# U.S. Department of Energy
# Hanford Site

December 1, 2020

20-TF-0106
REISSUE

Mr. Jeffrey J. Lyon, Tank Systems Operations
and Closure Project Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Mr. Lyon:

REISSUE - THE U.S. DEPARTMENT OF ENERGY, OFFICE OF RIVER PROTECTION, TRANSMITTAL OF RPP-RPT-61684, MAINTENANCE AND PERFORMANCE MONITORING PLAN FOR THE INTERIM BARRIERS PROGRAM, REV. 2.

References:

1. Ecology letter from J. J. Lyon to B. A. Harkins, ORP, "Approval of the United States Department of Energy's 60-day Extension Request for Comment Response on the Maintenance and Performance Monitoring Plan for the Interim Barriers Program, RPP-RPT-61684, Rev.1," 20-NWP-164, dated October 9, 2020.

2. ORP letter from B. A. Harkins to J. J. Lyon, Ecology, "Reissue – Response to 20-NWP-159 from the Washington State Department of Ecology," 20-TF-0101 REISSUE, dated October 8, 2020.

3. Ecology letter from J. J. Lyon to B. A. Harkins, ORP, "Department of Ecology's (Ecology) Comments on the United States Department of Energy – Office of River Protection's (USDOE-ORP) *Maintenance and Performance Monitoring Plan for the Interim Barriers Program* (RPP-RPT-61684, Rev. 1)," 20-NWP-159, dated September 18, 2020.

4. ORP letter from B. T. Vance to A. K. Smith, Ecology, "U.S. Department of Energy, Office of River Protection Response to Letter 19-NWP-194, "Department of Ecology's (Ecology) Review and Assessment of the Maintenance and Performance Monitoring Plan, RPP-RPT-61684," 19-TPD-0029, dated December 11, 2019.

This letter is being reissued due to incorrect Reference 4 in original letter.

This letter transmits RPP-RPT-61684, *Maintenance and Performance Monitoring Plan for the Interim Barriers Program*, Rev. 2. The attached plan incorporates comments received from the Washington State Department of Ecology via letter 20-NWP-159, dated September 18, 2020 (Reference 3). Tri-Party Agreement Milestone, M-045-92AC is complete, as stated in Reference 4. In accordance with the Hanford Federal Facility Agreement and Consent Order, Section 9.2, "Document Review and Comment Process," and Figure 9-1, this is being submitted on/before December 17, 2020.

If you have any questions, please contact me, or your staff may contact Becky Blackwell, Closure Project Manager, Tank Farms Programs Division, Office of River Protection, on (509) 376-0058.

Sincerely,

Brian A. Harkins

Digitally signed by Brian A. Harkins
Date: 2020.12.01 16:32:04 -08'00'

Brian A. Harkins, Deputy Assistant Manager
Tank Farms Project
Office of River Protection

TF:RIB

Attachments:
RPP-RPT-61684
20-NWP-159

cc w/attach:
J. Alzheimer, Ecology
M. Barnes, Ecology
J. H. Bell, NPT
A. Buck, Wanapum
L. Contreras, YN
D. R. Einan, EPA
M. E. Lamothe, WRPS
S. Leckband, HAB
M. Murphy, CTUIR
J. K. Perry, MSA
P. L. Rutland, WRPS
M. B. Skorska, Ecology
M. Woods, ODOE
Administrative Record
Environmental Portal
WRPS Correspondence

Attachment 1
20-TF-0106

# RPP-RPT-61684, MAINTENANCE AND PERFORMANCE MONITORING PLAN FOR THE INTERIM BARRIERS PROGRAM, REV 2.

(35 Pages Including Cover Sheet)

# 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



**Release Stamp**

DATE:
Nov 10,2020
HANFORD RELEASE

1. **Doc No:** RPP-RPT-61684 **Rev.** 02

2. **Title:**
Maintenance and Performance Monitoring Plan for the Interim Barriers Program

3. **Project Number:** ☒N/A

4. **Design Verification Required:** ☐Yes ☒No

5. **USQ Number:** ☒ N/A RPP-27195

6. **PrHA Number** **Rev.** ☒ N/A

**Clearance Review Restriction Type**: public

7. **Approvals**

| Title | Name | Signature | Date |
|---|---|---|---|
| Clearance Review | Harrison, Sarah E | *Harrison, Sarah E* | 11/10/2020 |
| Document Control Approval | Meinecke, Kathryn R | *Meinecke, Kathryn R* | 11/10/2020 |
| Originator | Lamothe, Margaret E | *Lamothe, Margaret E* | 11/09/2020 |
| Other Approver | Parker, Dan | *Parker, Dan* | 11/09/2020 |
| Responsible Manager | Rutland, Paul L | *Rutland, Paul L* | 11/09/2020 |

8. **Description of Change and Justification**

REV-0: Initial issue
REV-1: Complete revision to include new outline and additional monitoring updates
REV -2: Incorporates Dept. of Ecology comments from letter 20-NWP-159

9. **TBDs or Holds** ☒N/A

10. **Related Structures, Systems, and Components**

| a. **Related Building/Facilities** ☒N/A | b. **Related Systems** ☒N/A | c. **Related Equipment ID Nos. (EIN)** ☒N/A |
|---|---|---|
| | | |

11. **Impacted Documents – Engineering** ☒N/A

| Document Number | Rev. | Title |
|---|---|---|
| | | |

12. **Impacted Documents (Outside SPF):**

N/A

13. **Related Documents** ☒N/A

| Document Number | Rev. | Title |
|---|---|---|
| | | |

14. **Distribution**

| Name | Organization |
|---|---|
| Lamothe, Margaret E | CLOSURE & INTERIM MEASURES |
| Pappas, Alexander D | TECH MGMT & FIELD SOLUTIONS |
| Parker, Dan | CLOSURE & INTERIM MEASURES |
| Rutland, Paul L | CLOSURE & INTERIM MEASURES |

# INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

## Part I: Background Information

Title: Maintenance and Performance Monitoring Plan for the Interim Barriers Program

Information Category:
☐ Abstract ☐ Journal Article ☐ Summary
☐ Internet ☐ Visual Aid ☐ Software
☐ Full Paper ☑ Report ☐ Other

Publish to OSTI? ☐ Yes ☑ No

| Trademark/Copyright "Right to Use" Information or Permission Documentation | Yes ☐ | NA ☑ |
|---|---|---|

Document Number: RPP-RPT-61684 Revision 02 Date: October 2020

Author: Lamothe, Margaret E

## Part II: External/Public Presentation Information

Conference Name:

Sponsoring Organization(s): DOE-ORP

Date of Conference: Conference Location:

Will Material be Handed Out? ☐ Yes ☑ No Will Information be Published? ☐ Yes ☑ No *(If Yes, attach copy of Conference format instructions/guidance.)*

## Part III: WRPS Document Originator Checklist

| *Description* | *Yes* | *N/A* | *Print/Sign/Date* |
|---|---|---|---|
| Information Product meets requirements in TFC-BSM-AD-C-01? | ☐ | ☑ | |
| Document Release Criteria in TFC-ENG-DESIGN-C-25 completed? (Attach checklist) | ☑ | ☐ | Lamothe, Margaret E IDMS Data File att. 10/22/2020 |
| If product contains pictures, safety review completed? | ☑ | ☐ | Roberts, Sheryl K IDMS Data File att. 10/05/2020 |

## Part IV: WRPS Internal Review

| *Function* | *Organization* | *Date* | *Print Name/Signature/Date* |
|---|---|---|---|
| Subject Matter Expert | WRPS | 11/02/2020 | Lamothe, Margaret E IDMS Data File att. |
| Responsible Manager | WRPS | 10/05/2020 | Rutland, Paul L IDMS Data File att. |
| Other: | | | |

## Part V: IRM Clearance Services Review

| *Description* | *Yes* | *No* | *Print Name/Signature* |
|---|---|---|---|
| Document Contains Classified Information? | ☐ | ☒ | If Answer is "Yes," ADC Approval Required<br>Print Name/Signature/Date |
| Document Contains Information Restricted by DOE Operational Security Guidelines? | ☐ | ☒ | Reviewer Signature:<br>Print Name/Signature/Date |
| Document is Subject to Release Restrictions?<br>*If the answer is "Yes," please mark category at right and describe limitation or responsible organization below:* | ☐ | ☒ | Document contains:<br>☐ Applied Technology ☐ Protected CRADA<br>☐ Personal/Private ☐ Export Controlled<br>☐ Proprietary ☐ Procurement – Sensitive<br>☐ Patentable Info. ☐ OUO<br>☐ Predecisional Info. ☐ UCNI<br>☐ Restricted by Operational Security Guidelines<br>☐ Other (Specify) |
| Additional Comments from Information Clearance Specialist Review? | ☐ | ☒ | Information Clearance Specialist Approval<br>Print Name/Signature/Date |

**When IRM Clearance Review is Complete – Return to WRPS Originator for Final Signature Routing (Part VI)**

# INFORMATION CLEARANCE REVIEW AND RELEASE APPROVAL

## Part VI: Final Review and Approvals

| *Description* | *Approved for Release* | | *Print Name/Signature* | |
|---|---|---|---|---|
| | *Yes* | *N/A* | | |
| WRPS External Affairs | ☒ | ☐ | IDMS Data File att. | Mc Cune, Hal C |
| WRPS Office of Chief Counsel | ☒ | ☐ | IDMS Data File att. | Roden, Mari L |
| DOE – ORP Public Affairs/Communications | ☒ | ☐ | IDMS Data File att. | Tyree, Geoffery T |
| Other: ORP SME | ☒ | ☐ | IDMS Data File att. | Blackwell, Becky |
| Other: DOE OCC | ☒ | ☐ | IDMS Data File att. | King, Grace J |

Comments Required for WRPS-Indicate Purpose of Document:

Primary document associated with TPA Milestone M-045-92AC Maintenance and Performance Monitoring Plan. Document revision 02 is in response to Dept. of Ecology letter 20-NWP-159.

