

# Specification

PROJECT FILE NO. 021052

## Backhoe Modifications – Drum Weighing System 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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Rev. 03

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## ACRONYMS

ASTM	American Society of Testing and Materials
INEEL	Idaho National Engineering and Environmental Laboratory
OSHA	Occupational Safety and Health Administration
OU	operable unit
PGS	Packaging Glovebox System
QA	quality assurance
RCS	Retrieval Confinement Structure
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.

This incorporates a Retrieval Confinement Structure (RCS) located over the excavation site. The RCS consists of a steel-framed, steel-paneled structure with Lexan windows. The RCS is located within a larger fabric-skinned Weather Enclosure Structure. Packaging Glovebox Systems (PGS) are attached directly to the confinement structure and are fed by track-guided transfer carts. (See Figure 1.)

A standard CAT 446B backhoe performs the following tasks:

- Excavation of soil
- Removal of probes
- Removal of 55-gal drums (using a Jaw bucket design)
- Performing core sampling.

The backhoe cab and loader are located outside the RCS while the boom, stick, and various end effectors are located inside the contaminated RCS structure.

Retrieval of several waste drums containing combustibles, noncombustibles, sludge, and graphite is expected during excavation of the pit. The weight of these drums range from an empty drum up to 507-lb drums containing Series 743 sludge. Drums weighing over 350 lb are prohibited in the PGS because of safety concerns. To prevent a drum weighing more than 350 lb from entering the PGS, the weight of each drum will be monitored before loading the PGS transfer carts. In an effort to reduce downtime, the drum will be weighed using a calibrated precision mechanical pressure gauge mounted in the backhoe cab. This gauge will be supplied as government-furnished equipment to the subcontractor by INEEL.

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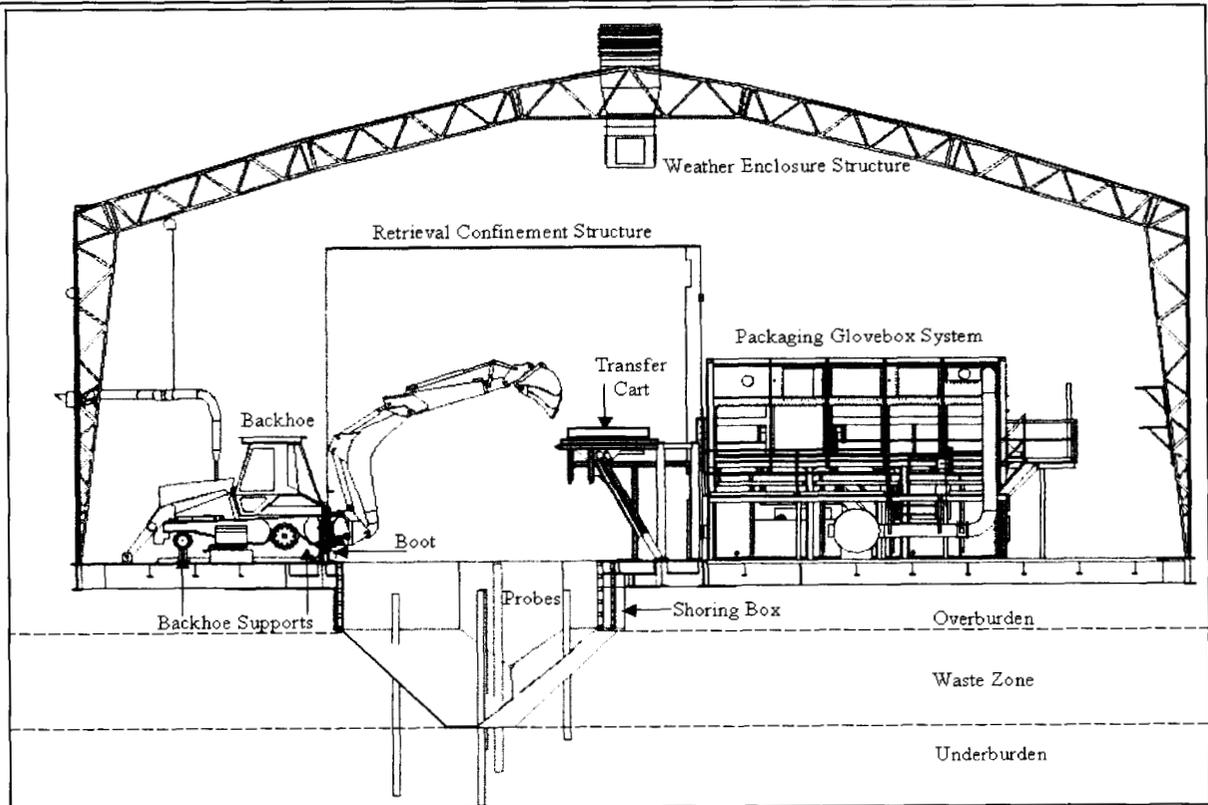


