# DOCUMENT RELEASE AND CHANGE FORM

Prepared For the U.S. Department of Energy, Assistant Secretary for Environmental Management
By Washington River Protection Solutions, LLC., PO Box 850, Richland, WA 99352
Contractor For U.S. Department of Energy, Office of River Protection, under Contract DE-AC27-08RV14800

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ENGINEERING IMPROVEMENT PLAN

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- [ ] Yes
- [x] No

## 5. USQ Number: N/A

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<th>Name</th>
<th>Signature</th>
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<td>RAYMER, JULIA R</td>
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<td>Originator</td>
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<td>Responsible Manager</td>
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Revised to reflect FY 2018 improvement plan.

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- [ ] Related Systems N/A
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## 12. Impacted Documents (Outside SPF):

NA

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Engineering Improvement Plan

M. F. Tavelli
Washington River Protection Solutions, LLC

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# Revision Log

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<tr>
<th>Date</th>
<th>Revision</th>
<th>Description</th>
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<tr>
<td>February 2011</td>
<td>0</td>
<td>Initial Release</td>
<td>M.J. Sutey, R.L. Garrett</td>
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<tr>
<td>September 2011</td>
<td>1</td>
<td>Revision 1 aligns the engineering improvement plan with the current version of the Top 5 Stoplight Matrix</td>
<td>R.G. Stickney, M.J. Sutey</td>
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<td>June 2012</td>
<td>2</td>
<td>Revision 2 updates the plan to the current engineering initiatives</td>
<td>M.J. Sutey, D.B. Little</td>
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<td>September 2013</td>
<td>3</td>
<td>Revision 3 updates the plan to the current initiatives</td>
<td>M.J. Sutey, D.B. Little</td>
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<td>October 2013</td>
<td>4</td>
<td>Revision 4 updates Section 5.5 of the plan to current engineering initiatives</td>
<td>M.J. Sutey, D.B. Little</td>
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<tr>
<td>March 2014</td>
<td>5</td>
<td>Revision 5 updates Section 5.5 of the plan to current engineering initiatives</td>
<td>M.J. Sutey, D.B. Little</td>
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<tr>
<td>February 2015</td>
<td>6</td>
<td>Revision 6 updates the plan to reflect current engineering initiatives</td>
<td>M.A. Knight, D.B. Little</td>
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<td>November 2017</td>
<td>7</td>
<td>Revision 7 updates the plan to reflect engineering initiatives for FY18 and beyond including the next phase of improving engineering technical rigor.</td>
<td>M.F Tavelli, N.R Davis</td>
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<td>ANST</td>
<td>American Society For Nondestructive Testing</td>
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<td>CCA</td>
<td>Common Cause Analysis</td>
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<td>DOE</td>
<td>U.S. Department of Energy</td>
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<td>DST</td>
<td>Double Shell Tank</td>
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<td>EIP</td>
<td>Engineering Improvement Plan</td>
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<td>ISMS</td>
<td>Integrated Safety Management System</td>
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<td>LDP</td>
<td>Leak Detection Pit</td>
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<td>MOP</td>
<td>Management Oversight Program</td>
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<td>Reliability Centered Maintenance</td>
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<td>System Performance Monitoring Plan</td>
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<td>Savannah River Remediation</td>
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<td>SSC</td>
<td>Systems, Structures, and Components</td>
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<td>TOC</td>
<td>Tank Operations Contract</td>
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1.0 PURPOSE

The purpose of this Engineering Improvement Plan (EIP) is to identify the key Washington River Protection Solutions LLC (WRPS) Engineering Function initiatives which present the potential for performance improvement and to identify the actions needed to accomplish the desired improvement. This plan considers input from observed engineering performance, Management Oversight Program (MOP), specialty assessments, causal analyses and internal and external customer feedback.

Key changes to the Plan in this revision include removing improvement initiatives that have been substantially implemented (e.g., Design Process Improvements, Safety Basis Enhancements, Shift Technical Engineering, Engineering Training and Qualifications, Value Stream Analysis and Staffing), and the addition of reliability engineering and the next phase of engineering technical rigor.