**Approved for Public Release; Further Dissemination Unlimited**

**Information Release Station**

Was/Is Information Product Approved for Release? ☒ Yes ☐ No

If Yes, what is the Level of Releaser? ☑ Public/Unrestricted ☐ Other (Specify) _____

Date Information Product Stamped/Marked for Release: 11/04/2020

Was/Is Information Product Transferred to OSTI? ☐ Yes ☒ No

**Forward Copies of Completed Form to WRPS Originator**

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RPP-RPT-61684
Revision 02

# Maintenance and Performance Monitoring Plan for the Interim Barriers Program

**Prepared by**

**Margaret LaMothe**

**Alexander Pappas**

Washington River Protection Solutions, LLC

Date Published
November 2020


Prepared for the U.S. Department of Energy
Office of River Protection

Contract No. DE-AC27-08RV14800

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# LIST OF TERMS

## Abbreviations and Acronyms

| | |
|---|---|
| DOE | U.S. Department of Energy |
| Ecology | Washington State Department of Ecology |
| FY | fiscal year |
| HFFACO | Hanford Federal Facility Agreement and Consent Order |
| HDU | heat dissipation unit |
| IMMP | Interim Measures Maintenance Plan |
| ORP | Office of River Protection |
| PER | Problem Evaluation Request |
| RBA | Radiological buffer area |
| SST | single-shell tank |
| TOC | Tank Operations Contractor |

## Units

| | |
|---|---|
| cm | centimeter |
| ft | foot |
| $ft^2$ | square feet |
| gal | gallon |
| in. | inch |
| L | liter |
| m | meter |
| % | percent |
| pCi | picocuries |
| vol% | volume percent |

## 1.0 OBJECTIVES AND SCOPE

The U.S. Department of Energy (DOE) Office of River Protection (ORP) has constructed interim surface barriers over portions of the T, TY, and SX Tank Farms.[1] The barriers divert meteoric water away from contaminated vadose zone soils within the tank farms. Infiltration of water into subsurface soils with pre-existing contamination can accelerate the mobilization of contaminants towards the water table. The interim surface barrier at T Tank Farm was completed in 2008, the interim surface barrier at TY Tank Farm was completed in 2010, and the interim surface barriers at SX Tank Farm were completed in 2019. The design for a new interim surface barrier at TX Tank Farm was completed in 2019, and construction is currently underway.

This plan describes the systematic inspections and maintenance of interim surface barriers, as well as monitoring of tank farms covered with interim surface barriers. This plan is being submitted to the Washington State Department of Ecology (Ecology) as required under Hanford Federal Facility Agreement and Consent Order (HFFACO) (Ecology et.al. 1989) Milestone M-045-92. This plan will be revised, updated, and submitted to Ecology with each new interim surface barrier design as required under Ecology et.al. 1989, HFFACO Milestone M-045-92. Results of this interim monitoring plan will be reported in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92).

## 2.0 BACKGROUND

The Hanford Site, located in southeastern Washington State, has 149 underground single-shell tanks (SST) that store chemical and radioactive waste. Interim surface barriers have been constructed over portions of the T, TY, and SX Tank Farms and one is currently being constructed over portions of the TX Tank Farm. Each tank farm has a number of tanks that are classified as "assumed leakers." Further information on these tanks and their related infrastructure can be found in the following reports:

- RPP-RPT-55084, *Hanford 241-T Farm Leak Inventory Assessment Report*
- RPP-RPT-42296, *Hanford TY-Farm Leak Assessments Report*
- RPP-ENV-39658, *Hanford SX-Farm Leak Assessments Report*.
- RPP-RPT-50870, *Hanford 241-TX Farm Leak Inventory Assessment Report*

The vadose zone, over which all interim surface barriers are constructed, is comprised of (in ascending order) the sandy gravels of Ringold Formation Unit E (containing the water table), the predominantly silty sands of the Ringold Formation Taylor Flats unit, the lower gravels and upper muds of the Cold Creek Unit, and the lower sands and upper sandy gravels of the Hanford formation. The hard caliche is contained within the cold creek unit. Due to the vadose zone properties, interim surface barriers are constructed over the tank farms to control moisture from precipitation events and slow migration of contaminants through the vadose zone. Once installed interim barriers will help to reduce peak contaminant concentrations in the water table (RPP-RPT-47123, *Interim Surface Barrier Evaluation Report*).

[1] Hanford tank farms, tanks, and equipment all begin with designated prefix '241-.' That prefix is omitted in this document to aid readability.

# 3.0 T TANK FARM

## 3.1 T FARM DESCRIPTION

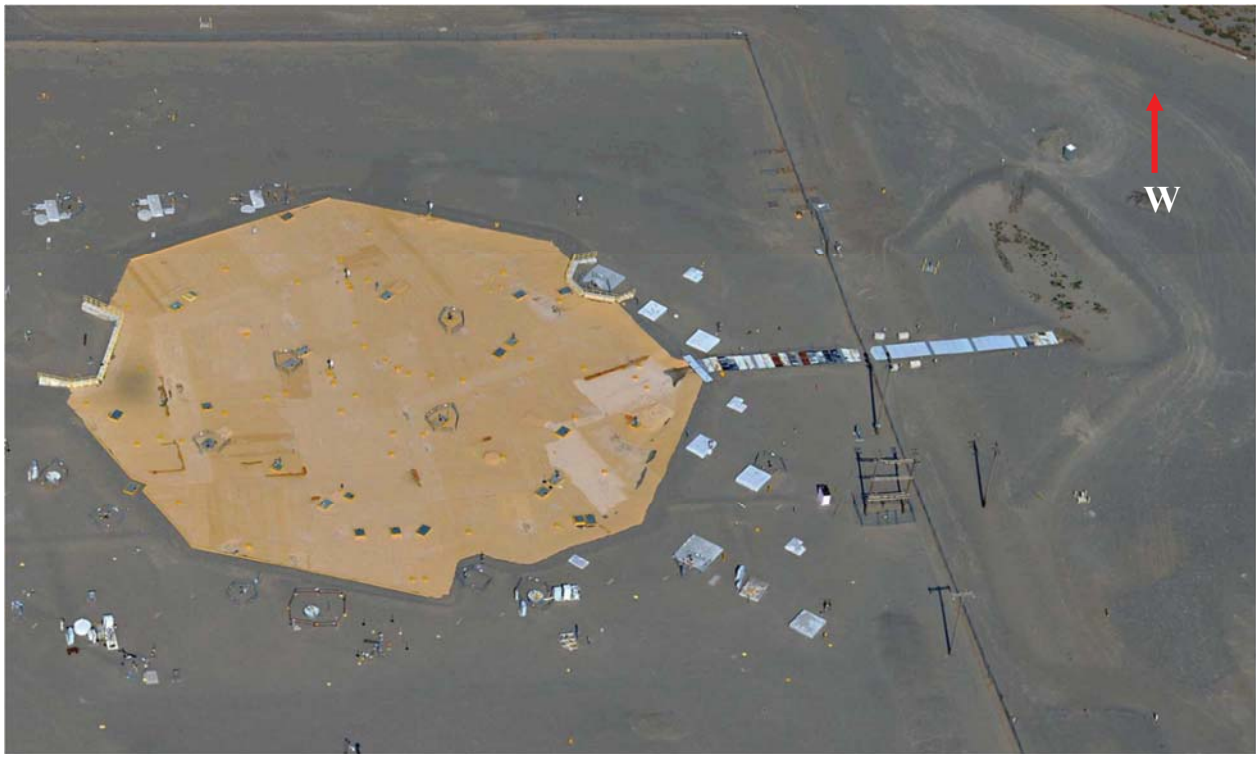
The T Tank Farm was constructed from 1943 to 1944 (RPP-23752, *Field Investigation Report for Waste Management Areas T and TX-TY*). It is comprised of 12 SSTs with a diameter of 23 m (75 ft) and a capacity of 2,006,050 L (530,000 gal); four SSTs with a diameter of 6.1 m (20.0 ft) and a capacity of 208,175 L (55,000 gal); waste-transfer lines; leak detection systems; and tank ancillary equipment.

The largest known tank leak in the SST system was in 1973 from the loss of tank integrity (leak) of Tank T-106 in T Tank Farm. Many of the contaminants from waste releases still reside within the vadose zone beneath the tank farms. T Tank Farm was chosen for an interim surface barrier because minimizing infiltration of precipitation would reduce the technetium water table contamination predictions by 1.98 E+5 pCi/L based on RPP-ENV-41309, *Criteria for Prioritizing Hanford Site Tank Farm Interim Surface Barriers and for Evaluating Their Performance*. T Tank Farm interim surface barrier serves as the first of two tank farms with a barrier constructed (PNNL-16538, *T Tank Farm Interim Surface Barrier Demonstration – Vadose Zone Monitoring Plan*) as part of the Interim Surface Barrier Demonstration Project.

Construction and design specifications of the T Tank Farm interim surface barrier (Figure 1) are described in RPP-33431, *Design Analysis for T-Farm Interim Surface Barrier (TISB)*. Work on the interim surface barrier began in October 2007 and was completed in April 2008. Approximately 0.3 m (1 ft) of thick compacted soil was added to the original ground surface before the barrier was emplaced. Above the compacted soil is a 0.6-cm (0.25-in.)-thick polyurea/geotextile as the impermeable barrier. The barrier dips slightly to the north to enable precipitation to drain along a lined runoff ditch to a runoff infiltration area. The interim surface barrier was designed to focus on the vadose zone contamination associated with the Tank T-106 leak, notably addressing over 90% of the volume and the majority of contaminants of released waste in T Tank Farm (HNF-EP-0182, *Waste Tank Summary Report for Month Ending April 30, 2020*).

Performance monitoring instruments in T Tank Farm collect data to determine if the soil under the interim surface barrier is drying out. These instruments are grouped into four nests (TA, TB, TC, TD). Each nest includes a neutron probe access tube, a capacitance probe with five sensors, and four heat dissipation units (HDU). The TA nest is located outside the barrier footprint and serves as a control. The TB nest is located on the barrier edge, and nests TC and TD are located completely inside the barrier footprint. These three instrument sites monitor soil moisture content under the barrier footprint. Nests TA and TB were installed in late fiscal year (FY) 2006 and monitoring was initiated in September 2006. Nests TC and TD were installed in FY 2007 and monitoring was initiated in May 2008. Figure 2 shows the nest site locations at T Farm.

