

STATEMENT OF WORK

Requisition #279556

Title: Full-Scale Ion Exchange Column Test and Engineering-Scale Integrated Test for the Low Activity Waste Pretreatment System

Revision Number: 0

Date: June 10, 2015

Prior SOW or Revision Date: N/A

1.0 Objective

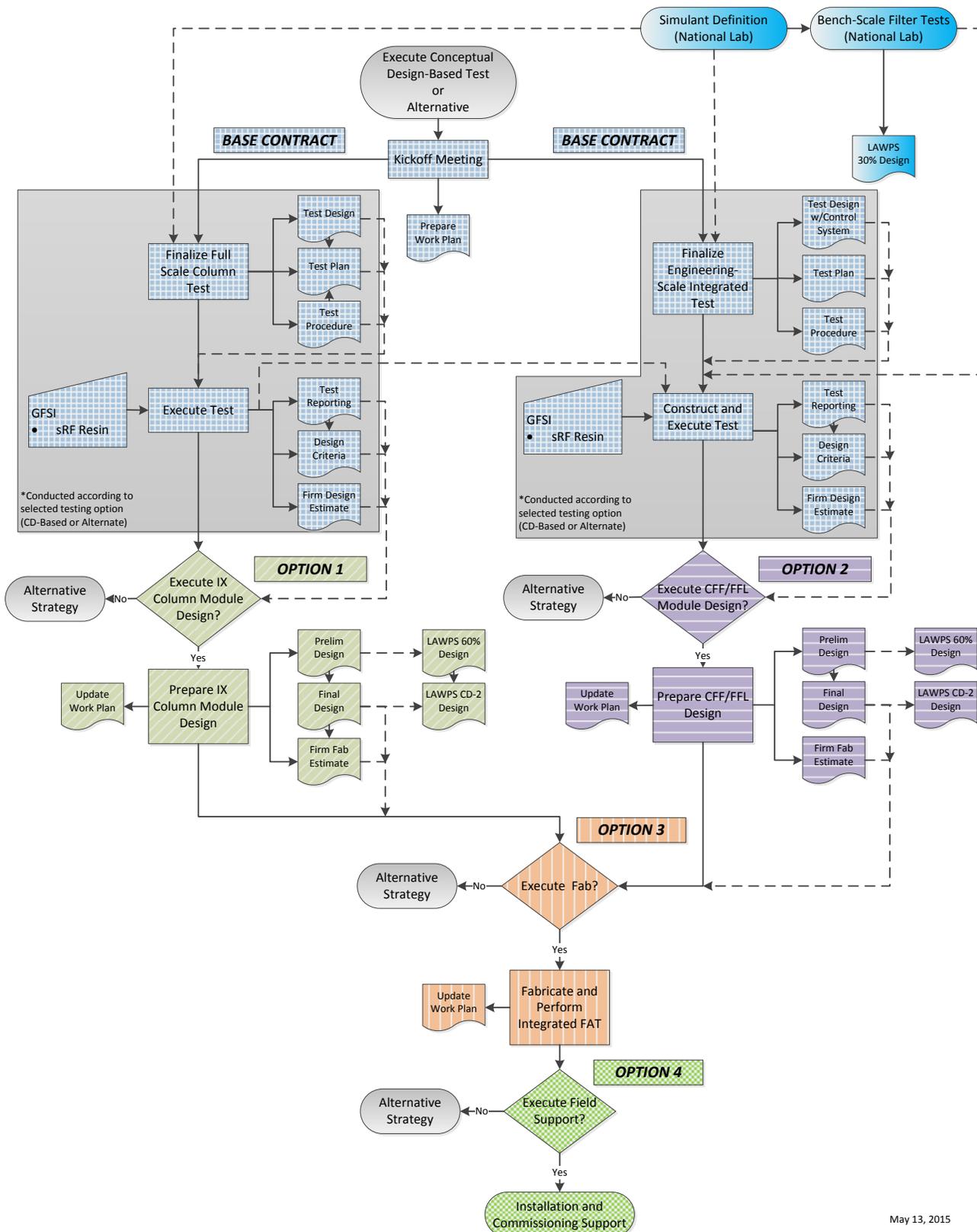
The first objective specific to this scope of work is to establish a cesium ion exchange (IX) column prototype design using spherical Resorcinol Formaldehyde (sRF) that will effectively integrate with other key unit process operations within the Low-Activity Waste Pretreatment System (LAWPS) flow sheet under an acceptable hazard control strategy. The second objective is to perform an engineering-scale integrated test of the key unit process operations including cesium IX using sRF, Cross Flow Filtration (CFF) and the Filter Feed Tank (FFT) loop that supplies untreated tank waste to the cross flow filters.

2.0 Background/Introduction

The LAWPS project provides for the early production of Immobilized Low Activity Waste (ILAW) by feeding LAW directly from Tank Farms to the Waste Treatment Plant (WTP) Low Activity Waste (LAW) Facility. Prior to the transfer of feed to the WTP LAW Vitrification Facility, tank supernatant waste will be pretreated in the LAWPS to meet the WTP LAW waste acceptance criteria. The key process operations for treating the waste include solids filtration and cesium removal. To support the design before the end of CD-2 (preliminary design) and to improve the technology maturation level of the LAWPS treatment system, an engineering-scale integrated test is planned.

3.0 Scope

The scope of the testing is comprised of a full-scale prototypic IX column test, and a separate prototypic engineering-scale test of the integrated system during the preliminary design phase to test interactions between the unit process operations at the appropriate scale to validate the preliminary design and inform the final design of the permanent plant equipment. The work scope execution strategy is shown in Figure 1.



