STATEMENT OF WORK

Requisition #: 296990

Title: Double-Shell Tank Primary Bottom Visual Inspection – Fiberscope

Revision Number: 0

Date: 1/16/2017

1.0 Objective

Through the execution of the scope identified in Section 3.0, a functional robotic solution will be developed to conduct visual inspection of the primary tank bottom within the AZ, SY, AW, AN, and AP double-shell tank designs at the Hanford site. Inspection will be accomplished through annulus access and deployment of sensory technology into the refractory pad air slot pattern below the primary tank bottom. Additional details of the configuration and expectations of capability are described further within the scope.

2.0 Background/Introduction

Twenty-eight carbon steel, double-shell, million gallon waste storage tanks located at the Hanford site in Washington State store both radioactive and hazardous waste (as defined by The Resource Conservation and Recovery Act) which is regulated as dangerous waste under Washington State regulations. To monitor their condition and ensure continued viability, these tanks are inspected periodically through a comprehensive integrity program. Tank configuration and construction conditions present several access challenges that will need to be overcome. Hanford’s double-shell tanks were built in groups, commonly referred to as Farms. As a summary, Table 1 provides the number of tanks in each farm and construction timeframe.

Table 1. Hanford Double-Shell Tank Overview

<table>
<thead>
<tr>
<th>Tank Farm</th>
<th># Tanks</th>
<th>Construction Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-AY</td>
<td>2</td>
<td>1968-1970</td>
</tr>
<tr>
<td>241-AZ</td>
<td>2</td>
<td>1970-1974</td>
</tr>
<tr>
<td>241-SY</td>
<td>3</td>
<td>1974-1976</td>
</tr>
<tr>
<td>241-AW</td>
<td>6</td>
<td>1976-1979</td>
</tr>
<tr>
<td>241-AN</td>
<td>7</td>
<td>1977-1980</td>
</tr>
<tr>
<td>241-AP</td>
<td>8</td>
<td>1982-1986</td>
</tr>
</tbody>
</table>

In 2012, the first leak in a double-shell tank at Hanford was discovered in the 241-AY tank farm (Tank AY-102) and the failure was observed to be from the primary tank bottom. The exact failure location and damage mechanism are both still undetermined. Further reviews of original construction records assessed the extent to which the other double-shell tanks in the system had similar as-built characteristics. Up to this point, ultrasonic inspection data has only provided information to engineers about the condition of the tank sidewalls and yielded no early warning as to the potential for double-shell tank bottom failure.

As a result of this discovered integrity monitoring weakness, primary tank bottom failure, and follow-up construction research, a key improvement needs to be made to the integrity program
that would add the capability to inspect the primary tank bottom of double-shell tanks. Direct inspection access to the primary tank bottom is limited to channels in an insulating concrete pad (refractory pad) that the primary tank rests on. Access through these refractory channels would provide data about the bottom of the primary tank from the exterior surface. Each double-shell tank has risers of various diameters that provide access to the annulus space from grade, the largest of which are 24-in and 12-in diameter. The annulus space is 30-in between the primary tank and secondary liner sidewalls.

![Diagram of double-shell tank](image)

Market research and expression of interest responses from prospective vendors has helped the Tank Operations Contract (TOC) narrow down the preferred approach to successfully executing visual inspection of the primary tank bottom region.

3.0 Scope

The Subcontractor will design and fabricate a double-shell tank annulus deployed system for use in visual inspection of the primary tank bottom. The system will access the primary tank bottom environment through air channels present in the refractory pad on which the tank rests. The system will deliver inspection equipment to these channels from a magnetically coupled position on the primary or secondary liner wall, avoiding contact with the floor of the annulus.