**Figure 1. T Tank Farm Interim Surface Barrier**




## 3.2 T FARM SYSTEMATIC INTERIM SURFACE BARRIER INSPECTIONS AND MAINTENANCE

The purpose of the interim surface barrier inspections and maintenance program is to ensure effective prevention of moisture intrusion under the barrier over the 25-year service life.

### 3.2.1 Visual Inspections

Visual inspections will be conducted quarterly. To perform these, engineering will use visual inspection sheets to note maintenance issues. Examples of past maintenance issues have been cracks in the barrier, pooling water, blockages within the water runoff ditch, or issues with the infiltration basin accumulating tumbleweeds. Inspection sheet observations will be included in the Annual Interim Surface Barrier Monitoring Report. Visual inspection sheets will be a routine part of the preventative maintenance activities performed on the T barrier to maintain its 25-year lifespan.

### 3.2.2 Interim Measures Inspections and Maintenance

In addition to quarterly visual inspections, the environmental group will conduct surveillance and inspect scheduled maintenance on an annual basis. Surveillance and maintenance of engineering controls will help to reduce infiltration of precipitation into contaminated soils and minimize the spread/transfer of contamination. Surveillance and scheduled maintenance activities will be captured using Site Form A-6007-352, “Annual Environmental Interim Measures Maintenance Plan Inspection.” Supplemental items that may be checked per TFC-PLN-14, *Waste Information Data System Surveillance and Maintenance Description* include:

- Confirm the berms, runoff collection areas and culverts ability to divert water runoff without failure.
- Verify that there are no obvious subsidence, voids, animal burrows, or low spots.
- Confirm adequate rock/gravel (e.g., Rip Rap) surface around berms, culverts and runoff collection areas rather than dirt/sand.
- Verify culverts are free of large cracks, washouts, missing sections, and ensures pipe lap joints are not obviously deficient or inadequate (e.g., damaged, bent, or torn lap seams).
- Confirm that discharge areas are not filled in with sand, tumbleweeds, vegetation, nor have substantial erosion.
- Identify changes to locations/conditions of installed interim measures controls.

Issues noted during surveillance will be addressed as follows:

> *Minor items (e.g., removal of sand from a culvert) will be addressed by processing a work request and will be assigned resources based on the priority of the repair. Note that environmental related work activities are considered of the highest priority for the TOC. For more significant items a PER will be prepared and submitted, a request for an engineering evaluation of the situation will be requested and a work request will be generated based on the outcome of the engineering evaluation*. (TFC-PLN-14)

### 3.2.3 Leak Detection, Intrusion Monitoring, and Drywell Logging Requirements

RPP-9937, *Single-Shell Tank System Leak Detection and Monitoring Functions and Requirements Document*, identifies leak detection methods, intrusion monitoring methods, required monitoring frequencies, and the leak/intrusion notification processes for all SSTs except for tanks being retrieved. As no tanks in T Farm are currently being retrieved, RPP-9937 identifies in-tank monitoring requirements for T Farm. Currently, in RPP-9937, there are no requirements to perform drywell logging. RPP-9937 was written to meet Ecology et al. 1989, HFFACO Milestones M-023-23 and M-023-24.

Requirements for leak detection in T Farm varies with each tank. Leak detection is dependent on the volume of drainable liquid, the potential for liquid intrusions and the available information on the liquid volumes inside each tank (RPP-9937). All tanks in T Farm have an Enraf gauge installed, and additionally five tanks (T-101, T-104, and tanks T-109-111) have liquid observation wells (LOWs) installed. Enraf gauges, manual tape, or LOWs will be used to monitor the drainable liquid levels contained within the sludge/saltcake layers. All tanks at T Farm have undergone isolation and/or interim stabilization to minimize the extent of a leak if one were to occur. Currently all T Farm tanks are required to be monitored at least periodically using best management practices (BMPs) (RPP-9937).

Any changes to these requirements that may result from a revision of RPP-9937 will be reflected in a future revision of this work plan.

## 3.3 SYSTEMATIC PERFORMANCE MONITORING

### 3.3.1 Barrier Performance Monitoring

Figure 2 shows the performance monitoring nest locations installed at T Farm. Nest TA was placed in an area outside of the interim surface barrier at T Farm to serve as a control. Control nests needed to be at least 5 m (16 ft) away from the closest edge of the surface cover to prevent measurable impacts from the cover (PNNL-16538). Nest TB is at the edge of the barrier to monitor the edge effect of the barrier on the soil-water regime. TC and TD nest sites are fully located within the barrier footprint. TC and TD locations were determined to be at least 5 m (16 ft) from the closest edge of the interim surface barrier and between two or more tanks where the largest change of soil water content (θ) will be expected with the emplacement of the interim surface barrier.

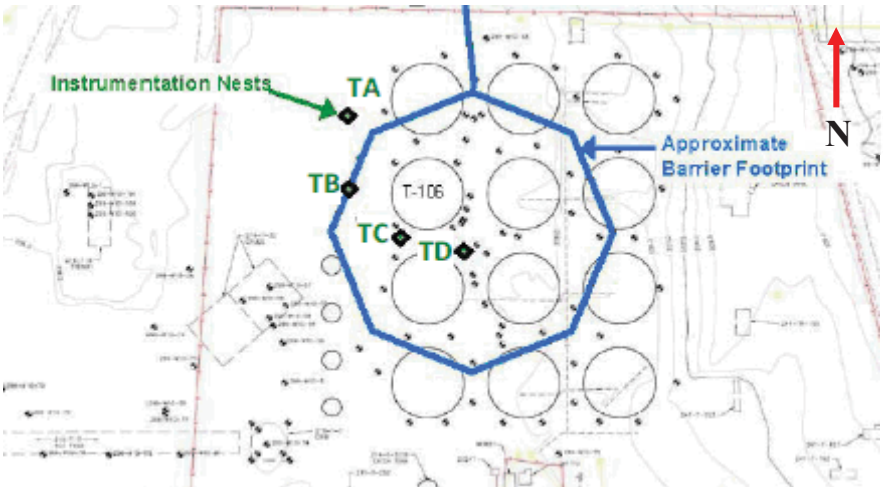



**Figure 2. T Farm monitoring nest locations (black diamonds)**

The monitoring nest data logger controls and stores the measurement data of moisture content from capacitance sensors, soil-water pressure and soil temperature from HDUs, precipitation from the rain gauge, and air temperature from the thermistor. Vertically, the monitoring depths of the nests at T Farm are 1 m (3 ft), 2 m (7 ft), 5 m (16 ft), and 10 m (33 ft) below ground surface (bgs). Considering that upon the emplacement of the interim surface barrier the changes of soil moisture are more significant in shallower depths, more intensive and frequent measurements will be taken at shallow depths.

To date, the nest monitoring data indicates that the interim surface barriers are continuing to curtail recharge of water to the vadose zone and reduce the impact of meteoric water on soil-moisture conditions.

Since FY 2017, no data from the capacitance probe nests have been utilized. The capacitance probe data are not used in current analyses because capacitance probes have a short operational life expectancy of one to two years (RPP-PLAN-49187, *241-SX Tank Farm North Interim Surface Barrier Monitoring Plan)*.

The monitoring approach will use the monitoring nest data from quarterly data downloads and the Hanford Meteorological Station records to evaluate the effectiveness of the interim surface barrier at T Tank Farm. PNNL-19772, *T-TY Tank Farm Interim Surface Barrier Demonstration – Vadose Zone Monitoring Plan*, summarized the six variables monitored, the monitoring methods, and the monitoring frequency. Table 1 (below) shows the revised monitoring frequency established and approved in RPP-RPT-53570, *Technical Basis for Soil Moisture and Soil Pore Pressure Head Measurement Frequency Reduction at T and TY Farm Interim Surface Barriers*.

Monitoring the soil deeper than the backfill will be performed using neutron access tubes, which extend into the undisturbed Hanford formation below the tanks. Neutron access tubes are accessible at all the barrier farms and results are referred to as neutron moisture probe (NP) readings (Table 1). Neutron-moisture-probe measurements will be performed manually at 0.3-m (1-ft) intervals to the depths of 50 feet following the neutron probe measurement procedure documented in TO-320-022, "Operate Model 503DR Ml HP-2 or Ml HP-3 Hydroprobe Neutron Moisture Gauge."

Moisture data collected in a fiscal year will be reported in the Annual Interim Surface Barrier Monitoring Report.

**Table 1. Data Collection Methods and Approximate Frequency Under Normal Working Conditions (2 pages)**

| Monitoring Variable | Monitoring Method[a] | Monitoring Frequency | Data Logger Download Frequency[b] |
|---|---|---|---|
| Soil-Water Content | Neutron Moisture Probe | Twice Annually | Not applicable |
| Soil-Water Content | Capacitance Probe[c] | Twice Daily | Quarterly |
| Soil-Water Pressure and Soil Temperature | Heat Dissipation Unit | Daily | |
| Air Temperature | Thermistor | Hourly | |
| Precipitation | Rain Gauge | Hourly | |

a) All measurements except the neutron probe are controlled by data loggers and taken automatically.
b) Based on RPP-RPT-53570.
c) Capacitance probes are not functional and are no longer being used.

Due to the age of the monitoring system, some of the instrumentation is no longer functional (e.g., HDUs for nests TA and most of the capacitance probes). The causes for functional problems with the capacitance probes and HDUs were: interruptions to the system; other operations (e.g., barrier activity); poor wire connections (e.g., due to corrosion occurrence); instrument failure; and/or data logger overload. Table 2 shows the status of instrument functionality. Because the monitoring systems have fulfilled their intended purpose and show the interim surface barriers effectively control moisture beneath the barriers, there is no need nor are there plans to replace failed monitoring equipment.

**Table 2. T Farm Instrument Functionality**

| Tank Farm | Nest | Capacitance Probes | Heat Dissipation Units | Thermistor | Rain Gauges |
|---|---|---|---|---|---|
| T | TA | No Functionality | No Functionality | No Functionality | Not used |
| | TB | Full Functionality | Full Functionality | Full Functionality | Not used |
| | TC | Partial Functionality | Full Functionality | Full Functionality | Not used |
| | TD | Partial Functionality | Full Functionality | Full Functionality | Not used |

### 3.3.2 Tank Leak Assessments

The objective of tank leak assessments is to determine the probability that a tank may be leaking. Conclusions from the leak assessment are then used to help determine the best retrieval method.