May 13, 2015

Figure 1. Work Scope Execution Strategy

Overarching technical objectives of performing the testing are to:

1. Test interactions between unit process operations;
2. Test removal of non-radioactive Cesium (Cs) from process stream;
3. Test removal of undissolved solids from process stream;
4. Confirm an operational flow rate range;
5. Confirm volumetric throughput of waste stream over flow operating range;
6. Confirm a range of process temperatures over planned operating range;
7. Establish system hydraulics and process criteria;
8. Coordinate key control and monitoring components; and
9. Establish that treated product chemistry meets requirements (Cs, solids, and pH).

Testing consists of (1) an ion exchange column test at full-scale, and (2) an engineering-scale integrated test using prototypic equipment. The Subcontractor shall provide a full-scale prototype IX column, test facility with environmental control, support equipment, simulants, reagents, and test documentation demonstrating the Subcontractor's approach to cesium ion exchange using elutable sRF resin.

The Subcontractor shall provide the prototype engineering-scale process equipment, test facility with environmental controls, support equipment, simulants, reagents, control and monitoring system, data acquisition, and test documentation that will demonstrate an integrated approach to filtering solids using CFF, removing cesium using sRF cesium ion exchange, eluting and regenerating sRF resin, cleaning filters, and maintaining an operating system within production parameters.

Specific test requirements, objectives and success criteria for the full-scale IX column test and the engineering-scale integrated test are provided in RPP-RPT-58683. Note that periodic tours with WRPS and stakeholders may be performed at Subcontractor test facilities to view testing activities. Tours will be scheduled with the Subcontractor in advance with the goal of minimizing impacts to scheduled test activities.

3.1 Ion Exchange Column Test (full-scale)

This full-scale prototypic column test will be conducted in support of the preliminary design to establish a cesium ion exchange process design using sRF resin that demonstrates an approved hazards control strategy in accordance with the safety-in-design control development process described in Section 3.4. The cesium ion exchange column design from the LAWPS conceptual design CD-1 package, with a resin dump hazard control strategy from advanced conceptual design is the established approach for safely removing cesium from supernatant tank waste.

The tested column design shall demonstrate overall column performance with respect to the ability to load fresh sRF resin into the column, resin conditioning, cesium removal within planned operating ranges, elution, regeneration, frequency of elution and regeneration, spent resin discharge from the column, and mitigation strategy for a column

flammable gas explosion event, and a column over-temperature-pressurized spray release event. The full-scale IX column test is a top priority test to inform preliminary design. Completion of this testing scope shall not delay or inhibit completing of the engineering-scale integrated test. The Subcontractor shall be responsible for the following during execution of the full-scale IX column testing work:

1. Test Design Documents (Section 3.3)
2. Test Plan (Section 3.5)
3. Test Procedure(s) (Section 3.6)
4. Test Report (Section 3.7)
5. IX Resin, Simulant and Reagents (Section 3.8)
6. Design Integration Consultation (Section 3.10)
7. Work Plan (Section 3.9)

These deliverables are reflected in the Master Submittal Register (MSR) discussed in Section 4.0.

3.2 Engineering-Scale Integrated Test (1/9th scale)

Cesium ion exchange using sRF resin, CFF and the FFT loop that supplies untreated supernatant tank waste to the cross flow filters shall be tested at the integrated engineering-scale level using prototypic equipment. The testing will be conducted to test interactions between the process components. The Subcontractor shall demonstrate an integrated approach to filtering solids, removing cesium, eluting and regenerating ion exchange resin, cleaning filters, and maintaining an operating system within planned production rates, operating ranges, and safety parameters. The hazard control feature(s) for mitigating flammable gas explosion in the IX column, due to loss of flow through the column, will not be demonstrated as part of the engineering-scale integrated test.

Bench-scale CFF filter testing will be conducted by WRPS and the Pacific Northwest National Laboratory (PNNL). One of the objectives of the bench-scale tests is to establish a shell-side CFF cleaning methodology to be implemented in the engineering-scale integrated test. Results of the filter cleaning bench-scale tests will be provided to the Subcontractor for use in engineering-scale integrated testing.

The Subcontractor shall be responsible for the following during execution of this testing work:

1. Test Design Documents (Section 3.3)
2. Test Plan (Section 3.5)
3. Test Procedure(s) (Section 3.6)
4. Test Report (Section 3.7)
5. IX Resin, Simulant and Reagents (Section 3.8)
6. Design Integration Consultation (Section 3.10)
7. Work Plan (Section 3.9)

These deliverables are reflected in the Master Submittal Register (MSR) discussed in Section 4.0.

3.3 Test Design

The Subcontractor is responsible for quality and technical aspects associated with the full-scale IX column prototypic test and the engineering-scale integrated test using prototypic equipment. Test design shall include technical requirements identified in this SOW and RPP-RPT-58683. The test design, including detailed P&ID and arrangement sketches, and scoping calculations as required shall be included (or referenced) in the test plan or test procedures.

3.4 Safety-In-Design

The LAWPS Project is required to implement the applicable requirements of DOE Order 420.1C, *Facility Safety*, DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, and DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, as key programmatic and project requirements. The Subcontractor shall support WRPS execution of the project in accordance with these requirements. The Subcontractor shall also coordinate with the activities of WRPS Nuclear Safety and the LAWPS Design Authority to implement the applicable requirements of DOE-STD-1189-2008, *Integration of Safety into the Design Process*.