2.0 BACKGROUND

As part of the Engineering Function’s support of the Integrated Safety Management System (ISMS) continuous improvement objective, engineering improvement initiatives are established that focus on three key areas: People, Processes, and Technology. These are typically multi-year initiatives, many of which are now complete and others which are continued in this plan. This EIP document has been updated to remove completed improvement initiatives and to include new or expanded improvement initiatives identified for FY2018 and beyond.

3.0 GOALS AND OBJECTIVES

The primary goal of this EIP is to document a structured approach to improved performance in specific areas supported by an Engineering organization that continuously strives toward the Engineering Vision below in a manner that is understood and actively supported by the entire WRPS engineering organization.

ENGINEERING VISION

WRPS Engineering will be known in the DOE complex and by our parent companies as the “best in class” for people, processes and technology and our ability to successfully respond to an ever changing environment by continually improving.

4.0 ENGINEERING IMPROVEMENT INITIATIVES

The key engineering improvement initiatives are as follows and as defined further in the following sections:
4.1 TANK MONITORING PROGRAM

Issue:
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 just now being confirmed. 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 and primary tank bottom failure, a key improvement needs to be made to the integrity program that would add the capability to inspect the floor region of double-shell tanks. In addition, current methods utilized within visual inspection and primary tank sidewall ultrasonic testing programs offer opportunity for improved efficiency and effectiveness.

Objectives:
- Enhance integrity inspection programs to improve the ability to more effectively and efficiently trend any degradation of tanks
- Baseline primary tank bottom condition of the remaining 27 double-shell tanks to determine extent of any damage and evaluate long-term viability for mission service

Completed Actions:
1. Evaluated construction history of all double-shell tanks to assess similarity to Tank AY-102
2. Solicited expert panel on DST inspection and forensic examination possibilities and developed a DST integrity improvement plan which included a risk ranking to guide future activities (RPP-RPT-57352)
3. Selected options to pursue and include in baseline planning for FY17 and 18.
4. Presented primary tank bottom inspection as a DOE Grand Challenge candidate project
5. Supported DOE headquarters funded development of concepts at Florida International University by DOE student fellows and faculty
6. Conducted American Society For Nondestructive Testing (ANST) workshop session in October 2015 to inform the nondestructive examination community of the inspection challenges at Hanford and seek improved methods
7. Demonstrated improved remote visual inspection concept supported by Inuktun and PNNL
8. Supported DOE headquarters funded development of concepts at Florida International University by DOE student fellows and faculty
9. Released Expression of Interest to solicit vendor development of primary tank bottom inspection system
10. Developed statement of work to construct mock-up facility for technology readiness testing
11. Evaluated Flash Thermography and determined it to be inappropriate for purpose.

Remaining Actions:
1. Procure/Test/Deploy Remote Video Inspection Crawler
2. Procure/Test/Deploy DST Air Slot Visual Inspection
3. Procure/Test/Deploy DST Air Slot Nondestructive Examination

4.2 DST SECONDARY LINER THINNING EVALUATION AND MITIGATION

Issue:
Many of the double-shell tank (DST) tertiary leak detection pits have been subject to long-term water intrusion and accumulation. Water accumulation underneath the liner, as evidenced by historical leak detection pit (LDP) water accumulation is suspected of causing corrosion of the outside of the liner. Loss of the secondary liner might be one of the higher probability failure mechanisms and would result in removing the tank from service.

Expert panels have expressed concerns about this water intrusion and its potential impact on external corrosion of the secondary liner, resulting in recommendations to conduct ultrasonic thickness examination of annulus floor liners where accessible. This ultrasonic thickness inspection of some DST secondary liners have shown localized, reportable thinning, ranging between 10 and 70 percent of the available wall thickness. Additional inspection activities have been proposed and mitigation options are being evaluated to better understand and address this issue.