Anomalous data was reported for Tanks T-102 and T-105, so a formal Tank Leak Assessment was initiated in 2009. Leak assessments on Tanks T-102 and T-105 were completed in FY 2018. The results of in-tank and ex-tank monitoring are reported in RPP-ASMT-55500, *Leak Assessment Report for Tanks 241-T-102 and 241-T-105*, and are summarized in Annual Interim Surface Barriers Monitoring Report.

Additionally, RPP-ASMT-61518, 2018, *Prioritized Single Shell Tank Leak Assessments TFC-ENG-CHEM-D-42*, states that leak assessments on Tanks 101, 103 and 109 will be three of the first 13 tanks prioritized due to their "assumed leaker" classification. Classifying these three tanks correctly will be valuable for retrieval and closure activities.

When the leak assessment report for T Farm tanks 101, 103, and 109 is released, the results will be summarized in Annual Interim Surface Barriers Monitoring Report.

### 3.3.3 Annual Monitoring Report

Data collected at T Farm as part of the maintenance and monitoring of interim surface barriers will be summarized in the Annual Interim Surface Barrier Monitoring Report.

The data in the annual report will include:

- A short description of T Tank Farm, the interim surface barrier located within the farm, and the runoff area associated with the interim surface barrier.
- Results of visual inspections performed during the year, including results captured on site form A-6007-352, *Annual Environmental Interim Measures Maintenance Plan Inspection*.
- Results of maintenance performed/scheduled (if applicable).
- Barrier moisture monitoring data and trend tables or graphs.
- Barrier farm tank leak assessments (if applicable).
- Research on new barrier technology (if applicable).

## 4.0 TY TANK FARM

The TY Tank Farm was built from 1951 through 1952 and is comprised of six SSTs with a diameter of 23 m (75 ft) and a capacity of 2,870,000 L (758,000 gal); waste-transfer lines; leak detection systems; and tank ancillary equipment (RPP-23752).

TY Farm was selected for an interim surface barrier because it ranked in the top five for water table impacting technetium plumes in RPP-ENV-41309. At TY Farm, five out of the six tanks are classified as assumed leakers. Leak assessment results are reported in RPP-RPT-61279, *Single-Shell Tank Farm Leak Inventory Assessments Summary*. With only six tanks, TY Farm is smaller than most and has minimal surface obstructions, which made the farm readily accessible for interim surface barrier placement. Interim surface barrier installation at the TY Tank Farm also occurred as part of the Interim Surface Barrier Demonstration Project (PNNL-16538 and PNNL-19772).

Construction of the TY Tank Farm interim surface barrier began in February 2010 and was completed in September 2010. Figure 3 shows the barrier in place at TY Farm. The barrier consists of a 10-cm (4-in.) thick layer of modified asphalt over a base layer to collect precipitation. Collected water flows by gravity to two collection points at the west side of the barrier and from there to an evapotranspiration basin: from there, the runoff water evaporates, is used by local vegetation, or is transpired.

TY Tank Farm has two nests (TYA, TYB) that can be seen in Figure 4. Each nest includes a neutron probe access tube, a capacitance probe with five sensors, and four HDUs. Nests TYA and TYB were installed in FY 2010, and monitoring was initiated in March 2010. Monitoring nest instruments collect moisture data that determines whether the soil under the barrier is drying out. These results will be routinely published in the annual interim surface barrier monitoring report.

**Figure 3. TY Tank Farm Interim Surface Barrier**


## 4.1 TY FARM SYSTEMATIC INTERIM SURFACE BARRIER INSPECTIONS AND MAINTENANCE

The purpose of the interim barrier inspections and maintenance program will be to ensure effective prevention of moisture intrusion under the barrier over the 25-year service life.

### 4.1.1 Visual Inspections

Visual inspections will be conducted quarterly and are a requirement listed in PMID-BAS-4241, *Maintenance Program System Analysis and Technical Basis*. Additionally the TY Farm interim surface barrier has an evapotranspiration basin. Maintenance and inspection guidelines for the basin are included in RPP-PLAN-49651, *Maintenance Guidance Manual for Tank Farm Interim Barrier Evapotranspiration Basins*. Engineering will use visual inspection sheets to note issues with the barrier or basin. Inspection sheet observations will be included in the Annual Interim Surface Barrier Monitoring Report. Visual inspection sheets will be part of the preventative maintenance activities performed to maintain the 25-year lifespan of TY barrier.

### 4.1.2 Interim Measures Inspections and Maintenance

In addition to quarterly visual inspections, the environmental group will conduct surveillance and scheduled maintenance on an annual basis to maintain engineering controls installed to reduce infiltration of precipitation into contaminated soils. These controls minimize the spread/transfer of contamination. Surveillance and scheduled maintenance activities will be captured on Site

Form A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection." Supplemental items that may be checked per TFC-PLN-14 include:

- Confirm the berms, runoff collection areas and culverts ability to divert water runoff without failure.
- Verify that there are no obvious subsidence, voids, animal burrows, or low spots.
- Confirm adequate rock/gravel (e.g., Rip Rap) surface on berms, runoff collection areas and culverts rather than dirt/sand.
- Verify culverts are free of large cracks, washouts, missing sections, and ensures pipe lap joints are not obviously deficient or inadequate (e.g., damaged, bent, or torn lap seams).
- Confirm that discharge areas are not filled in with sand, tumbleweeds, vegetation, nor have substantial erosion.
- Identify changes to locations/conditions of installed interim measures controls.

Issues noted during surveillance will be addressed as follows,

> *Minor items (e.g., removal of sand from a culvert) will be addressed by processing a work request and will be assigned resources based on the priority of the repair. Note that environmental related work activities are considered of the highest priority for the TOC. For more significant items a PER will be prepared and submitted, a request for an engineering evaluation of the situation will be requested and a work request will be generated based on the outcome of the engineering evaluation*. (TFC-PLN-14)

### 4.1.3 Leak Detection, Intrusion Monitoring, and Drywell Monitoring Requirements

RPP-9937, *Single-Shell Tank System Leak Detection and Monitoring Functions and Requirements Document*, identifies leak detection methods, intrusion monitoring methods, required monitoring frequencies, and the leak/intrusion notification processes for all SSTs except for tanks being retrieved. As no tanks in TY Farm are currently being retrieved, RPP-9937 identifies in-tank monitoring requirements for TY Farm. Currently, in RPP-9937, there are no requirements to perform drywell logging. RPP-9937 was written to meet Ecology et al. 1989, HFFACO Milestones M-023-23 and M-023-24.

Requirements for leak detection in TY Farm vary with each tank. Leak detection is dependent on the volume of drainable liquid, the potential for liquid intrusions and the available information on the liquid volumes inside each tank (RPP-9937). All tanks in TY Farm have an Enraf gauge installed and additionally two tanks (TY-103 and TY-105) have liquid observation wells (LOWs) installed. Enraf gauges, manual tape, or LOWs will be used to monitor the drainable liquid levels contained within the sludge/saltcake layers. All tanks at TY Farm have undergone isolation and/or interim stabilization to minimize waste level changes inside the tanks. Currently all TY Farm tanks are required to be monitored at least periodically using BMP.

Any changes to these requirements that may result from a revision of RPP-9937 will be reflected in a future revision of this work plan.

## 4.2 SYSTEMATIC PERFORMANCE MONITORING

### 4.2.1 Barrier Performance Monitoring

The monitoring nest data logger controls and stores the measurement data of moisture content from capacitance sensors, soil-water pressure and soil temperature from HDUs, precipitation from the rain gauge, and air temperature from the thermistor. Figure 4 shows the location of the two nest monitoring stations installed at TY Farm. Nest TYA was placed outside of the interim surface barrier to serve as a control. Control nests were installed at least 5 m (16 ft) away from the closest edge of the surface cover to prevent measurable impacts from the cover (PNNL-16538). The other nest site at TY Farm is TYB, which is located within the barrier footprint. The location of TYB was determined to be at least 5 m (16 ft) from the closest edge of the interim surface barrier and between two or more tanks where the largest decrease of soil water content (θ) was expected after the emplacement of the interim surface barrier.

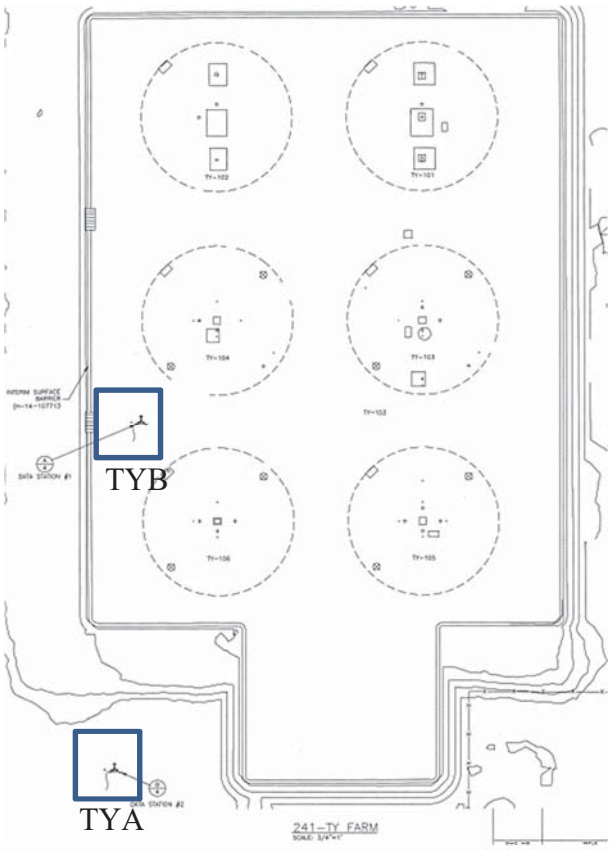



**Figure 4. Location of nest monitoring sites at the TY Farm (blue squares)**

Vertically, the monitoring depths of the nests at TY Farm are 1 m (3 ft), 2 m (7 ft), 5 m (16 ft), and 10 m (33 ft) bgs. Considering that upon the emplacement of an interim surface barrier the changes of soil moisture will be more significant in shallower depths, therefore more intensive and frequent measurements at TY Tank Farm will be taken at shallow depths. To date, the quarterly monitoring nest data indicate that interim surface barriers are curtailing recharge of water to the vadose zone and reducing the impact of meteoric water on soil-moisture conditions.