Figure 1. Cross section of the Glovebox Excavator Method Project facility.

The gauge will meet the following criteria:

- Heise 4000 CMM 6-in. pressure gauge (or equivalent)
- Range 0 to 4,000 psig
- 1/4-in. female national pipe thread bottom port
- Wall mount
- 403 stainless steel
- Temperature compensated.

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This gauge shall be piped into the hydraulic line leading from the backhoe control valve to the rod side of the stick cylinder as shown on contract Drawing 519931, “OU 7-10 Glovebox Excavator Method Project Excavator Modifications WSE (Western States Equipment) Modifications.”

To weigh a drum, the backhoe grapples a drum on its ends with the Jaws of the Jaw bucket, positions the bucket at a predetermined angle, and slowly raises the stick to the horizontal positions and stops the motion at horizontal. The operator reads the hydraulic pressure on the rod side of the stick cylinder and determines the drum weight from a table that lists pressure versus drum weight. If the pressure is in excess of a corresponding drum weight of 350 lb, the drum is kept in the pit and the drum-sizing tray may be used to size it into manageable pieces.

## **1.2 Work Included**

This specification covers the subcontractor requirements, fabrication, assembly, installation, and testing for the drum-weighing system. It is not the intent of this specification to completely define all details of installation. Equipment shall be fabricated, assembled, and installed in accordance with this specification and standard practices of the subcontractor when such practices do not conflict with this specification.

The drum-weighing system and all associated hardware shall be completely assembled and installed into the CAT 446B backhoe at the subcontractor’s facility.

The following shall be delivered to the INEEL:

1. A complete and fully integrated design of the drum-weighing system on a CAT 446B backhoe as shown on contract Drawing 519931
2. Vendor data submittals in accordance with vendor data schedule and this specification
3. The final installation of all components of this system shall not occur until the backhoe is returned to the subcontractor from the Nuclear Quality Assurance -1 subcontractor (see the “Preparation for Boot Installation and Preparation for Field Use” section of this specification).

## **1.3 Work Not Included**

Equipment, unless specified herein, is not included. The following actions shall not be included in the scope of work of the subcontractor.

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- Procurement of the Heise pressure gauge (the gauge will be provided as government-furnished equipment by INEEL)

#### **1.4 INEEL-Furnished Materials, Equipment, and Services**

The INEEL will furnish the CAT 446B backhoe loader and the Heise pressure gauge.

## **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 Administration

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

American Society of Testing and Materials (ASTM)

ASTM A108-99, Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality

ASTM A576-90B, Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality

ASTM B117-97, Standard Practice for Operating Salt Spray (Fog) Apparatus

Society of Automotive Engineers (SAE)

SAE J1453, Fitting - O-Ring Face Seal

SAE J514, Hydraulic Tube Fittings

SAE J516, Hydraulic Hose Fittings

SAE J517, Hydraulic Hose

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SAE 100R1AT, Hydraulic Hose

SAE 100R12, Hydraulic Hose

### 2.3 Military (National) Specification

MS33649-4, Boss, Fluid Connection – Internal Straight Thread, Military Specification

MS33656-4, Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal (S/S by SAE-AS4395).