Objectives:
- Enhance tank integrity inspection program to include periodic secondary liner bottom inspection capability to trend degradation not previously observed by current inspection practices
- Baseline the condition of remaining 27 double-shell tanks to determine extent of any damage and evaluate long-term viability for mission service
- Develop and deploy mitigation strategies to arrest the threat to secondary liner integrity

Completed Actions:
1. Evaluated leak detection pit intrusion history and threat to secondary liner (RPP-RPT-55666)
2. Consulted expert panels for guidance to evaluate and address knowledge gap
3. Incorporated annulus floor thickness measurements into the current inspection program on an 8-10 year periodicity
4. Shared information and baseline condition with Savannah River to compare secondary liner bottom inspection experiences
5. Performed floor scanning within 11 of 27 double-shell tanks
6. Developed investigation and mitigation plan (RPP-PLAN-60778)

**Remaining Actions:**

1. Perform accelerated floor scanning within the remaining double-shell tanks outside the normal inspection periodicity
2. Expand area of inspection coverage through development and implementation of new inspection technologies leveraged from primary tank inspection development efforts
3. Inspect additional leak detection pit drain lines and tank foundations to baseline condition
4. Obtain sample of tubercles to assess the presence of microbiologically induced corrosion
5. Conduct corrosion testing to assess the long-term threat of moisture in contact with the secondary liner bottom
6. Identify the causes and mechanisms of moisture intrusion within the tank foundation and leak detection pit system
7. Mitigate or eliminate moisture intrusion within the tank foundation and leak detection pit system

**4.3 EQUIPMENT RELIABILITY**

**Issue:**

The reliability of critical TOC plant and equipment, in particular ventilation and retrieval systems, is unsatisfactory, impacting performance objectives and increasing project and operating costs. The lack of a systematic structured approach to assessing TOC equipment reliability in a way that facilitates the recommendation of optimum monitoring and maintenance plans results in the perpetuation of unplanned shutdowns and reactive maintenance activities.

**Objectives:**

Improve the reliability of select critical TOC plant and equipment through the selection and implementation of a preferred structured approach to asset reliability assessment and maintenance planning.

**Actions:**

1. Facilitate training of key engineering personnel in reliability concepts, methods and technologies.
2. Determine/select a structured approach (e.g., RCM) for WRPS for assessing equipment reliability and developing improved maintenance plans.
3. Select a critical TOC asset/system (e.g., DST ventilation system) and pilot the selected reliability assessment approach.
4. Identify, selecting and purchase performance monitoring and analysis instrumentation technology.
5. Deploy performance monitoring and analysis instrumentation and commence data collection and testing of select technologies.
6. Issue interim report evaluating the initial efficacy of the select techniques on improving the reliability/availability of the critical components studied.
4.4 SYSTEM HEALTH MONITORING AND REPORTING

Issue:
System Health Reporting across the TOC has been a focus area for the past several years and has improved significantly in line with the maturity of the System Engineering Program. Notwithstanding this improvement, additional improvement in establishing the status and health of TOC assets may be possible by adopting the Savannah River Remediation (SRR) approach to the development of System Performance Monitoring Plans (SPMPs) for critical assets that define the approach to gathering data and data sources that can provide direct or indirect indications of the onset of degradation mechanisms along with the method to be used for trending data. Further, evidence from other DOE prime contractors (in particular SRR) demonstrates that the content and format of TOC System Health Reports could be further improved.

Objectives:
Improve the quality of TOC System Health Monitoring and Reporting and assess the benefit of developing System Performance Monitoring Plans (SPMPs) for critical TOC assets in order to enhance our ability to accurately assess asset health and inform associated asset management plans.

Actions:
1. Benchmark TOC System Health Monitoring and Reports against the best available from across the DOE complex.
2. Investigate the SRR SPMP process and relevant examples to determine how these plans are being used, the perceived benefit and the scope of the effort involved.
3. Make a recommendation as to whether WRPS should proceed with the development of SPMPs and, if the recommendation is positive, suggest an approach to start the development process.
4. Determine how TOC System Health Reports could be improved to approach best in class.
5. Develop a template for improved System Health Reports and pilot the template on a critical TOC system.