For the purposes of this statement of work (SOW), the inspection device is requested to be a semi-rigid fibrescope with onboard lighting, color, and capability to control the camera unit within the inspection environment. Camera control could be accomplished through several means, including articulating heads or angled mirrors with camera unit rotation. The goals of the inspection are to assess the condition of the carbon steel tank bottom material, determining the presence of degradation or leakage. This inspection device was chosen for the application given the simplicity and high probability of success to deliver a camera to the center of the tank pad in the AZ, SY, AW, AN, and AP double-shell tank designs. The refractory air channel pattern for these designs is shown in the following graphic.
The AY Tank Farm refractory pad design is excluded from consideration to further tailor the design for more broad success in the remaining balance of the tanks. Modularity is a highly valued feature of the inspection device design, allowing for adaptation for future nondestructive examination sensor developments.

Design for annulus deployment should consider both 24-in and 12-in riser penetrations. Outer diameter of the system should therefore be deployable through a 10-in inner diameter hole. Given that annulus access is not a high hazard activity, manual delivery of the system through the riser penetration is the preferred option by the TOC to limit complexity/cost and increase flexibility of field operations. A typical field deployment environment is shown below.
Operation of the equipment will be from a significant distance away outside the fence line of the tank farm and down below grade approximately 50 feet. This total distance can often equate to several hundred feet (200-500 ft). Provisions for equipment operation in this environment will need to be considered.

With system deployment logistics considered, the selected Subcontractor will perform the following tasks:

1. Provide a preliminary design of a fibroscope style visual inspection solution that is deployable into the annulus and air channel environment of double-shell tanks to be reviewed by TOC Engineering personnel.
2. Based on feedback from TOC Engineering, provide a final design of the inspection solution that is deployable into the annulus and air channel environment of double-shell tanks for TOC Engineering Approval.
3. Fabricate/assemble the approved design.
4. Cold test the unit at the Subcontractor facility, ensuring the system is deployable in a functional demonstration test.
5. Deliver the functional solution to Richland, WA.
6. Provide on-site training to TOC operations and engineering personnel regarding system use, capabilities, and data interpretation.
7. Support on-site cold testing of completed unit in a TOC provided mock-up.

4.0 Submittals

In support of the work scope established in Section 3.0 above, submittals are listed on the Master Submittal Register (MSR).

Submittals shall be provided using the TOC Incoming Letter of Transmittal (form A-6005-315). All transmittal subject headings shall contain, at a minimum, the subcontract number, submittal number, and submittal description.

Submittals shall be provided in electronic format unless available only as a hard copy. Electronic submittals may be sent to TOCVND@rl.gov or delivered via a WRPS designated File Transfer Protocol (FTP) site. Electronic formats must be non-password protected in one of the following formats:

- Microsoft® Office Compatible
- Portable Document Format (PDF)
- Tagged Image File Format (TIFF)
- Graphics Interchange Format (GIF)
- Joint Photographic Experts Group (JPEG)
- Windows Media Video (WMV)
- Moving Picture Expert Group (MPEG)
- Extensible Markup Language (XML)
- HyperText Markup Language (HTML)
- Comma Separated Values (CSV)
- Text (TXT)

5.0 Acceptance Criteria

Unless otherwise approved by the TOC, all electrical control panels and electrical equipment [a general term including material, fittings, devices, appliances, luminaries (fixtures), apparatus, and the like, used as a part of, or in connection with, an electrical installation] delivered or brought onto the site in performance of this subcontract must be listed or labeled by an organization
currently recognized by Occupational Safety and Health Administration (OSHA) as a Nationally Recognized Testing Laboratory (NRTL).

For any system or completed assembly containing electrical systems, the Subcontractor shall provide evidence of NRTL listing along with labeling. If a category for the assembly does not exist (e.g. custom-made equipment), the Subcontractor shall provide information necessary for WRPS evaluation based on compliance with the provisions of the National Electric Code (NEC) containing the following information:

1. Provide a complete list of components/parts used in the fabrication of the assembly along with the Underwriter’s Laboratory (UL) file number associated with each part number.
2. Provide a summary of conditions of acceptability for any “Recognized” components used in the fabrication of the assembly.
3. For any unevaluated component, provide descriptive literature to verify the use of the unevaluated component, including product specification and a description of its intended application.

6.0 Configuration Management and Standards

6.1 Configuration Management Requirements

There are no specific Configuration Management requirements applicable to this SOW.

6.2 Applicable Standards

There are no specific standards applicable to this SOW.