### 2.4 Related Specifications

Not applicable.

### 2.5 References

Not applicable.

## 3. TECHNICAL REQUIREMENTS

### 3.1 General

The drum-weighing system shall be installed as shown on Drawing 519931 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 drum weighing system.

1. The installed pressure gauge shall be a Heise pressure gauge as described in Section 1.1 above and as provided by INEEL
2. The gauge shall be mounted in the operator cab in full view of the operator when operating the backhoe
3. The system shall have a manual bleed valve if required, a Heise pressure gauge snubber, and a manual shutoff valve, all near the gauge in the cab
4. The gauge shall be piped to the hydraulic line leading from the backhoe control valve to the rod-side of the stick cylinder as shown on contract Drawing 519931.

### 3.2 Restrictions

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None identified.

### **3.3 Performance Requirements**

The drum-weighing system shall be capable of providing the backhoe operator with an analog readout of the static pressure imposed on the rod side of the stick cylinder when stopped after raising the stick to the horizontal position.

### **3.4 Software**

Not applicable.

### **3.5 Registered Professional Engineer Certification**

Not applicable.

### **3.6 Human Factors**

The gauge and manual valves shall be mounted using human factor engineering principles and criteria such that all equipment is easily read and operated.

### **3.7 Reliability and Maintainability**

#### **3.7.1 Reliability**

All subcomponents of the drum weighing system (except the Heise pressure gauge that will be supplied by INEEL) shall have an expected mean time between failures of not less than 1,080 hours.

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

The drum-weighing system hardware shall be based on industry standard components that have been proven in similar systems.

#### **3.7.2 Maintainability**

The drum-weighing system shall be assembled to facilitate ease of inspecting, servicing, and maintaining equipment.

The drum-weighing system standard replacement parts, shown on manufacturer's recommendations, shall be readily available for routine maintenance activities.

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**3.8 Environmental Regulatory Requirements and/or Site and Operating Requirements**

Not applicable.

**3.9 Natural Phenomena Requirements**

Not applicable.

**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.

The Heise pressure gauge has a blowout plug on the back for overload conditions. This should be taken into account when locating and mounting the gauge. The pressure line and valves leading to the gauge shall be located so as not to impact the operator with hydraulic fluid or components should a hydraulic rupture occur.

**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.

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## **5. MANUFACTURING AND ASSEMBLY**

### **5.1 General**

The drum-weighing system shall be assembled and installed onto a CAT 446B backhoe in the subcontractor's shop to ensure proper fits and operation. The contractor's technical representative (or alternate) will inspect the assembled final product. Assembly of the equipment shall be made in a clean area of the subcontractor's facility.

### **5.2 Prohibitions**

None identified.

### **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 shall be as delineated on contract drawings.

### **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 will be cross-referenced.

### **5.8 Other Processes**

Not applicable.

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## 6. SUBMITTALS

As a minimum, the subcontractor shall provide the contractor with the submittals referenced in this section. 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, drawings, or other contract documents.

Each submittal shall contain identification for each separable and separate piece of material or equipment, and 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, drawing or 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 Form 431.13, "Construction Vendor Data Transmittal & Disposition Form." The form provides the subcontractor a method to submit vendor data and provides

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the contractor a means of dispositioning the submittal. The subcontractor shall list the vendor data schedule item number, a vendor data transmittal tracking number (if applicable), the drawing or 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

The contractor's comments 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 appear 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 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. Dispositioned submittals coded as A, B, and C will be returned to the subcontractor.