Hazards analysis was performed during the LAWPS conceptual design. Follow-on control development continued during advanced conceptual design. The Subcontractor's test design is required to demonstrate the hazard control strategy and its effectiveness by test for the following hazards:

- a. Flammable gas deflagration or detonation in an ion exchange column.
- b. Ion exchange column over-temperature event – pressurized spray release

The Buyer's current hazards controls strategy dumps the resin from the column to a resin dump tank after a pre-determined period of time following loss of flow through the IX column. The Subcontractor shall demonstrate this hazard control strategy in the full-scale IX column test.

3.5 Test Plan

The Subcontractor shall prepare a test plan for the full-scale IX column test and the engineering-scale integrated test. The Subcontractor is urged to provide separate test plans for the two tests so that the full-scale IX column test can proceed well in advance of the engineering-scale integrated test. Test plans shall be submitted for review and approval by WRPS before testing begins. The Subcontractor shall disposition the review comments and update the document accordingly prior to resubmitting the final document for approval. The dispositioned comments shall be submitted along with the final document. Test plans shall address the following, as a minimum:

- Provide detailed information to implement this SOW and the test specifications, including a detailed description of the work broken into logical phases.
- Provide a summary that describes the overall test scope and shows how the various subtasks are integrated to accomplish the overall objectives of this work.
- Provide success criteria for demonstrating test specification objectives have been met.
- Specify both qualitative and quantitative data to be gathered.
- Describe the test design (or reference the test design).
- Describe the test equipment and identify test articles including critical dimensions, configuration, and calibration requirements.
- Identify integrated test monitoring and control strategy and equipment.
- Test equipment and instrumentation availability.
- Include specific characteristics to be tested.
- Include test prerequisites that address instrument calibration, data to be recorded, and environmental condition requirements.
- Include the selection and identification of measuring and test equipment based on the type, range, accuracy, and tolerance needed to accomplish the required test measurements.
- Location of calibration logs and calibration reports during testing.
- Method for test data collection and storage to ensure integrity of test data and to prevent inadvertent loss or alteration of test data.
- Identify key test positions, roles and responsibilities (e.g. Test Director, Test Engineer, QA, QC).
- Identify test personnel training requirements.
- Identify control of changes to the tested configuration and management of test document changes (e.g. redline control changes for IX column rapid prototype development)
- Identify any verification, witness, or hold points.
- Identify control and management of test simulant and ion exchange resin.
- Identify sampling, sample control and chain of custody of samples.
- Identify test reporting requirements.
- Identify process for managing test exceptions as follows:

If during performance of a test, acceptance criteria provided in the test procedure and/or test plan cannot be met, the Test Engineer or Test Director will address the deficiency with the following actions:

1. Makes a log entry in the Test Log. Record equipment status, procedure step affected, date and time and suspend testing.
2. Generates a Test Exception Report (TER) to recommend a necessary disposition and remedial actions, and obtains approval of the TER.
3. The Test Director makes a determination at this time as to whether other testing may continue. If other testing is allowed to continue, make necessary annotations to the procedure and make a log entry noting the Test Director's instruction to restart the test.

4. If acceptance criteria in the test procedure and/or test plan must be changed, approve and issue the change under approved document change control before continuing with the applicable portion of the test.

If during the performance of a test, the test procedure provides inadequate direction to perform the intended task, two or more procedures conflict, or any unexpected event occurs (i.e., system/equipment malfunction, test design deficiency, etc.), the Test Engineer or Test Director will address the deficiency with the following actions:

1. Makes a log entry in the Test Log. Record equipment status, procedure step affected, date and time and suspend testing.
2. Generates a Test Exception Report to recommend a necessary disposition and remedial actions, and obtains approval of the TER.

The Test Director will make a determination at this time as to whether testing may continue. If testing is allowed to continue, make necessary annotations to the procedure and make a log entry noting the Test Director's instruction to restart the test.

3.6 Test Procedure

The Subcontractor shall prepare separate test procedures for the full-scale IX column test and the engineering-scale integrated test. The test procedures shall be submitted for review by WRPS before testing begins. The Subcontractor shall disposition the review comments and update the document accordingly prior to resubmitting the final document for approval. The dispositioned comments shall be submitted along with the final document. Test procedures shall implement the requirements identified in test plans in a format that identifies test prerequisites, any verification, witness, or hold points, test data requirements, and list of steps for performing the testing work. Test personnel shall initial and date completion of test steps as required to demonstrate procedure implementation.

3.7 Test Report

The Subcontractor shall prepare and submit test memorandums and test reports documenting the results of the respective test (e.g., full-scale IX column test, engineering-scale integrated test) with respect to test objectives and success criteria identified in the test plans/test procedures. The test results memorandums shall summarize the preliminary test results for use as early feedback to the engineering design while the test report is being prepared. Draft test reports shall be prepared and submitted to WRPS for review after test completion. The test report should cover the following:

- Executive Summary
- Introduction
- Test Purpose and Scope
- Test Description (include photographs, figures, diagrams)
- Test Results

- Discussion of Test Results
- Conclusions
- Recommendations
- References
- Appendices

Assume ten (10) working days for WRPS review of the draft test report. The Subcontractor shall disposition the review comments and update the document accordingly prior to resubmitting the final document for approval. The dispositioned comments shall be submitted along with the final document. The test memorandums and the test reports shall include key performance/design criteria necessary to refine equipment specifications for design of cesium ion exchange, CFF, and FFT loop components.

3.8 Ion Exchange Resin, Simulant and Reagents

The following sections discuss IX resin, tank waste simulants and reagents that will be used for testing. The IX resin will be supplied by WRPS. Simulants and reagents will be purchased by the Subcontractor.