Since FY 2017, no data from the capacitance probe nests have been utilized. The capacitance probe data will not be used in future interim surface barrier performance analyses because capacitance probes have a short operational life expectancy of one to two years (RPP-PLAN-49187).

Future monitoring nest data from quarterly data downloads and the Hanford Meteorological Station records will continue to evaluate the effectiveness of the interim surface barrier at TY Farm. PNNL-19772 summarizes the six variables monitored, the monitoring methods, and the monitoring frequency. Table 3 shows the current monitoring frequency established and approved in RPP-RPT-53570.

Additional barrier performance monitoring deeper than the backfill will be performed using neutron access tubes which extend 50 feet, or more, into the undisturbed Hanford formation below the tanks. Neutron access tubes are currently accessible at TY barrier farm and data will be collected semi-annually and referred to as neutron moisture probe (NP) measurements (Table 1). Neutron-moisture-probe measurements will be performed manually at 0.3-m (1-ft) intervals to 50 foot depths following the neutron probe measurement procedure documented in TO-320-022.

Monitoring nest data and neutron moisture measurements collected during the year will be included in the Annual Interim Surface Barrier Monitoring Report.

**Table 3. Data Collection Methods and Approximate Frequency Under Normal Working Conditions**

| Monitoring Variable | Monitoring Method[a] | Monitoring Frequency | Data Logger Download Frequency[b] |
|---|---|---|---|
| Soil-Water Content | Neutron Moisture Probe | Twice Annually | Not applicable |
| Soil-Water Content | Capacitance Probe[c] | Twice Daily | Quarterly |
| Soil-Water Pressure and Soil Temperature | Heat Dissipation Unit | Daily | |
| Air Temperature | Thermistor | Hourly | |
| Precipitation | Rain Gauge | Hourly | |

a) All measurements except the neutron probe are controlled by data loggers and taken automatically.
b) Based on RPP-RPT-53570.
c) Capacitance probes are not functional and are no longer being used.

Due to the age of the monitoring system, some of the instrumentation is no longer functional (e.g., HDUs for nest TYB and most of the capacitance probes). The causes for functional problems with the capacitance probes and HDUs were: interruptions to the system, other operations (e.g., barrier activity), poor wire connections (e.g., due to corrosion occurrence), instrument failure, and/or data logger overload. Table 4 shows the status of instrument functionality. Monitoring systems have fulfilled their intended purpose and show the interim surface barriers effectively control moisture beneath the barriers, so there is no need nor are there

plans to replace failed monitoring equipment. Suspect or erroneous data will not be reported on in the Annual Interim Surface Barrier Monitoring Report.

**Table 4. TY Farm Instrument Functionality**

| Tank Farm | Nest | Capacitance Probes | Heat Dissipation Units | Thermistor | Rain Gauges |
|---|---|---|---|---|---|
| TY | TYA | Partial Functionality | Partial Functionality | Full Functionality | Not used |
| | TYB | No Functionality | No Functionality | No Functionality | Not used |

### 4.2.2 Tank Leak Assessments

The objective of tank leak assessments is to determine the probability that a tank may be leaking. Conclusions from the leak assessment are then used to help determine the best retrieval method.

RPP-ASMT-61518, 2018, *Prioritized Single Shell Tank Leak Assessments TFC-ENG-CHEM-D-42*, states that a leak assessment on Tank TY-101 will be one of the first 13 tanks prioritized due to its assumed leaker classification. Classifying this tank correctly will be valuable for future retrieval and closure activities.

When the leak assessment report for Tank TY-101 is released, the results of the in-tank and ex-tank monitoring will be summarized in Annual Interim Surface Barrier Monitoring Report.

### 4.2.3 Annual Monitoring Report

Data collected at TY Farm as part of the maintenance and monitoring of the interim surface barrier will be summarized in the Annual Interim Surface Barrier Monitoring Report.

The data in the annual report will include:

- A short description of TY Tank Farm, the interim surface barrier located within the farm and the runoff area.
- Results of visual inspections performed during the year, including a summary of results captured on site form A-6007-352, “Annual Environmental Interim Measures Maintenance Plan Inspection.
- Results of maintenance performed/scheduled (if applicable).
- Barrier moisture monitoring data and trend tables or graphs.
- Barrier farm tank leak assessments (if applicable).
- Research on new barrier technology (if applicable).

## 5.0 SX TANK FARM

The SX Farm is comprised of fifteen 100-series carbon steel SSTs encased in a reinforced concrete shell built during 1953 – 1954. Each of the tanks has a diameter of 23 m (75 ft) and a capacity of 3,785,000 L (1 million gal). Included in the farm are also waste-transfer lines, leak-detection systems, and tank ancillary equipment.

SX Farm was evaluated in the Resource Conservation and Recovery Act groundwater quality assessment of 1996 because of elevated specific conductance and high-levels of technetium-99 in down gradient monitoring wells (WHC-SD-EN-AP-191, *Assessment Groundwater Monitoring Plan for Single Shell Tank Waste Management Area S-SX*).

The SX Farm was selected to receive an interim surface barrier following completion of the interim surface barriers demonstration projects at T and TY Farms. SX Farm was chosen based on the estimated reduction of water table impacts from technetium-99 in the vadose zone if a barrier was installed at SX Farm (RPP-ENV-41309). Vadose zone contamination is primarily due to eight of the fifteen tanks in the SX Farm currently being designated as assumed leakers (HNF-EP-0182, Rev. 392). SX South and SX North barriers were the first and second barriers required under Ecology et al. 1989, HFFACO Milestone M-045-92. During construction, SX Farm also received an additional barrier north of the north barrier, referred to as the SX Expansion Barrier. The expansion allowed all fifteen tanks in SX Farm to be covered under one contiguous interim surface barrier.

Figure 5 below shows the completed interim surface barrier at SX Farm. Construction consisted of building three modified asphalt interim surface barriers over SX Farm, and the three interim surface barriers were completed in 2019. The first barrier is the SX South Barrier which entirely covers Tanks SX-110 through SX-115. The second barrier is the SX North Barrier which covers all of Tanks SX-107 through 109, and the southern portions of Tanks SX-104 through SX-106. The SX Expansion Barrier covers Tanks SX-101 through SX-103 and the northern portions of Tanks SX-104 through SX-106. The three barriers cover all the SSTs in SX Farm to reduce the movement of vadose zone contamination toward the water table.

To monitor barrier performance, the south and north panels at SX Farm have monitoring nests, which started collecting data in August of 2019. The nest sites can be seen in Figure 6. The south panel nest consists of two HDU monitoring probe installations that collect data from 1 m (3 ft) down to 20 m (66 ft) in depth. The north panel monitoring probes collect data from 1 m (3 ft) down to 10-m (33-ft). The data from these nests will be reported in the Annual Interim Surface Barrier Monitoring Report.

**Figure 5. SX Tank Farm Interim Surface Barrier**


## 5.1 SX FARM SYSTEMATIC INTERIM SURFACE BARRIER INSPECTIONS AND MAINTENANCE

The purpose of the interim surface barrier inspections and maintenance program is to ensure effective prevention of moisture intrusion under the barrier over the 25-year service life.

### 5.1.1 Visual Inspections

Visual inspections will be conducted quarterly, a requirement listed in PMID-BAS-4241. Additionally the SX Farm interim surface barrier has an evapotranspiration basin. Maintenance and inspection guidelines for the basin are included in RPP-PLAN-49651. Engineering will use visual inspection sheets to note issues with the barrier or basin. Inspection sheet observations will be included in the Annual Interim Surface Barrier Monitoring Report. Visual inspection sheets will be part of the preventative maintenance activities performed to maintain the 25-year lifespan of the barriers.

### 5.1.2 Interim Measures Inspections and Maintenance

In addition to quarterly visual inspections, the environmental group will conduct surveillance and schedule maintenance on an annual basis to maintain engineering controls installed to reduce infiltration of precipitation into contaminated soils. Engineered controls help minimize the spread/transfer of contamination. Surveillance and scheduled maintenance activities will be

captured on Site Form A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection." Supplemental items that may be checked per TFC-PLN-14 include:

- Confirm the berms, runoff collection areas, and culverts ability to divert water runoff without failure.
- Verify that there are no obvious subsidence, voids, animal burrows, or low spots.
- Confirm adequate rock/gravel (e.g., Rip Rap) surface on berms, runoff collection areas, and culverts rather than dirt/sand.
- Verify culverts are free of large cracks, washouts, missing sections, and ensures pipe lap joints are not obviously deficient or inadequate (e.g., damaged, bent, or torn lap seams).
- Confirm that discharge areas are not filled in with sand, tumbleweeds, vegetation, nor have substantial erosion.
- Identify changes to locations/conditions of installed interim measures controls.

Issues noted during surveillance will be addressed as follows:

> *Minor items (e.g., removal of sand from a culvert) will be addressed by processing a work request and will be assigned resources based on the priority of the repair. Note that environmental related work activities are considered of the highest priority for the TOC. For more significant items a PER will be prepared and submitted, a request for an engineering evaluation of the situation will be requested and a work request will be generated based on the outcome of the engineering evaluation*. (TFC-PLN-14)

### 5.1.3 Leak Detection, Intrusion Monitoring, and Drywell Logging Requirements

RPP-9937 identifies leak detection methods, intrusion monitoring methods, required monitoring frequencies, and the leak/intrusion notification processes for all SSTs except for tanks being retrieved. As no tanks in SX Farm are currently being retrieved, RPP-9937 identifies in-tank monitoring requirements for SX Farm. Currently, in RPP-9937, there are no requirements to perform drywell logging. RPP-9937 was written to meet Ecology et al. 1989, HFFACO Milestones M-023-23 and M-023-24.

