vendor data schedule item number, a vendor data transmittal tracking number (if applicable), specification number reference, a tag number (if applicable), the submittal status (e.g., mandatory approval, information only, or resubmittal), the revision level, and the item description. The description should be complete enough that a person unfamiliar with the project can determine what the submittal includes.

6.1.4 Disposition by the Contractor

Comments from the contractor and required action by the subcontractor will be indicated by a disposition code on the submittal. The disposition codes will be classed as follows:

- A. **Work May Proceed:** Submittals so noted will generally be classed as data that appears to be satisfactory without corrections.
- B. **Work May Proceed with Comments Incorporated. Revise Affected Sections and Resubmit Entire Submittal:** This category will cover data that, with the correction of comments

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noted or marked on the submittal, appear to be satisfactory and require no further review by the contractor before construction.

C. **Work May NOT Proceed. Revise and Resubmit:** Submittals so dispositioned will require a corrected resubmittal for one of the following reasons:

- (1) Submittal requires corrections, shown on comments, before final review
- (2) Submittal data incomplete and requires more detailed information before final review
- (3) Submittal data does not meet subcontract document requirements.

D. **Accepted for Use. Information Only Submittal:** Submittals so dispositioned will generally be classified as information only for as-specified material and equipment.

Mandatory approval-coded vendor data will be reviewed by the contractor and receive an A, B, or C disposition. Information-only submittals without comments will receive a D disposition. A, B, and C coded dispositioned submittals will be returned to the subcontractor. D dispositioned submittals will not be returned to the subcontractor. The contractor may provide internal review of information-only submittals. In the event that comments are generated on an information-only submittal, the submittal may be dispositioned B or C and returned to the subcontractor for appropriate action. Acknowledgment of receipt of dispositioned vendor data by the subcontractor will not be required.

The contractor will return dispositioned submittals with reasonable promptness. The subcontractor shall note that a prompt review is dependent on timely and complete submittals in strict accordance with these instructions.

6.2 Spare Parts and Special Tools List

The subcontractor shall submit to the contractor a list of recommended spare parts and any special tools required for operation and maintenance of the fire suppression system. This list shall include all corresponding suppliers of each component and associated phone numbers.

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6.3 Operations and Maintenance Manuals

The operations and maintenance manual shall cover the installation, operation, and maintenance of the fire suppression equipment in detail. All drawings, diagrams, and record forms required for the installation shall be included and incorporated in the manual.

6.4 Drawings

The equipment supplier or subcontractor shall submit prints of the final drawings disclosing the configuration of the fire suppression system. These drawings shall document the mechanical, electrical, and instrumentation configuration. The drawings shall be of sufficient detail to allow the contractor to identify and evaluate the systems and components for installation, operation, maintenance, and repair activities without detailed physical inspection of the actual hardware.

6.5 Software

Not applicable.

6.6 MSDSs

Before fabrication release, the contractor shall approve any material safety data sheets. The contractor shall submit material safety data sheets for approval on any material that periodically requires disposal. This allows the contractor to verify waste acceptance and disposal requirements. Suspect or known carcinogenic materials are not acceptable for use.

7. QUALITY ASSURANCE

7.1 Minimum Qualifications of Manufacturer, Supplier, or Personnel

The equipment shall be assembled and installed by a firm that has prior related experience pertaining to the installation of an automated fire suppression system within the CAT 446B backhoe.

The hydraulic fluid shall be replaced by a firm that has prior related experience pertaining to replacement of standard hydraulic fluid with a fire-resistant hydraulic fluid within the CAT 446B backhoe.

7.2 QA Program

The manufacturer is responsible for providing materials and workmanship that meet the codes and standards identified in this specification.

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Subcontractor quality requirements and all standard procurement requirements will be listed in the procurement package.

7.3 Nondestructive Examination

Not applicable.

7.4 Operational Testing

Not applicable.

7.5 Special Processes

Not applicable.

8. PACKAGING AND SHIPPING

8.1 Packing and Packaging

Not applicable.

8.2 Marking and Handling

Not applicable.

8.3 Special Transportation Requirements

Not applicable.

9. INSTALLATION AND MAINTENANCE

9.1 Installation

The fire suppression system shall be installed in the CAT 446B backhoe at the subcontractor's facility.

9.2 Startup and Calibration

Not applicable.

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9.3 Training

NOTE: *It is anticipated that the fire suppression system will be simple enough that formal training above the instructions provided will not be required.*

Any required training above the instructions provided with the fire suppression system shall be provided initially by the subcontractor to an INEEL representative who will then provide training to other INEEL personnel that require training.

9.4 Maintenance

The fire suppression system manufacturer(s) shall provide recommended maintenance instructions for the automated device and all associated equipment.

The subcontractor and manufacturer shall provide any additional backhoe maintenance requirements that may result from the use of fire-resistant hydraulic fluid.

10. MARKING AND IDENTIFICATION

Not applicable.

11. ACCEPTANCE

11.1 Final Acceptance Method

Submittal of all documents listed on the vendor data schedule will constitute acceptance.

11.2 Inspection and Hold Points

Unless otherwise specified by the purchase order, the supplier shall notify the contractor at least 5 working days in advance of the time that the fire suppression system will be available for source inspection by the contractor representative. Work cannot proceed without written authorization from the contractor after hold point inspection.

