TRI-PARTY AGREEMENT

Change Notice Number TPA-CN- 0881	TPA CHANGE NOTICE FORM	Date: 12/16/19
Document Number, Title, and Revision: DOE/RL-2014-37, *Removal Action Work Plan for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*, Rev. 0		Date Document Last Issued: November, 2015
Approved Change Notices Against this Document: TPA-CN-0719, TPA-CN-0809		
Originator: Mark Byrnes		Phone: 509-373-3996

Description of Change:
DOE/RL-2014-37 is revised to expand the number of perched water extraction wells and to add perched water monitoring.

M. W. Cline (**DOE**) and D. Goswami (**Lead Regulatory Agency**) agree that the proposed change modifies an approved workplan/document and will be processed in accordance with the Tri-Party Agreement Action Plan, Section 9.0, *Documentation and Records,* and not Chapter 12.0, *Changes to the Agreement.*

Pages 2, 11, 13, 15, and C-1 in Appendix C are revised to expand the scope of the perched water removal action activities to include additional extraction wells and to add perched water monitoring, and to state that biological treatment of nitrate will be suspended for the duration of the 200-ZP-1 optimization study plan (DOE/RL-2019-38).

Additions are shown using double underline. Deletions are shown using ~~strikeout~~.

Note: Include affected page number(s): 2, 11, 13, 15, and C-1

Justification and Impacts of Change:

Twelve new perched water extraction and monitoring wells are planned for installation over the next two years to enhance the extraction rate and monitoring capability for the perched water in the deep vadose zone of the 200-DV-1 Operable Unit. Expanding the number of extraction wells is expected to increase the rate of perched water extraction. Adding perched water monitoring will facilitate evaluation of extraction operations and remediation alternatives within and surrounding the perched water zone for protection of groundwater. The actual schedule for installation, construction, and operation of the extraction and monitoring wells will be determined based on priority of Hanford Site work activities and available funding each FY.

Approvals:

DOE Project Manager	Date 12/16/2019	[X] Approved [ ] Disapproved
EPA Project Manager N/A	Date	[ ] Approved [ ] Disapproved
Ecology Project Manager	Date 12/16/19	[X] Approved [ ] Disapproved

- Remove contaminant mass from perched water and support final remedial options for both the 200-DV-1 and 200-BP-5 OUs.

DOE is the lead agency for this removal action, with review and approval by EPA and Ecology.

1.2 Scope

The scope of this RAWP is limited to the extraction, transport, treatment, and disposal of contaminated perched water from the 200-DV-1 OU. Extracted perched water contains the following contaminants of concern (COCs): uranium, technetium-99, nitrate, total chromium, hexavalent chromium, and tritium. The concentrations of these COCs exceed MCLs and represent the primary risk to the underlying groundwater and HHE. The COCs, with the exception of tritium, will be treated at the 200 West P&T to concentrations below MCLs in order to meet the aquifer injection criteria. There is no treatment method for tritium; however, the resulting combined discharge concentration from the 200 West P&T is expected to be below the MCL with the exception of nitrate for the duration of the 200-ZP-1 optimization study plan (DOE/RL-2019-38). Removal and treatment of COCs from perched water at the 200 West P&T meet the requirements of the AM (DOE/RL-2014-34) and this RAWP.

1.3 Site Conditions and Background

The following subsections provide an overview of site conditions and background information for the Hanford Site and the 200-DV-1 OU perched water.

1.3.1 Physical Location

The Hanford Site lies within the semiarid Pasco Basin of the Columbia Plateau in southeastern Washington State (Figure 1). The area is located north of the confluence of the Columbia, Yakima, and Snake Rivers and encompasses approximately 1,517 km^2 (586 mi^2). Except for portions of the Site modified by past plutonium-production-related activities and current DOE operations and remediation, the Hanford Site is a relatively undeveloped area of shrub-steppe habitat (a drought-resistant, shrub and grassland ecosystem). The area contains a rich diversity of plant and animal species.