7.0 ESH&Q Requirements

7.1 Quality Assurance Requirements

The Contractor’s program shall be submitted for review/approval against the requirements identified on site form A-6006-661 Quality Assurance Requirements dated 1/30/2017. This work is designated as Quality Level 3.

7.1.1 Supplier Quality Assurance Program

The Subcontractor's Quality Assurance Program shall be subject to review at all times, including prior to award.

7.1.2 Supplier Quality Assurance Program Changes

The Subcontractor shall, during the performance of this subcontract, submit proposed changes to their approved quality assurance program to the WRPS Buyer for review and concurrence prior to implementation.

7.1.3 Quality Assurance Oversight

WRPS personnel will co-ordinate with the supplier to conduct scheduled and periodic oversight of activities or products associated with this scope of work.
7.1.4 Quality Assurance Requirements for Analytical Laboratory Services

There are no specific quality assurance requirements for analytical laboratories that are applicable to this SOW.

7.2 Price-Anderson Amendments Act Requirements

This 7.2 section and the General Provisions Article 2.11 entitled, *Price-Anderson Amendments Act (PAAA)*, are both determined to be *not applicable.*

7.3 Special ESH&Q Requirements

Preliminary hazard assessment PHA ID: 32 is to be used for general office duties performed in TOC-controlled office facilities and/or observations/walkthroughs in tank farm non-radiological and controlled radiological areas, including soil contamination areas and buffer areas, requiring a General (Not Specific) Radiological Work Permit (RWP) only. Only observation activities are allowed (no hands-on work activities may be performed). Ladder/scaffolding access is not allowed. Prior to performing any other activities, a Job Hazard Analysis (JHA) must be completed to cover the activities to be performed. The JHA must be approved by a TOC Safety Representative.

8.0 Verification/Hold Points

As part of the subcontract submittal process and unless otherwise specified, TOC will review Subcontractor prepared documents and designate all required TOC review, inspection, witness, and notification points.

There are two hold points requiring review and approval by TOC Engineering personnel prior to proceeding and they follow tasks 1 and 3 in the scope section defined above.

1. Following task 1, TOC Engineering personnel will review and approve design of the candidate system for inspection to ensure compatibility with the physical and environmental constraints of a double-shell tank annulus deployment.
2. Following system fabrication and cold testing (task 3), TOC Engineering will review and approve results to ensure the system is capable and ready for field deployment.

9.0 Reserved

10.0 Work Location/Potential Access Requirements

While work will predominately be performed at the Subcontractor’s off-site facility, access to Hanford facilities will be required in the later stages of the contract performance to deliver and field deploy the system. Office access should be provided to 2620 Fermi [Richland], 2425 Stevens [Richland], 2704HV [200E Area], and outside the fence line of a 200E tank farm in a trailer for deployment and operation.

11.0 Training

Subcontractor personnel will be visitor badged and escorted during visits to Richland and onto the Hanford site. No specific Hanford site training will be applicable.
12.0 Qualifications

Subcontractor personnel should be competent in the field of robotics as demonstrated by provided resumes and past work experience. Prior success deploying remote inspection equipment in a nuclear environment is required.

13.0 Special Requirements

Not applicable.

Use of Government Vehicles

There is no anticipated need for any Subcontractor employees to use a Government-furnished vehicle in the performance of this statement of work. The Subcontractor’s employees, therefore, are specifically prohibited from driving any Government-furnished vehicles under the performance of this statement of work unless this statement of work is formally so modified by the parties and the employee(s) will present a valid driver’s license to the BTR for review.

14.0 Reporting/Administration

- Reporting and administration will be accomplished through bi-weekly letter reports to the TOC Project Manager, detailing scope completion and contract cost forecasting.
- Conference calls will be had as necessary to ensure integration between the Subcontractor and TOC personnel.
- TOC Engineering personnel plan to make one site visit to the Subcontractor’s facility to observe the testing of the completed product during the cold testing task.

15.0 Workplace Substance Abuse Program Requirements

A Workplace Substance Abuse Program is not required for this SOW.