3.8.1 Ion Exchange sRF Resin

WRPS will supply sRF resin in the amount of two (2) column bed volumes for the full-scale IX column test. A single column bed will be used to demonstrate normal process flow, elution, and regeneration cycles. Two column bed volumes are required to demonstrate a loss of flow event where two columns of resin will be discharged to a full-scale mockup of the bottom portion of the RDT to evaluate resin flow and dispersion in the RDT. The full-scale column design assumed in the LAWPS conceptual design holds approximately 308 gallons/column of sRF resin in sodium form.

A second inventory of sRF resin for two (2) IX columns, to be used for the engineering-scale integrated test, will be supplied by WRPS. A 1/9th scale full height column envisioned by WRPS needs approximately 34 gallons/column of sRF resin.

The sRF ion exchange resin shall be stored under nitrogen pressure and protected from oxygen exposure prior to testing use. Nitrogen cover pressure shall be verifiable during storage. Resin shall be protected from exposure to direct sunlight, freezing temperatures (below 34°F), and temperatures in excess of 113°F. Manufacturer's recommended handling and storage instructions shall take precedence over information provided in this SOW.

The Subcontractor will assume controlled inventory storage and traceability of resin during testing and up to one year after completion of testing. WRPS will provide written direction to the Subcontractor for final disposition of spent and unused resins.

3.8.2 Tank Waste Simulants

The Subcontractor shall supply simulant in the amount necessary to perform the full-scale IX column test and the engineering-scale integrated test. Simulant development work will be conducted by WRPS and PNNL. Two (2) simulant recipes will be provided to the Subcontractor for testing. Further information on simulants is provided in RPP-RPT-58683. Simulant shall be protected from exposure to direct sunlight, freezing temperatures, and temperatures in excess of 40°C. The Subcontractor will assume controlled inventory storage and traceability of simulant during testing and up to one year after completion of testing. WRPS will provide written direction to the Subcontractor for final disposition of simulant.

3.8.3 Reagents

The Subcontractor shall supply acid and caustic reagents in various concentrations for both the full-scale IX column test and the engineering-scale integrated test. Nitric acid reagent is used for eluting cesium from the sRF resin and a sodium hydroxide reagent is used to regenerate the resin following elution. Reagents will also be used to test CFF cleaning methodologies during the engineering-scale integrated test. The Subcontractor should assume the following reagents and concentrations for testing:

- 0.5M Nitric Acid
- 0.1M Sodium Hydroxide
- 1.0M Sodium Hydroxide

3.9 Work Plan

The Subcontractor shall prepare and maintain a work plan that reflects the objectives, approach, activities, deliverables, overall schedule, and resources required to accomplish the tasks funded in this SOW. The work plan information shall be presented in a manner consistent with the furnished Contract Work Breakdown Structure (CWBS). WRPS will review and concur with the work plan prior to the start of work activities. The Subcontractor shall execute the work in accordance with the work plan.

- Lower-tier subcontractors shall be identified in the work plan.
- Identify the objective, technical approach, and organizational structure for execution of this SOW;
- Identify the key technical members and the management assigned to this effort for approval;
- Identify project management procedures and controls that will be used to manage, status, and report progress including funds management, technical progress, and reporting requirements;
- Describe the technical scope of work to be performed for each task required by this SOW;
- For each task, identify the activities to be performed, the analyses required to support functional development, the specific documents (including codes and standards) required to support technical development, and the types of design media to be produced;

- Include a work plan schedule utilizing a Gantt chart to illustrate the activities and identify the total resources required, including estimated staff hours. This schedule, when approved, will become the Subcontractor’s performance measurement baseline; and
- The work plan shall identify all work scope defined in this SOW.

The Subcontractor shall manage the approved work plan at the working level through the Subcontractor's change control process. Changes requiring WRPS action shall be handled as discussed in Section 14.6. The Subcontractor shall review and report against the plan on a periodic basis, as discussed in Section 14.5.

3.9.1 Contract Work Breakdown Structure (CWBS)

The Subcontractor shall comply with the furnished CWBS. The CWBS shall identify all work to be performed as part of this SOW. All planning and performance measurements shall be based on the approved CWBS and include the following requirements:

- Be compatible with and support the LAWPS Project Work Breakdown Structure (WBS) shown in Table 3.9.1-1. The starting point for the Subcontractor’s CWBS for the Work plan is shown in Table 3.9.1-1.
- Provide for a logical CWBS and project WBS rollup of all budget, earned-value, and cost data.
- The schedule must provide a CWBS dictionary description for each element.

Table 3.9.1-1. Low Activity Waste Pretreatment System Project WBS

WBS Number	Title
5.05.07.12.03	Technology Maturation Integrated Scale Test

3.9.2 Work Plan Performance Measurement Baseline

A time-phased performance measurement baseline (PMB) (staff hours and dollars) for completing the scope defined in this SOW shall be prepared by the Subcontractor and included in the work plan. The PMB shall have the following characteristics.

- Consistent with the directed work scope, work plan, and CWBS.
- Structured by CWBS level.
- Directly linked to the work plan schedule.
- Maintained through the Subcontractor's change control process and updated, as required.
- Consistent with and roll up to the CWBS reporting level baseline (one baseline) at the lowest level.
- Documented to the lowest level of the CWBS, including the earned value methodology to be used.
- Performance indicators reviewed/analyzed on a monthly basis for the following:
 - Trends and indications of deteriorating and/or improving conditions;

- For adverse trends, based on statistical calculations;
- For lessons learned and good practices that should be used to prevent occurrences; and
- Staffing curve status and trending.