Requirements for leak detection in SX Farm vary with each tank. Leak detection is dependent on the volume of drainable liquid, the potential for liquid intrusions and the available information on the liquid volumes inside each tank (RPP-9937). All tanks in SX Farm have an Enraf gauge installed and additionally, eight tanks (SX-101-106, and tanks SX-111-112) have liquid observation wells (LOWs) installed. Enraf gauges, manual tape, or LOWs will be used to monitor the drainable liquid levels contained within the sludge/saltcake layers. All tanks at SX Farm have undergone isolation and/or interim stabilization to minimize waste level changes inside the tanks. Currently all SX Farm tanks are required to be monitored at least periodically using best management practices (BMP).

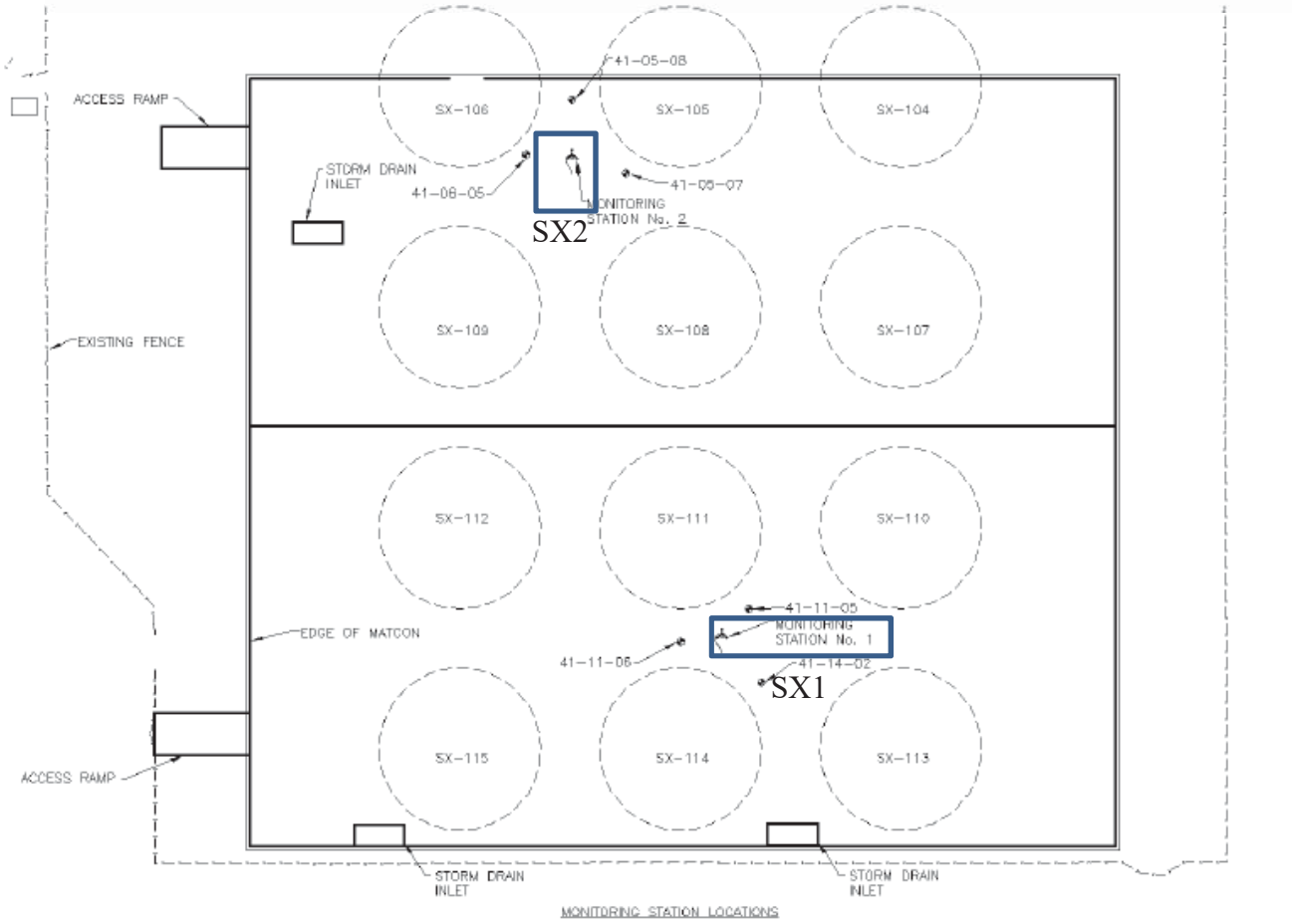
Any changes to these requirements that may result from a revision of RPP-9937 will be reflected in a future revision of this work plan.

## 5.2 SYSTEMATIC PERFORMANCE MONITORING

### 5.2.1 Barrier Performance Monitoring

Vertically, the monitoring depths of the SX1 south barrier will be monitored by two separate HDU monitoring probe arrays. One HDU monitoring array will collect data at 1 m (3 ft), 2 m (7 ft), 3 m (10 ft), 5 m (16 ft), and 10 m (33 ft). The other HDU monitoring array collect data at depths of 10 m (33 ft), 15 m (49 ft), and 20 m (66 ft). The north panel monitoring nest, SX2, has one HDU monitoring array located at depths of approximately 1 m (3 ft), 3 m (10 ft), 5 m (16 ft), and 10 m (33 ft). Considering that, upon the emplacement of the interim surface barrier the changes of soil moisture are more significant in shallower depths, more intensive and frequent measurements will be taken at shallow depths. The two SX Farm monitoring nest locations lie within backfill material in order to track soil moisture changes for a longer period of time. These two locations can be seen in Figure 6 with a blue rectangle around them.

**Figure 6. Diagram shows the monitoring stations installed (blue rectangles) at SX Farm**




The monitoring approach at SX Farm is the same as at T and TY Farms in that will use the monitoring nest data from quarterly data downloads and the Hanford Meteorological Station records to evaluate the effectiveness of the SX interim surface barrier. The one difference will be that capacitance probes at SX Farm were not installed due to their short operational life

expectancy of one to two years (RPP-PLAN-49187). PNNL-19772 summarizes the six variables monitored, the monitoring methods, and the monitoring frequency.

Table 5 (below) shows the revised monitoring frequency established and approved in RPP-RPT-53570.

Neutron-moisture-probe measurements at SX Tank Farm will be performed manually at 0.3-m (1-ft) intervals to depths of 50 feet following the neutron probe measurement procedure documented in TO-320-022. The monitoring nest data logger will control and store the measurement data of moisture content from capacitance sensors, soil-water pressure and soil temperature from HDUs, precipitation from the rain gauge, and air temperature from the thermistor.

Monitoring nest data and neutron moisture measurements collected during the year will be included in the Annual Interim Surface Barrier Monitoring Report.

**Table 5. Data Collection Methods and Approximate Frequency Under Normal Working Conditions**

| Monitoring Variable | Monitoring Method[a] | Monitoring Frequency | Data Logger Download Frequency[b] |
|---|---|---|---|
| Soil-Water Content | Neutron Moisture Probe | Twice Annually | Not applicable |
| Soil-Water Pressure and Soil Temperature | Heat Dissipation Unit | Daily | Quarterly |
| Air Temperature | Thermistor | Hourly | |
| Precipitation | Rain Gauge | Hourly | |
| Soil Water Potential | Soil Water Potential Sensor | Hourly | |

a) All measurements except the neutron probe are controlled by data loggers and taken automatically.
b) Based on RPP-RPT-53570.
c) Capacitance probes are not functional and are no longer being used.

Table 6 (below) shows the status of instrument functionality. Because the monitoring systems are new, all probes are functioning as expected.

**Table 6. SX Farm Instrument Functionality**

| Tank Farm | Nest | Capacitance Probes | Heat Dissipation Units | Thermistor | Soil Water Potential Sensor | Rain Gauges |
|---|---|---|---|---|---|---|
| SX | SX1 | Not installed | Full Functionality | Full Functionality | No Functionality | Not installed |
| | SX2 | Not installed | Full Functionality | Full Functionality | Not installed | Not installed |

### 5.2.2 Tank Leak Assessments

The objective of tank leak assessments is to determine the probability that a tank may be leaking. Conclusions from the assessments will then be used to help determine the best retrieval method

A leak assessment of all SSTs in SX Farm was conducted in 2008/2009, and results were documented in RPP-ENV-39658. The assessment confirmed or revised the status of the 15 SST tank integrities located at the SX Farm. Since the 2009 assessment, an additional tank leak assessment for SX-104 was initiated in 2017 due to the decreasing interstitial liquid level trend consistently observed (RPP-ASMT-63062, *Leak Assessment Report for Tank 241-SX-104 Interstitial Liquid Level Anomaly 2017*). Findings of the most recent leak assessment of SX-104, completed in 2019, reclassified the tank from "assumed leaker" to "sound." Currently HNF-EP-0182, Rev 392 classifies eight out of fifteen tanks at SX Farm as "assumed leakers."

Additional monitoring at SX Farm includes six drywells that will be neutron logged for moisture on a semi-annual basis: 41-05-07, 41-05-08, and 41-06-05 on the north panel; and 41-11-05, 41-11-06, and 41-14-02 on the south panel. Moisture monitoring helps to determine whether or not the soil beneath the barriers is drying out. Monitoring system plans for the south and north panels can be found in RPP-PLAN-48439, *241-SX Tank Farm South Interim Surface Barrier Monitoring Plan*, and RPP-PLAN-49187.

### 5.2.3 Annual Monitoring Report

The Annual Interim Surface Barrier Monitoring Report will include:

- A short description of the SX Tank Farm, the SX interim surface barrier, and the runoff area located within the SX Tank Farm
- Results of visual inspections performed during the year, including a summary of results captured on site form A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection"
- Results of maintenance performed/scheduled (if applicable)
- Barrier moisture monitoring data and trend tables or graphs
- Barrier farm tank leak assessments (if applicable)
- Research on new barrier technology (if applicable)

## 6.0 TX TANK FARM

The TX Tank Farm is a single-shell tank (SST) farm within waste management area TX-TY. Constructed between 1947 and 1948, the TX Tank Farm tanks store hazardous waste. There are a total of 18 SSTs within TX Tank Farm, making it the largest tank farm according to number of tanks at the Hanford Site. Each of the 18 second-generation SSTs has a capacity of 758,000 gal and a diameter of 75 ft. (RPP-RPT-60506,*241-TX Interim Surface Barrier Design Considerations Report,* 2018). Per Ecology et al. 1989, HFFACO Milestone M-045-92, DOE completed the design for a TX Tank Farm interim surface barrier in 2019. The design for the barrier includes two combined panels with a total combined area of approximately 221,000 $ft^2$ and will cover all 18 of the TX Tank Farm tanks. Construction material and design will resemble the SX barrier and basin installation (RPP-RPT-60506).