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Information-only submittals without comments will receive a D disposition and will not be returned to the subcontractor. The contractor may provide internal review of information-only submittals. If 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 special tools required for maintenance of the drum-weighing system. This list shall include all corresponding suppliers of each tool and associated phone numbers.

## **6.3 Operations and Maintenance Manuals**

The subcontractor shall submit an operating procedure to the contractor for operating the drum-weighing system. The operating procedure shall contain the operations that should be performed as a result of knowledge gained from the testing that will occur in accordance with Section 7.4.1 of the drum-weighing portion of this specification. Instructions for operating the shutoff and bleed valves, with precautions, shall be included in the operating procedure.

## **6.4 Drawings**

The equipment supplier shall submit prints of the final drawings disclosing the configuration of the drum-weighing system. These drawings shall document the mechanical 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 Inspection Test Plans/Procedures/Reports**

Inspection test plans, procedures, and reports include the following:

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- **Performance test procedures (subcontractor preshipment):** Performance test plans, procedures, and reports as outlined in Section 7.4.1 of this specification.
- **Performance test reports (subcontractor preshipment):** Performance test results and reports as outlined in Section 7.4.3 of this specification.

## 7. QUALITY ASSURANCE

### 7.1 Minimum Qualifications of Manufacturer, Supplier, or Personnel

- The Yokogawa pressure sensor (or equivalent) shall be assembled and installed by a firm that has prior related experience pertaining to rerouting of backhoe hydraulic lines and installation of auxiliary equipment onto the battery box of a CAT 446B.
- A firm having prior related experience pertaining to electrical connections from a CAT 446B backhoe fuse box, shall perform all electrical connections for the Yokogawa pressure transmitter.

### 7.2 QA Program

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

### 7.3 Nondestructive Examination

Not applicable.

### 7.4 Operational Testing

#### 7.4.1 Performance Test Procedures

The subcontractor shall submit a test procedure to the contractor before demonstration of the drum-weighing system at the subcontractor's facility. The procedure shall include the testing date, conditions, duration, sequence, materials used, and methods of performing the tests.

The procedure shall include lifting and weighing drums from 100 to 500 lb in increments of 100 lb. The drums shall be grasped with the jaw bucket, which shall be held in a predetermined and repeatable orientation. The stick extension shall be fully retracted and the stick shall be raised slowly and stopped and held in the horizontal position. Then the pressure reading of the Heise pressure gauge corresponding to the

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drum weight shall be recorded. The stick shall be lowered and raised to the horizontal position three times with the same drum weight to determine hysteresis errors in the pressure reading.

The subcontractor shall inform the contractor 1 week in advance of performance testing so a contractor representative may be present during the testing process.

Subcontractor testing shall demonstrate that all equipment operates and interfaces together into a functional drum-weighing system as defined in this specification.

#### 7.4.2 Testing Acceptance Criteria

- Records of pressure versus drum weight are provided for all 15 runs of the weighing procedure
- Hydraulics are installed to read the pressure in the rod-side of the stick cylinder
- Shutoff valve isolates the gauge from the pressure source
- Bleed valve operates as intended
- Leakage from the hydraulics in the drum weighing system does not occur
- Operator visibility is good and reading the Heise pressure gauge is easy
- Operation of the gauge shutoff and bleed valves by the operator in the cab is easy.

#### 7.4.3 Performance Test Report

The subcontractor shall submit to the contractor the in-shop testing report following the testing outlined in Section 7.4.1.

### 7.5 Special Processes

Not applicable.

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## **8. PACKAGING AND SHIPPING**

### **8.1 Packing and Packaging**

Packaging and shipping shall be performed in accordance with the backhoe shipment to the INEEL. The drum-weighing system shall not be disconnected from the backhoe after in-shop testing is complete.

### **8.2 Marking and Handling**

Not applicable.

### **8.3 Special Transportation Requirements**

Only transportation requirements that pertain to shipment of the backhoe to the INEEL apply.