Updated monthly and included in the submitted Monthly Activity Status Report as required in Section 14.5.

3.9.3 Work Plan Schedule

The Subcontractor shall prepare a schedule to identify the major activities associated with this SOW and reflect compliance with the delivery schedule identified in the contract Master Submittal Register (MSR). The schedule shall be developed in sufficient detail to plan and control the required work tasks and shall have the following characteristics.

- Time-phased, resource-loaded, logic-based for all activities.
- Structured to indicate established deliverables with key milestones.
- Supported by lower-level discipline schedules.
- Preferably delivered in a Primavera Project Planner™ (P6)¹ format.
- When the work plan has been approved, WRPS will make two (2) copies of the schedule. WRPS will archive one copy for historical reference and the other copy will be attached to the working schedule to provide a baseline for Earned Value measurement.
- Updated weekly to reflect status and any agreed-upon changes and submitted as required in Section 14.5.

3.10 Innovative Alternatives

The Subcontractor is highly encouraged to propose alternatives in accordance with guidance provided in the sections below. The subcontractor is responsible for developing and presenting the background information, technical basis, and a detailed list of advantages to WRPS. The information may be used by WRPS when evaluating the overall benefit of the alternative to determine if the approach should be explored further.

For alternatives in which the Subcontractor has unique technical knowledge, the Subcontractor engineering personnel may be requested to participate in periodic design meetings to support integration of the alternative into the process design. Consultation support will occur in parallel with testing work scope. The Subcontractor should assume up to 100 hours of consultation time using senior engineering disciplines with in-depth technical knowledge of the alternative. Minimum personnel qualifications are provided in Section 12.0 of this SOW.

3.10.1 Cesium Ion Exchange

The Subcontractor is encouraged to propose an alternative cesium ion exchange column design using sRF resin for Buyer consideration, especially if the alternative design has

¹ Primavera Project Planner (P6) is a trademark of Primavera Systems.

been successfully implemented in a similar and relevant environment within the U.S. Department of Energy complex, or other established commercial nuclear project.

The Subcontractor is encouraged to propose innovative solution(s) to address specific hazards identified in Section 3.4, especially where a hazard control solution has been successfully implemented in a similar application within the U.S. Department of Energy complex or other established commercial nuclear project. The Subcontractor may use an alternate hazard control strategy in lieu of that described in Section 3.4, provided that the alternate hazard control strategy does not reduce overall column performance and is reviewed and accepted by the WRPS Safety Design Integration Team (SDIT). The subcontractor is responsible for developing the background information and technical basis for the alternate hazards control strategy and presenting the information to the SDIT. Evidence of review and acceptance of a Subcontractor proposed alternate hazard control strategy will be documented in the SDIT meeting minutes.

3.10.2 Filtration

The Subcontractor is encouraged to propose alternate filtration approaches for Buyer consideration that can be demonstrated in small-scale, low solids, filter optimization testing. Results of the filter optimization testing will be evaluated for performance and compared with CFF performance to determine if further testing and evaluation is warranted. Up to two (2) filtration alternatives, other than CFF may be considered for low solids filtration service provided that there is demonstrated experience with the alternative filtration approach in similar and relevant environments. Alternative filtration examples include dead-end, backwash-able filters (<http://www.mottcorp.com/industry/process-filtration/liquid-solids.cfm>).

3.10.3 Alternate Test Scale

The Subcontractor may provide a design for an integrated test scale between 1/10th scale to full scale, provided that there is technical, cost, and schedule justification for the chosen scale test. Minimizing the test equipment fabrication cost and schedule, and volume of waste simulant and ion exchange resin needed for the test should be considered when selecting a test scale. The key focus of the equipment sizing is to maintain process velocities, residence time, and chemical performance at the scaled process rate. The Subcontractor shall provide an estimate of the sRF resin volume and simulant volume needed to test alternate configurations at least 50 working days before test runs are scheduled to begin.

3.11 Options

Permanent plant equipment design options for the IX column module (Option 1) and the CFF and FFT loop (Option 2) may be awarded at the discretion of the WRPS Buyer to the Subcontractor that successfully demonstrates their products/technologies by test using prototypic equipment. A follow-on fabrication and factory acceptance test option (Option 3) of permanent plant equipment may be awarded at the discretion of the WRPS Buyer if determined to be in the best interest of the WRPS and the government. Option 3 may include part or all of the IX column, CFF, and FFT loop. A field support option (Option 4) may be awarded at the discretion of the WRPS Buyer to support field-related

work, e.g., full-scale integrated testing of the permanent plant equipment, equipment installation, and commissioning of Subcontractor-supplied modules. No option shall be awarded until the Subcontractor's NQA-1 Quality Assurance Program is evaluated and approved for performing the work scope under the option.

The design and fabrication options will be based on requirements from RPP-SPEC-56967, *Project T5L01 Low Activity Waste Pretreatment System Specification* applicable to full-scale production of cesium ion exchange using sRF resin, CFF and FFT loop modules. The Buyer reserves the right to integrate the permanent plant process control and monitoring system hardware and software, and other systems during the integrated factory acceptance test. Specifications and updated SOW requirements will be provided at a later date for this work. Firm fixed price proposals may be requested by the Buyer to support these follow-on options:

- Option 1 - IX Column Module Design
- Option 2 - Cross-Flow Filter and Filter Feed Tank Loop Modules Design
- Option 3 - Fabrication and Integrated Factory Acceptance Testing
- Option 4 - Field Support

4.0 Submittals

In support of the work scope established in Section 0 above, submittals are listed on the Master Submittal Register (MSR). All documents submitted shall include "Official Use Only" on each page of the document, preferably in the footer.