Construction for the TX interim surface barrier is currently underway. Figure 7 shows the preliminary outline of where the barrier location is planned to be. Construction progress on barrier design components will be included in future versions of this monitoring plan.

**Figure 7. TX Tank Farm Aerial Image and Preliminary Barrier Location**

## 6.1 TX FARM SYSTEMATIC INTERIM SURFACE BARRIER INSPECTIONS AND MAINTENANCE

The purpose of the interim barrier inspections and maintenance program is to ensure effective prevention of moisture intrusion under the barrier over the 25-year service life.

### 6.1.1 Visual Inspections

TX Farm interim surface barrier and evapotranspiration basin designs have been completed. Current construction activities on TX Farm Basin are underway. Upon completion of construction activities for the basin and barrier, visual inspection requirements will be similar to those listed in PMID-BAS-4241 for T, TY, and SX Farms. Maintenance and inspection guidelines for evapotranspiration basins can be found in RPP-PLAN-49651. Engineering will use visual inspection sheets to note issues with the barrier or basin. Inspection sheet observations will be included in the Annual Interim Surface Barrier Monitoring Report. Visual inspection sheets will be part of the preventative maintenance activities performed to maintain the 25-year lifespan of the barriers.

### 6.1.2 Interim Measures Inspections and Maintenance

In addition to quarterly visual inspections, the environmental group will conduct surveillance and schedule maintenance on an annual basis to maintain engineering controls installed to reduce infiltration of precipitation into contaminated soils. Engineered controls help minimize the

spread/transfer of contamination. Surveillance and scheduled maintenance activities will be captured on Site Form A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection." Supplemental items that may be checked per TFC-PLN-14 include:

- Confirm the berms, runoff collection areas, and culverts ability to divert water runoff without failure.
- Verify that there are no obvious subsidence, voids, animal burrows, or low spots.
- Confirm adequate rock/gravel (e.g., Rip Rap) surface on berms, runoff collection areas, and culverts rather than dirt/sand.
- Verify culverts are free of large cracks, washouts, missing sections, and ensures pipe lap joints are not obviously deficient or inadequate (e.g., damaged, bent, or torn lap seams).
- Confirm that discharge areas are not filled in with sand, tumbleweeds, vegetation, nor have substantial erosion.
- Identify changes to locations/conditions of installed interim measures controls.

Issues noted during surveillance will be addressed as follows:

> *Minor items (e.g., removal of sand from a culvert) will be addressed by processing a work request and will be assigned resources based on the priority of the repair. Note that environmental related work activities are considered of the highest priority for the TOC. For more significant items a PER will be prepared and submitted, a request for an engineering evaluation of the situation will be requested and a work request will be generated based on the outcome of the engineering evaluation*. (TFC-PLN-14)

### 6.1.3 Leak Detection, Intrusion Monitoring, and Drywell Logging Requirements

RPP-9937 identifies leak detection methods, intrusion monitoring methods, required monitoring frequencies, and the leak/intrusion notification processes for all SSTs except for tanks being retrieved. As no tanks in TX Farm are currently being retrieved, RPP-9937 identifies in-tank monitoring requirements for TX Farm. Currently, in RPP-9937, there are no requirements to perform drywell logging. RPP-9937 was written to meet Ecology et al. 1989, HFFACO Milestones M-023-23 and M-023-24.

Requirements for leak detection in TX Farm vary with each tank. Leak detection is dependent on the volume of drainable liquid, the potential for liquid intrusions and the available information on the liquid volumes inside each tank (RPP-9937). All tanks in TX Farm have an Enraf gauge installed and additionally, 16 tanks (TX-102-106, and tanks TX-18-118) have liquid observation wells (LOWs) installed. Enraf gauges, manual tape, or LOWs will be used to monitor the drainable liquid levels contained within the sludge/saltcake layers. All tanks at TX Farm have undergone isolation and/or interim stabilization to minimize waste level changes inside the tanks. Currently all TX Farm tanks are required to be monitored at least periodically using best management practices (BMP).

Any changes to these requirements that may result from a revision of RPP-9937 will be reflected in a future revision of this work plan.

## 6.2 SYSTEMATIC PERFORMANCE MONITORING

T, TY and SX Farm interim barrier monitoring instruments have provided substantial data to conclude that the interim surface barriers are effective at redirecting precipitation and runoff water away from the tank farms and contaminated soil that surrounds them. Therefore, the requirement to perform additional monitoring at TX Farm was agreeably removed from the Tri Party Agreement milestone verbiage using change control form M-45-18-03 (06/28/2018).

# 7.0 U TANK FARM

## 7.1 INTERIM SURFACE BARRIER UPDATE

U Tank Farm will be the next tank farm to receive an interim surface barrier after TX Tank Farm interim surface barrier and will be completed under Ecology et al. 1989, HFFACO Milestone M-045-92, which was approved in 2018 per the milestone change control form M-45-18-03. This work plan will be updated upon approval of the U Farm interim surface barrier design by the Department of Ecology.

# 8.0 RESEARCH COMPLETED TO EVALUATE NEW PERFORMANCE MONITORING TECHNOLOGIES

There are a number of different materials and concepts available to use for an interim surface barrier. Fourteen materials were researched in depth in RPP-RPT-47488, *241-SX Tank Farm Interim Surface Barrier Material Alternatives Study* and in RPP-RPT-38323, *Tank Farm Interim Surface Barrier Materials and Runoff Alternatives Study* thirteen materials were evaluated. Due to MatCon's™[2] advantages such as its ability to minimize water infiltration (low hydraulic conductivity), easy to expand/remove, and low maintenance and installation costs, it has been picked for three out of the four interim surface barrier designs.

A variety of collection and storm water discharge systems were also explored to determine the best option for surface water runoff to reduce water table infiltration into the vadose zone. Options were recently published in RPP-RPT-60506, *241-TX Interim Surface Barrier Design Considerations Report*. The preferred runoff collection system was to use an evapotranspiration basin. This is a lined pond concept that is then filled in with native soil and vegetation which absorbs and transpires excess water from the runoff collection system. This evapotranspiration basin system has been chosen for three out of the four interim surface barrier designs installed at Hanford.

Additional materials and technologies for monitoring and controlling moisture levels in the vadose zone below the interim surface barriers will be considered and reported on in the Annual Interim Surface Barrier Monitoring Report as new data becomes available.

[2] MatCon is a trademark of Wilder Construction Company

## 9.0 CONCLUSION REQUIREMENTS FOR THE MAINTENANCE AND PERFORMANCE MONITORING REPORT

To ensure the success of the installed interim surface barriers the data from performance monitoring, quarterly visual inspections, interim measures inspections and maintenance, and current interim surface barrier farm tank leak assessments will be published in the Annual Interim Surface Barrier Monitoring Report. Data collected will track the performance of the interim surface barriers and their ability to route water away from the vadose zone surrounding the tanks. Trends will be displayed in visual formats to help aid the reader in seeing the benefits of the installed interim surface barrier. Results from throughout the year will be compiled into a single report and summarized in the conclusion.

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# ATTACHMENT 2
# 20-TF-0106

# 20-NWP-159 ENCLOSURE COMMENT RESPONSE

(8 Pages Including Cover Letter)

| REVIEW COMMENT RECORD | Date 9/18/2020 | Review No. 1 |
|---|---|---|
| | Project No. | Page 1 of 7 |

| Document Number(s)/Title(s) | Program/Project/Building Number | Reviewers | Organization/Group | Location/Phone |
|---|---|---|---|---|
| RPP-RPT-61684 Maintenance and Performance Monitoring Plan for the Interim Barriers Program | | Maria Skorska<br>Jon Lindberg<br>Kyle Rucker | Ecology | |

Comment Submittal Approval: Agreement with indicated comment disposition(s) Status:

| | | | | |
|---|---|---|---|---|
| _____ | | _____ | | _____ |
| Organization Manager (Optional) | _____ Date | Reviewer/Point of Contact | _____ Date | Reviewer/Point of Contact |
| | | _____ | | _____ |
| | | Author/Originator | | Author/Originator |

| Item | Page #/ section # Line # | Comment (s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/resolve the discrepancy/ problem indicated.) | Hold Point | Disposition (Provide justification if NOT accepted.) | Status |
|---|---|---|---|---|---|
| 1 | Title of report | Suggest that the title of the report be change to RPP-PLAN-61684 from the current RPP-RPT-61684. The current title implies a report instead of a work plan. | | Declined | Comments received initiate a revision to the document. Changing the document number cannot happen at this point in the process. |
| 2 | Page 1, Section 1.0, last paragraph. | At the end of the last paragraph add a sentence stating that results of the inspections, maintenance, and monitoring activities specified in this work plan will be included in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92). | | Accepted | |
| 3 | Page 1, Section 1.0, paragraph 1, end of 3rd sentence, and a few other places within the document | "Groundwater" occurs in the vadose zone (unsaturated zone), as well as within the underlying saturated zone (beneath the water table). The correct terminology would be to say, "…can accelerate the mobilization of contaminants towards the water table (or saturated zone)." | | Accepted | |