11.3 INEEL Surveillance and Audits

The authorized contractor representative may perform source inspection or surveillance.

12. ATTACHMENTS

Form 431.14, "Vendor Data Schedule."

| | | |
|---|---|--|
| Specification Environmental Restoration | BACKHOE MODIFICATIONS – FIRE SUPPRESSION FOR THE OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT | Identifier: SPC-401 Revision: 0 Page: 16 of 16 |
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| Specification | BACKHOE MODIFICATIONS – FIRE SUPPRESSION FOR THE OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT | Identifier: SPC-401 |
| Environmental | | Revision: 0 |
| Restoration | | Page: A1 of A2 |

ATTACHMENT

431.14
08/01/2001
Rev. 03

Vendor Data Schedule

Project Title OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT - BACKHOE
MODIFICAITON - FIRE SUPPRESSION **Project No.** 021052 - 21996

System Engineer/ Project Manager LOPEZ DARYL A **Date:** 12-APR-02 **Rev:** 0

Vendor Data Coordinator Address STURM BETH L, WCB-3WH502, MS: 3535

| Vendor Data Codes | | | | |
|---|--|--|---|--|
| <ul style="list-style-type: none"> A. As-Built Drawings B. Assembly Drawings C. Attendance Record D. Blasting Plan E. Catalog Data F. Chem & Physical Analysis G. Concrete Mix Design H. Control System Diagram I. Design Calculations J. Installation Instructions | <ul style="list-style-type: none"> K. Manufacturers Data Report L. O&M Manual M. Parts List N. Piping Drawing O. Procedure/Instructions P. Pump Head Curves Q. Personnel Qualifications R. Red_line Drawings S. RSMI & Maintenance Log T. Sample(Color, Texture, etc.) | <ul style="list-style-type: none"> U. Shop Drawings V. Survey Records W. Test Procedure X. Special Processes Y. Operational/CC Testing Z. Test Reports AA. UL/FM Listing AB. Warranty/Guarantee AC. Weld Records AD. Wiring Diagrams | <ul style="list-style-type: none"> AE. MSDS AF. Hardware Schedule AG. Specification AH. Manufacturing/Inspection/Test Plan AI. Test Certification AJ. Recommended Spares AK. Special Tools List AL. Certificate of Conformance AM. Certificate of Disposal or Destruction AN. Design Verification | <ul style="list-style-type: none"> AO. Design Qualification Testing AP. Traceability Procedure AQ. Cleaning Procedure AR. Weld Procedure Qualification AS. Welder Performance Personnel Qualifications AT. Non-Destructive Examination Personnel Certifications AU. Inspector Certifications AV. Limited Shelf Life/Operational Data AW. Special Packaging, Shipping, and Rigging Procedure AX. Certificate of Materials to ASME Code AY. Chemical Inventory AZ. Other |
| When to Submit | | | | |

| | | | |
|---------------|---|-------------|----------|
| Specification | BACKHOE MODIFICATIONS – FIRE SUPPRESSION FOR THE OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT | Identifier: | SPC-401 |
| Environmental | | Revision: | 0 |
| Restoration | | Page: | A2 of A2 |

ATTACHMENT

| | | | | |
|--|--|---|--|---|
| AC - As Completed AT - After Test BC - Before Contract Awarded | BFA - Before Final Acceptance BFR - Before Fabrication Release ROS - Removed Off-Site PDS - Prior to Delivery on site | PTP - Prior to Purchase PS - Prior to Shipment PT - Prior to Test | PTC - Prior to Construction Start PTI - Prior to Installation PTW - Prior to Welding | TS - Time of Shipment WP - With Proposal |
|--|--|---|--|---|

| Item No. | Clause/Article or Drawing/Specification Reference | Description | Vendor Data Code | Extra Copies Required | When to Submit | Approval Code |
|----------|---|----------------------|------------------------|-----------------------|----------------------------------|-------------------|
| | 6.2 | | AK. Special Tools List | 4 | PS - Prior to Shipment | Information Only |
| | 6.6 | | AE. MSDS | 4 | BFR - Before Fabrication Release | Approval Required |
| | 6.3 | | L. O&M Manual | 4 | PS - Prior to Shipment | Information Only |
| | 6.4 | | B. Assembly Drawings | 4 | BFR - Before Fabrication Release | Approval Required |
| | 6.2 | | AJ. Recommended Spares | 4 | PS - Prior to Shipment | Information Only |
| | 3.3.1-C | Change-out Procedure | AZ. Other | 4 | PTI - Prior to Installation | Approval Required |

- Instructions:
1. Refer to subcontract documents for instructions on submittals.
 2. Electronic submittals in lieu of paper documents are acceptable and encouraged.
 3. The normal number of copies required is ONE. If more are required, the number will be shown here.
 4. THE INEEL WILL SCAN ALL SUBMITTED VENDOR DATA INTO A SYSTEM THAT IS ACCESSIBLE TO ALL INEEL EMPLOYEES UNLESS THE SUPPLIER/SUBCONTRACTOR IDENTIFIES SUBMITTED INFORMATION AS PROPRIETARY.