Submittals shall be provided using the Tank Operating Contractor (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

Acceptance criteria that will be used to measure completion of work scope in this SOW is based on implementing work scope in Section 0, and WRPS acceptance of submittals identified in the MSR as discussed in Section 4.0 above.

Record documents are the documents required by this SOW. Contract documents are documents that implement the contract and include the contract and all requirements, references, records and other related documents. All records submitted by the Subcontractor shall be submitted and processed in accordance with WRPS procedure TFC-BSM-IRM_DC-C-07, *Vendor Processes*.

All technical documents submitted to the project management team for review shall first be thoroughly reviewed by appropriate members of the Subcontractor's technical staff including, but not limited to: Quality Assurance, safety, and engineering checker personnel. Reports and documents shall be checked for technical and editorial accuracy before they are submitted to the project management team for any review. Reports and documents submitted to the project management team for acceptance shall be approved by the Subcontractor. The Subcontractor shall have written procedures in place that delineate the requirements for reviewing, checking, technical editing, and approval of documents before issuance. These procedures shall be available to the project management team for review. The Subcontractor shall make every effort to ensure that a complete and thoroughly reviewed submittal is provided to WRPS for review. Any WRPS review comments, findings, or non-conformances must be fully resolved prior to final acceptance.

Preparation, identification, approval, transmittal, and final disposition of new and revised record documents shall conform to the Subcontractor's established procedures or special instructions. Use of contract documents shall be controlled in accordance with the Subcontractor's established procedures or special instructions.

Engineering deliverables shall be prepared using Standard English units. Exceptions shall be identified and submitted to the project management team for approval.

Record Documents

Supporting documentation that is not available in an electronic format will be included in the documents as an appendix identifying where the source information is recorded.

Each deliverable record document shall also show the following:

- Project and contract identification
- Originating firm's name
- End-item document title
- WBS number
- Document identification number
- Document descriptive title
- Revision or addendum number or letter (on each page with the revised portion of the page indicated)
- Issue or revision date (released documents only)
- Authorized use stamp (e.g., draft, for approval, approved for construction, proprietary information, secret)
- Total number of pages and number of each page (e.g. 1 of 4)
- Table of Contents or attachments (as needed)

- Approval sheet with signature and title of responsible person(s) in both the WRPS organization and originating firm (for released documents only)
- Documents or vendor information containing proprietary or restricted use statements shall have a written release so they can be used by WRPS

Record file documents are those documents that describe or support the project design baseline (e.g. requirements, calculations, sketches), with current and previous revisions shall be maintained as record documents in accordance with the Subcontractor's approved configuration control program. The Subcontractor shall submit a list of record documents to the project management team for review. The Subcontractor shall keep duplicate copies of data to meet code or legal requirements.

Unless otherwise approved by 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 Hanford Site in performance of this subcontract must be listed or labeled by an organization currently recognized by OSHA as a nationally recognized testing laboratory.

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 perform an independent NEC inspection providing an NEC Inspection Report upon delivery. WRPS will then approve by inspection before equipment is released for field use by completing Non-NRTL Electrical AHJ Approval Form (A-6005-705).

Custom-made Industrial Control Panel assemblies must comply with the provisions of UL508A. Include the following applicable requirements for custom-made assemblies:

For Industrial Control Panels, the Subcontractor shall fabricate and certify the control panel in accordance with the provisions of UL508A and affix his label to completed assembly.

6.0 Configuration Management and Standards

Configuration management requirements for this Release are based upon the types of engineering services being procured and include the TOC standards listed in Section 6.2 Applicable Standards and the statements below.

In general, engineering outputs (e.g., test plans and procedures, reports, drawings, calculations, specifications) produced by the Subcontractor in performance of this SOW that do not directly modify existing Hanford Site structures, systems, or components shall be maintained and controlled in accordance with the Subcontractor's approved configuration management procedures, until turnover of the LAWPS facilities to WRPS for operations.

6.1 WRPS Configuration Management Requirements

New or revised Technical Documents shall be prepared in accordance with TFC-BSM-AD-STD-02, *Editorial Standards for Technical Documents*.

6.2 Applicable Standards

Table 6.2-1 below lists documents referenced in this SOW. The WRPS project management team can provide the applicable version of each document specified in Table 6.2-1. Unless otherwise noted, documents specified in this SOW are assumed to be the latest revision of the documents as of the date of contract award.

Table 6.2-1. Applicable Documents

	Document Number	Document Title
1	DOE Order 413.3B	<i>Program and Project Management for the Acquisition of Capital Assets</i>
2	DOE-STD-3009-2014	<i>Preparation of Nonreactor Nuclear Facility Documented Safety Analysis</i>
3	DOE-STD-1189-2008	<i>Integration of Safety into the Design Process</i>
4	DOE Order 420.1C	<i>Facility Safety</i>
5	TFC-BSM-AD-STD-02	<i>Editorial Standards for Technical Documents</i>
6	TFC-ENG-DESIGN-C-25	<i>Technical Document Control</i>

7.0 ESH&Q Requirements

7.1 Quality Assurance Requirements

The Subcontractor's program shall be submitted for review/approval against the requirements identified on site form A-6006-661 Quality Assurance Requirements dated June 10, 2015.

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. If Options 1 through 4 described in Section 3.1.1 are desired to be executed by WRPS, additional scope of NQA-1 requirements may be applied. No additional work scope other than the base contract testing work scope contained herein shall be performed without specific QA review and concurrence.