4.5 ENGINEERING TECHNICAL RIGOR

Issue:
In an effort to improve performance in the area of engineering technical rigor, WRPS Engineering retained Management Systems, LLC to perform a Common Cause Analysis (CCA) to help determine the factors that have contributed to periodic technical work product deficiencies experienced by the WRPS Engineering Function going back to 2012. The final report, delivered by Management Systems LLC in August of 2017, included nine “Limiting Weaknesses” (i.e., barriers to improvement) with recommendations on how to address each. The final report can be found in the deliverable for WRSP-PER-2017-1088.

WRPS Engineering has analyzed the Limiting Weaknesses (LWs) and associated recommendations (RLWs) to determine the appropriate follow-on actions, most of which are captured in this EIP.
Objectives:

Implement an enhanced approach to ensuring Technical Rigor across WRPS Engineering that minimizes technical deficiencies that lead to less than adequate quality of engineering work products.

Actions:

1. Develop a definition of Technical Rigor for TOC Engineering (RLW-01)
   a. Develop a common definition of Technical Rigor and the associated attributes considering the recommendations of Management Systems, LLC and input from the WRPS Engineering management team.
   b. Determine how and where the definition should be enshrined.
   c. Publish and communicate the definition to the Engineering organization.

2. Adopt and implement a comprehensive model of Technical Rigor within the Engineering Function. (RLW-01)
   a. Evaluate and refine the Technical Rigor Model proposed by Management Systems, LLC.
   b. If warranted, complete a review of a select number of previous technical rigor-related events/PERs against the refined model and capture learning.
   c. Determine how and where the Technical Rigor Model should be enshrined.
   d. Determine how the Technical Rigor Model will be used in future assessments and causal analyses. (RLW-03-A)

3. Improve the analysis and corrective actions associated with technical rigor-related PERs
   a. Develop criteria for triggering more in depth analyses of lower-level technical rigor deficiencies and options for this analysis. (RLW-03-B)
   b. Determine the approach to improving the quality of corrective actions written to deliver long-term impact to technical rigor issues. The approach should focus on methods to ensure these types of corrective actions are explicitly structured to change the way routine technical engineering activities are carried out. (RLW-04, RLW-05)
   c. Establish the expectation and a mechanism (e.g., MOP or other type of assessment) that ensures that the completion and closure of technical rigor-related corrective actions are verified by the appropriate manager (RLW-04).

4. Analyze Management Systems, LLC “transparency” recommendation (RLW-06) to determine the best way to apply this concept to TOC engineering activities.
   a. Evaluate and refine the Transparency element (Attribute H) of the Technical Rigor model proposed by Management Systems, LLC.
   b. Determine how this concept should be “branded” and defined.
   c. Determine which engineering activities would benefit most from enhanced transparency.
   d. Determine how and where the Transparency concept should be enshrined.
   e. Develop and publish implementing documentation and associated communications.
f. Determine a reliable tracking mechanism that captures and ensures closure of unverified assumptions.

5. Develop a “knowledge transfer” strategy that mitigates the loss of tribal knowledge within the Engineering Function due to attrition. (RLW-07)

6. Institutionalize the Human Performance “Survival Guide” (WRPS-56532) and take better advantage of the document to bring behaviors across the WRPS Engineering Function further into alignment with the content. (RLW-08)
   a. Add use of HPI Survival Guide to TFC-POL-07 (Engineering Policy and Chief Engineer’s Expectations)
   b. Increase emphasis in Level 2 and 3 Engineering Manager Performance Objectives.
   c. Add HPI Survival Guide topics to the Engineering Technical Staff and Engineering Technical Manager Qualification Cards (350850 and 350848 respectively).
   d. Increase emphasis and encourage discussion of HPI Survival Guide topics in routine engineering meetings and presentations.
   e. Work with training to develop an HPI refresher course for engineering staff.

   a. Determine which of the Technical Rigor Model elements are sufficiently quantifiable and reasonably measureable that may be included in the WRPS Engineering Technical Rigor Key Performance Indicator (KPI). (RLW-03-A)
   b. Propose a method to trend Technical Rigor performance that is “forward-looking” to supplement the “backward-looking” performance indicators currently employed.
   c. Consider WRPS Engineering data currently available or that can reasonably be made available within SmartPlant Foundation®.
   d. Develop a plan to implement the proposed approach.