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| 4 | Page 1, Section 2.0, Second paragraph, 1st sentence. | The first sentence of the paragraph starts with "The vadose zone…" uses old geologic terms. The terms "middle-designated Ringold Formation" and "upper Ringold Formation" are outdated. More up-to-date terminology would have the sentence written as follows: The vadose zone, over which all interim surface barriers are constructed, is comprised (in ascending order) of the sandy gravels of Ringold Formation Unit E (containing the water table), the predominantly silty sands of the Ringold Formation Taylor Flats unit, the lower gravels and upper muds of the Cold Creek unit, and lower sands and upper sandy gravels of the Hanford formation. The hard caliche is within the Cold Creek unit. | | Accepted | |
| 5 | Page 3, last sentence | Regarding: "Items checked per TFC-PLN-14, *Waste Information Data System Surveillance and Maintenance Description*," please clarify *where* these items are listed. (i.e., below?) | | Accepted | Made item 20 and item 5 the same. Clarified with the word "include" in both places. |
| 6 | Section 3.2, general comment | This section is written in the present tense and provides descriptions of activities that currently occur at T Farm Barrier. The work plan should identify activities that will be performed over the 25-year life time of this barrier. Starting with subsection 3.2.1 change text from the present tense to the future tense to describe the activities that will occur in the future. | | Accepted | |
| 7 | Page 4, first bullet | Please clarify who/what is "their" in this bullet. Is it the T farm interim barrier? Be specific. | | Accepted | Text was modified fromTFC-PLN-14 which called out 'their' to mean "Berms, runoff collection areas and culverts" |
| 8 | Page 4, 3rd bullet | Does this bullet address the rip rap on the sides of the detention basin? Revise this bullet to clarify the location of the rip rap surfaces. | | Accepted | No, Text was modified fromTFC-PLN-14 which called out surfaces such as "Berms, runoff collection areas and culverts" |
| 9 | Page 4, section 3.2.3 | Delete the last sentence: ~~Due to the document being under revision, the reader is referred to RPP-9937 for the most current in-tank and ex-tank monitoring requirements applicable to T Farm.~~<br>Describe in this work plan the in-tank monitoring and ex-tank monitoring requirements in RPP-9937. Add a statement that any changes to these requirements that may | | Accepted | |

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| | | result from the revision of RPP-9937 will be reflected in a future revision of this work plan. | | XXXXXXXXXX | XXXXXXXXXX |
| 10 | Page 5, lines 1-3. | Are there neutron access tubes in T Farm? Please clarify and discuss how moisture monitoring in deep soils will be performed at T farm. | | Accepted | Added information on neutron logging and added to a depth of 50 feet. |
| 11 | Page 4, Section 3.2.3 | Remove the last sentence. List the in-tank and ex-tank monitoring (e.g., drywell logging) requirements for T Farm identified in RPP-9937. Please add a statement that these in-tank and ex-tank monitoring requirements applicable to T-Farm may be revised when RPP-9937 is revised, and that this revision will be reflected when this work plan is updated and submitted to Ecology with each new interim surface barrier design as required under Ecology et.al. 1989, HFFACO Milestone M-045-92. | | Accepted | |
| 12 | Page 4, Section 3.3.1 | Add a figure illustrating locations of monitoring nests at T Farm. | | Accepted | |
| 13 | Page 5, second paragraph. | Appendix A does not belong in this document and remove references to Appendix A throughout this work plan. Reporting of results of barrier maintenance and performance monitoring activities is out of scope for this work plan, but should instead be provided in a separate report titled *Annual Interim Barriers Maintenance and Performance Monitoring Report* (M-045-92) due annually on 10/31. | | Accepted | |
| 14 | Page 5, 6th paragraph, last sentence | Revise this paragraph as follows: ~~"Annual monitoring reports are published, and data included in the report is gathered from the previous fiscal year.~~ *Moisture data collected in a fiscal year will be reported in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92).* | | Accepted | |
| 15 | Page 6 | Delete the last sentence in the paragraph above Table 2 ( reference to Appendix A). | | Accepted | |
| 16 | Page 6, Section 3.3.2 | Revise the last sentence as follows: "and are summarized in ~~Appendix~~ the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92)." | | Accepted | |
| 17 | Page 6, Section 3.3.3 | Revise the introductory paragraph as follows: | | XXXXXXXXXX | XXXXXXXXXX |

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| | | ~~"Results of the~~ Data collected at T Farm as part of the maintenance and monitoring of interim barriers will be summarized in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92)." ~~are reported in Appendix A. The results may be included as part of the monitoring plan (such as this one) or as a separate report.~~ | | Accepted | |
| 18 | Page 6, Section 3.3.3,first bullet | Revise as follows:<br>"A short description of ~~each barrier farm~~ T Farm and interim barrier, …" | | Accepted | |
| 19 | Page 6, Section 3.3.3, 2nd bullet | Revise this bullet as follows: "Results of visual inspections performed during the year, including a summary of results captured on Site Form A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection" | | Accepted | |
| 20 | Page 9, last sentence in the first paragraph. | Revise this sentence as follows: "Items checked per TFC-PLN-14 ~~are listed~~ *include*:" | | Accepted | |
| 21 | Page 9, first bullet | Does this bullet address the rip rap on the sides of the detention basin? Revise this bullet to clarify the location of the rip rap surfaces. | | Accepted | No, Text was modified from TFC-PLN-14 which called out surfaces such as "Berms, runoff collection areas and culverts" |
| 22 | Page 9, Section 4.1.3 | Delete the last sentence: "~~The reader is referred to RPP-9937 for the most current in-tank and ex-tank monitoring requirements applicable to T Farm.~~"<br>Add a description of the in-tank monitoring and ex-tank monitoring requirements in RPP-9937. Add a statement that any changes to these requirements that may result from the revision of RPP-9937 will be reflected in a future revision of this work plan. | | Accepted | Deleted sentence and added monitoring requirements stated in RPP-9937 (See document). Also added "Any changes to these requirements that may result from a revision of RPP-9937 will be reflected in a future revision of this work plan." |
| 23 | Page 9, section 4.2.1, last sentence | The last sentence in the first paragraph is not clear. Was the intent to say that water flux was expected due to large changes in soil water content between the tanks? Please revise. | | Accepted | Deleted, "and hence water flux" from the last sentence |
| 24 | Page 9, section 4.2.1 | Please add a figure illustrating locations of nest sites. | | Accepted | |

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| 25 | Page 10, 2nd paragraph | Revise the second paragraph as follows: "To date, the monitoring data indicates that the interim surface barriers are continuing to curtail recharge of water to the vadose zone and reduce the impact of meteoric water on soil-moisture conditions. ~~Additional~~ Data analysis and graphs on the impact of the barriers to the vadose zone moisture monitoring ~~can be found in Appendix A of this document.~~ will be included in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92)." | | Accepted | |
| 26 | Page 10, 6th paragraph | Revise that paragraph as follows: "~~Annual monitoring reports are published, and data included in the report is gathered from the previous fiscal year.~~ Moisture data collected during the year ~~in FY 2018 can be viewed in Appendix A of this monitoring plan.~~ will be included in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92). | | Accepted | |
| 27 | Page 10, Section 4.2.2 | Discuss objectives and findings of the leak assessment program specific to TY Farm.<br>Delete: "No tank leak assessments were completed for TY Farm in FY 2018." This information belongs in the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92). | | Accepted | |
| 28 | Page 11, Section 4.2.3, 1st paragraph. | Revise as follows:<br>Results of the data collected at TY Farm as part of the maintenance and monitoring of *the* interim barrier~~s are~~ *will be* reported in ~~Appendix A. The results may be included as part of the monitoring plan (such as this one) or as a separate report.~~ the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92). | | Accepted | |
| 29 | Page 11, Section 4.2.3, first bullet | Revise as follows: "A short description of ~~each barrier~~ TY farm and interim barrier…" | | Accepted | |
| 30 | Page 11, Section | Revise this bullet as follows: "Results of visual inspections performed during the year, including a summary of results captured on Site Form | | Accepted | |

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| | 4.2.3, 2nd bullet | A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection" | | XXXXXXXXXXXXXXXX | XXXXXXXXXXXXX |
| 31 | Page 12, 3rd paragraph, first sentence | Revise the sentence as follows: "The SX Tank Farm was selected to receive ~~a~~an interim barrier following completion of the interim barriers ~~barrier~~ demonstration projects at T and TY Farms." | | Accepted | |
| 32 | Page 12, 4th paragraph | Include a figure illustrating locations of the monitoring nests at the SX Farm. | | Accepted | |
| 33 | Page 12, 4th paragraph, last sentence | Revise the sentence as follows: "…the 2020 ~~annual interim barrier monitoring report~~ *the Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92).* | | Accepted | |
| 34 | Page 14, 1st paragraph, last sentence | Revise as follows: "Items checked per TFC-PLN-14 ~~are listed.~~ include:" | | Accepted | |
| 35 | Page 16, Section 5.2.3, 1st sentence | Revise the first as follows: "~~The format of the annual monitoring report will include the following items~~" The Annual Interim Barriers Maintenance and Performance Monitoring Report (M-045-92) will include: | | Accepted | |
| 36 | Page 16, Section 5.2.3, 1st bullet | Revise to read: "A short description of ~~each barrier~~ SX farm and interim barrier,…" | | Accepted | |
| 37 | Page 16, Section 5.2.3. 2nd bullet | Revise this bullet to read: "Results of quarterly visual inspections performed during the year, including a summary of results captured on Site Form A-6007-352, "Annual Environmental Interim Measures Maintenance Plan Inspection". | | Accepted | |
| 38 | Page 16, Section 6 | Design of the TX interim barrier has already been approved and, per HFFACO Milestone M-045-92, it should be included in this revision of the work plan. Revise this section to include information for the TX interim barrier analogous to the sections addressing interim barriers at T, TY, and SX farms. | | Accepted | Added in information on TX barrier design |

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| 39 | Page 16, Section 7. | At the end of the Barrier Update paragraph add the following: "This work plan will be updated when the U Farm interim barrier is approved by Ecology." | | Accepted | Modified sentence per ECY suggestion with the addition of the word "design" after "U farm interim barrier" |
| 40 | Page 16, Section 8 | Delete "Section 8.0 Conclusion". Add "Section 8 Research Completed to Evaluate New Performance Monitoring Technologies." Add a new section that addresses the need for a conclusion in The Annual Interim Barriers Maintenance and Performance Monitoring Report | | Accepted | |
| 41 | Appendix A | Appendix A does not belong in this document and remove references to Appendix A throughout this work plan. Reporting of results of barrier maintenance and performance monitoring activities is out of scope for this work plan, but should instead be provided in a separate report titled *Annual Interim Barriers Maintenance and Performance Monitoring Report* (M-045-92) due annually on 10/31. | | Accepted | |