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

Subcontractors not on the Hanford Site shall have an implemented quality assurance program that complies with the (Department of Energy Consolidated Audit Program (DOECAP) Quality Systems for Analytical Services (QSAS)

(https://doecap.oro.doe.gov/DOECAP_Public/documentsLab.aspx) or DOE/RL 96-68.

7.1.5 Nuclear Facility Applications Subpart Listing

The Subcontractor shall ensure the applicable requirements from the ASME NQA-1 Part II Subparts listed in Table 7.1.5-1 are addressed in Design Output deliverables to be applied by a future Construction Contractor. The requirements shall be tracked in a matrix with implementation or non-applicability justification statements.

Table 7.1.5-1. Nuclear Facility Applications Subparts

Subpart #	Title
2.1	<i>Quality Assurance Requirements for Cleaning of fluid Systems and Associated Components for Nuclear Power Plants</i>
2.2	<i>Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants</i>
2.3	<i>Quality Assurance Requirements for Housekeeping for Nuclear Power Plants</i>
2.4	<i>Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities</i>
2.5	<i>Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete, Structural Steel, Soils, and Foundations for Nuclear Power Plants</i>
2.7	<i>Quality Assurance Requirements for Computer Software for Nuclear Facility Applications</i>
2.8	<i>Quality Assurance Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems for Nuclear Power Plants</i>
2.14	<i>Quality Assurance Requirements for Commercial Grade Items and Services</i>

Subpart #	Title
2.15	<i>Quality Assurance Requirements for Hoisting, Rigging, and Transporting of Items for Nuclear Power Plants</i>
2.18	<i>Quality Assurance Requirements for Maintenance of Nuclear Facilities</i>
2.20	<i>Quality Assurance Requirements for Subsurface Investigations for Nuclear Power Plants</i>
2.21	<i>Quality Assurance Guidelines for Decommissioning Nuclear Facilities</i>

7.2 Price-Anderson Amendments Act Requirements

The Subcontractor shall comply with Article 2.11 entitled, *Price-Anderson Amendments Act (PAAA)*, contained in the General Provisions and shall have a process in place to ensure that noncompliance documentation that affects work performed for WRPS, is submitted to WRPSPAAA@RL.Gov.

Subcontractor personnel shall be trained to the nuclear safety rules consistent with their specific position and assigned work.

7.3 Special ESH&Q Requirements

Access to the Hanford Site is required for delivery of items and to attend meetings.

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 radiologically controlled areas, including soil contamination areas and buffer areas, requiring a General (Not Specific) Radiological Work Permit (RWP) only. Observation activities only are allowed; no hands-on work activities may be performed. No ladder/scaffolding access is 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.

Offsite Subcontractor-managed test facilities shall be permitted to handle the chemical simulants and reagents, as required by federal, state and local regulations. Test facilities shall be equipped and staffed with the safe chemical handling resources (chemical hoods, storage cabinets, trained personnel, etc.). Oversight of safety practices related to Subcontractor testing activities may be performed by WRPS personnel.

8.0 Verification/Hold Points

Any required verification, witness and hold points will be identified by the Subcontractor in test plans and procedures that are prepared and submitted for review and approval by WRPS in support of testing.

9.0 Reserved

10.0 Work Location/Potential Access Requirements

The primary work location for the scope of work described herein will be at the Subcontractor's facilities. Periodic Hanford site/work facility visits are required for reporting, reviews and coordination activities. Hanford site visits will also be made available for walk downs of the existing facility, with prior notification, clearance, and training. See Section 7.3 for special ESH&Q requirements.

Subcontractor's work schedules and facility operations may not be consistent with the Hanford Site work schedules. The Buyer may require the Subcontractor to perform services to support alternate work schedules including shift work other than a standard 8x9 (with alternate Friday closures) or 4x10 work week. WRPS will not be subject to any additional costs which result from the Subcontractor's assignment to an alternate work schedule.

Access to the Subcontractor's standard work location shall be granted to WRPS for activities such as progress reviews, observation of test preparation and test execution work, periodic "over-the-shoulder" reviews of the work in progress, periodic tours, and Quality Assurance oversight described in Section 7.1.3.

11.0 Training

Subcontractor's personnel required to be on site for more than six consecutive days in support of this scope of work shall at a minimum, complete Hanford General Employee Training (HGET).

The Subcontractor shall be responsible for all costs associated with training and/or continuing education for Subcontractor's employees that is not Hanford-specific (e.g., commercially available training for certifications, etc.). The Subcontractor shall maintain company and regulatory required certifications and qualifications for their personnel.

12.0 Qualifications

The Subcontractor shall demonstrate proven performance in delivering projects similar in scope, total cost, and complexity on time and within budget, with demonstrated technical competency under an implemented NQA-1 Quality Assurance Program.

The Subcontractor's past 10 year history shall demonstrate experience in similar and relevant work to the LAWPS cesium ion exchange using elutable resins and cross-flow filtration process. Personnel performing work shall have training, experience, qualifications, and certifications to perform these tasks. The Subcontractor shall maintain company and regulatory required certifications and qualifications for personnel supporting this scope of work.

Test engineers, Test Director and engineering support personnel in disciplines such as Process Engineering, Mechanical Systems, Structural Analysis, Civil / Structural / Architectural, and Electrical, Instrumentation & Controls shall have a minimum of a B.S. in Engineering with 10 years of engineering experience or equivalent experience in a

related field.

WRPS shall accept key staff assignments of Project Manager, Test Director, and Design Integration Consultant(s) (Section 3.10). Key staff members and their qualifications shall be identified in the work plan. The Subcontractor's Project Manager shall act as the point of contact and shall be available to the WRPS project management team in order to update project status and appropriately direct the Subcontractor's project team.