## **9. INSTALLATION AND MAINTENANCE**

### **9.1 Installation**

The drum-weighing system shall be installed into the CAT 446B backhoe at the subcontractor's facility as shown on contract Drawing 519931.

### **9.2 Startup and Calibration**

Not applicable.

### **9.3 Training**

The contractor's backhoe operator representative shall be trained on the drum-weighing system at the subcontractor facility before shipment.

### **9.4 Maintenance**

See special tools list (see Section 6.2).

## **10. MARKING AND IDENTIFICATION**

Not applicable.

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## **11. ACCEPTANCE**

### **11.1 Final Acceptance Method**

Performance of the test, training of the operator, and submittal and approval of all documents listed on the vendor data schedule will constitute acceptance of the drum-weighing system.

### **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 drum-weighing system components 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**

Vendor Data Schedule - Form 431.14

Contractor Drawing 519931, "OU 7-10 Glovebox Excavator Method Project Excavator Modifications WSE (Western States Equipment) Modifications."

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### ATTACHMENT A

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## Vendor Data Schedule

**Project Title**      OU 7-10 GLOVEBOX EXCAVATOR METHOD PROJECT - BACKHOE MODIFICATION - DRUM WEIGHING SYSTEM      **Project No.**      021052 - 24713

**System Engineer/Project Manager**      LOPEZ DARYL A      **Date:** 17-JUN-02      **Rev:** 0

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

Vendor Data Codes				
A. As-Built Drawings	K. Manufacturers Data Report	U. Shop Drawings	AE. MSDS	AO. Design Qualification Testing
B. Assembly Drawings	L. O&M Manual	V. Survey Records	AF. Hardware Schedule	AP. Traceability Procedure
C. Attendance Record	M. Parts List	W. Test Procedure	AG. Specification	AQ. Cleaning Procedure
D. Blasting Plan	N. Piping Drawing	X. Special Processes	AH. Manufacturing/Inspection/Test Plan	AR. Weld Procedure Qualification
E. Catalog Data	O. Procedure/Instructions	Y. Operational/CC Testing	AI. Test Certification	AS. Welder Performance Personnel Qualifications
F. Chem & Physical Analysis	P. Pump Head Curves	Z. Test Reports	AJ. Recommended Spares	AT. Non-Destructive Examination Personnel Certifications
G. Concrete Mix Design	Q. Personnel Qualifications	AA. UL/FM Listing	AK. Special Tools List	AU. Inspector Certifications
H. Control System Diagram	R. Red_line Drawings	AB. Warranty/Guarantee	AL. Certificate of Conformance	AV. Limited Shelf Life/Operational Data
I. Design Calculations	S. RSMI & Maintenance Log	AC. Weld Records	AM. Certificate of Disposal or Destruction	AW. Special Packaging, Shipping, and Rigging Procedure
J. Installation Instructions	T. Sample(Color, Texture, etc.)	AD. Wiring Diagrams	AN. Design Verification	AX. Certificate of Materials to ASME Code
				AY. Chemical Inventory
				AZ. Other
<b>When to Submit</b>				

Specification  Environmental Restoration	<b>BACKHOE MODIFICATIONS –          DRUM WEIGHING SYSTEM          FOR THE OU 7-10 GLOVEBOX          EXCAVATOR METHOD PROJECT</b>	Identifier: SPC-401 Revision: 0 Page: A2 of A2
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**ATTACHMENT A**

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
	6.2		AJ. Recommended Spares	4	PS - Prior to Shipment	Information Only
	6.3		L. O&M Manual	4	PS - Prior to Shipment	Information Only
	6.4		A. As-Built Drawings	4	BFR - Before Fabrication Release	Approval Required
	7.4.1		W. Test Procedure	4	PT - Prior to Test	Approval Required
	7.4.3		Z. Test Reports	4	AT - After Test	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.