13.0 Special Requirements

N/A

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.

Government Property

Pursuant to the Subcontract General Provisions article entitled, "Management of Subcontractor-Held Government-Owned Property," the following Government-owned property will be provided to the Subcontractor. The Subcontractor will be responsible for managing the Government-owned property as required in the Subcontract General Provisions:

- sRF Cesium Ion Exchange Resin

14.0 Reporting/Administration

14.1 Kickoff Meeting

A kick-off meeting will be held after issuance of a notice-to-proceed. The meeting's purpose is to provide the Subcontractor with additional information as required to accomplish the scope specified in this SOW, and to develop lines of communications, and a working relationship. This meeting will focus on a discussion of the work scope and goals and roles and responsibilities of each testing participant. Pertinent documents will also be reviewed and discussed. The Subcontractor shall explain how they intend to take advantage of previous experience and personnel. The Subcontractor shall prepare meeting minutes that emphasize agreements, commitments, and planned actions. Draft minutes shall receive participants' agreement and WRPS project management team's agreement before being submitted as the final minutes. The Subcontractor shall submit the final minutes after the meeting in accordance with the MSR.

14.2 Status Meetings

Status meetings will be held weekly during planning, set-up and testing to ensure that the Subcontractor is proceeding as instructed, to review the progress and general approach to the testing, and to provide weekly schedule status. The Subcontractor shall prepare meeting minutes that emphasize agreements, commitments, and planned actions. Draft minutes shall receive participants' agreement and WRPS project management team's agreement before being transmitted as the final minutes. The Subcontractor shall transmit the final minutes after the meeting in accordance with the MSR.

14.3 Communications

Any oral communications, or informal written communications (e.g. e-mail), affecting the approved work scope shall be brought to the attention of the WRPS Procurement Specialist/Buyer by the Subcontractor's project manager as soon as possible, but absolutely before the Subcontractor takes any action. Any changes or additions affecting the work scope shall be formalized by written contract amendment issued by the contract administrator.

The Subcontractor shall prepare and submit meeting minutes for meetings with WRPS project personnel. The meeting minutes shall emphasize agreements, commitments, and planned actions. Draft minutes shall receive participants' agreement and the WRPS project management team's agreement before being submitted as final.

14.4 Notifications

Notify the WRPS technical representative at least ten (10) working days before each phase of testing begins for both the full-scale column test and the engineering-scale integrated test. The technical representative may choose to observe some or all test evolutions and test documentation. Buyer's quality assurance oversight activities may be performed before, during and after testing to assure implementation of contract QA requirements.

14.5 Management Reports

The Subcontractor shall submit a Monthly Activity Status Report by the fifth of each month for the previous month. The Monthly Activity Status Report shall include, but not be limited to, the following information:

- Project Manager's narrative highlights, funds management, and status assessment for each CWBS element including activities planned for the next month (i.e. accomplishments and 30 day look ahead).
- Issues and concerns (cost, schedule, technical), recommended solutions, and progress made toward resolution.
- New or outstanding agreements and/or commitments for problem or technical issue resolution.
- Cost and schedule performances (BCWP, BCWS, ACWP, SPI, CPI, ETC (spread by month), and EAC) with respect to the Performance Measurement Baseline for current month and contract-to-date.
- Action Item List showing the cumulative status of action items.

- Weekly Man-Hour Report.
- Change Management Log (monthly updates).
- Detailed Engineering Performance Report.
- Manpower Histogram and S Curve.
- Monthly Accrual Report (Monthly and Cumulative analysis)
- Include staffing profiles and actual FTE comparisons to the resource-loaded schedule.
- Develop design to cost targets and provide in the monthly report by system.

Earned value progress and any changes in the latest estimate shall be included in the cost performance report with variance explanations. All of the Subcontractor's detailed budget information (staff hours and dollars) shall be available for review by the project management team as requested.

Variance analysis shall be on the current month and cumulative to date for control accounts that exceed variance reporting thresholds, and shall include cause, effect and corrective action. Variance analysis shall be prepared with explanations as required to adequately address problems. The Subcontractor and project management team will determine the variance analysis thresholds (current month and contract-to-date).

In addition, the Subcontractor shall also submit weekly updates to the work plan schedule for WRPS management team approval; emerging technical and EVMS issues shall be brought to the attention of the WRPS project management team.

The Subcontractor shall submit to WRPS a fiscal month end percent complete on test activities no later than the Tuesday following the fiscal month end closing date.

14.6 Work Plan Change Control

The Subcontractor shall provide notification of cost, schedule, and/or scope changes against the work plan requiring WRPS action. Changes will not be authorized for performance variance. Change history shall be maintained in a log. Change requests shall reflect total project impact (i.e., design, procurement, construction, etc.).

The Subcontractor shall prepare and submit change requests to WRPS. Prior to submittal, proposed changes shall be reflected in a copy of the work plan baseline schedule as follows:

- No activity that has been reported as complete can be deleted or modified;
- If any activity that has earned value reported against it needs to be re-planned, that activity must be stopped and the resources set to equal the value of the performance reported to date. The remaining resources may then be re-planned as part of the change; and
- Once the Subcontractor is satisfied with the proposed changes, the work plan schedule will be submitted to the WRPS Project Manager and BTR for review and approval.

After submittal, the Subcontractor shall provide support to the WRPS Project Change Board review process, as required.

Change requests approved by the WRPS Project Manager and BTR shall be implemented into both the schedule baseline and current files within five (5) working days of approval.

15.0 Workplace Substance Abuse Program Requirements

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