Elevations across the central portion of the basin and the Hanford Site range from approximately 119 m (390 ft) above mean sea level at the Columbia River to 1,060 m (3,480 ft) above mean sea level at Rattlesnake Mountain (located along the southern boundary of the Hanford Site). Public access to the Hanford Site is currently restricted and controlled at the Wye Barricade on Route 4 and the Yakima and Rattlesnake Barricades on State Highway 240.

The Hanford Site was selected for plutonium production in 1942 as part of the Manhattan Project, primarily because of the availability of water from the Columbia River and access to power from the Bonneville and Grand Coulee Dams. The remote location and weather conditions of the area, which allowed for nearly year-round construction, also contributed to the selection. Between 1943 and 1964, nine plutonium-production reactors were built along the Columbia River in six areas: 100-BC (two reactors), 100-K (two reactors), 100-N, 100-D (two reactors), 100-H, and 100-F (Figure 1).

The environmental cleanup mission at the Hanford Site began in 1989, following a plutonium-production era that lasted from 1943 to 1989. During plutonium production, the Hanford Site was divided into production areas, including the 200 East and 200 West Areas, which contain the major nuclear fuel processing, waste management, and disposal facilities. The historical designations for the 200 East and 200 West Areas are used in context throughout this RAWP, where appropriate.

2 Removal Action Elements

The 200-DV-1 OU perched water removal action consists of three primary elements: extraction of perched water from the subsurface, transfer of the water to the 200 West P&T, and treatment and disposal of the water at the 200 West P&T.

2.1 Removal Action Work Activities

Gravity drainage of water and cyclical pumping will be the primary method of extracting water from the perched water extraction well (299-E33-344) and the two additional perched water wells (299-E33-350 and 299-E33-351) that were installed in 2014 (Figure 2). The two new perched water extraction wells (299-E33-350 and 299-E33-351) will be configured similarly to well 299-E33-344 (Figure 4). Perched water will be removed from all three wells by using gravity to drain contaminated water into the wells and dedicated pumps to extract the water to a container on the ground surface near the wells. The water then will be transferred by tanker truck to the 200 West P&T, where the water will be treated to remove contaminants and then injected into the aquifer beneath the 200 West Area. The perched water may alternatively be transferred to the 200 West P&T by pipeline once a pipeline is constructed. The perched water removal work activities are shown in Figure 5.

Additional perched water extraction wells and monitoring wells may be installed during implementation of this removal action to enhance the extraction rate and monitoring capability for the perched water in the deep vadose zone of the 200-DV-1 OU. The actual schedule for installation, construction, and operation of the extraction and monitoring wells will be determined based on priority of Hanford Site work activities and available funding each FY.

Two additional phases of perched water extraction were included in the treatability test plan (DOE/RL-2011-40). The second phase would add a vacuum system to accelerate recharge into the well, thus increasing the removal capacity. This phase is referred to as vacuum-enhanced recovery of perched water. The third phase of pumping, which would occur as drainable perched water is reduced, would continue to use the vacuum system to extract pore water from the perched zone to maximize contaminant removal. This phase is referred to as pore water extraction.

With three wells in operation, the rate of perched water removal is expected to increase, and the static water level in the wells is expected to decrease. This three-well system will establish performance data to estimate the remediation time for removing a significant portion of the perched water. Assessment of these data will guide a decision regarding whether and when to implement the additional phases of extraction.

The second phase of perched water extraction (vacuum-enhanced recovery) could be implemented when levels and yields from the perched zone significantly decrease. The anticipated initial yield from all three wells is between 17,000 and 23,000 L (4,500 and 6,000 gal) per week. When the volume of perched water extracted decreases to between 4,000 and 6,000 L (1,000 and 1,500 gal) per week, consideration will be given to implementing vacuum-enhanced recovery. A vacuum would be applied to at least one extraction well.

2.2.1 Perched Water Well Field Activities

Activities performed at the well field may include, but are not necessarily limited to, the following:

- Cyclical pumping of a minimum of three~~up to three~~ extraction wells to remove perched water
- Collecting the extracted perched water in a nearby aboveground container
- Performing water-level and electrical conductivity measurements in the collection container
- Collecting baseline samples of perched water prior to initiating extraction operations under this removal action
- Collecting samples of extracted perched water from the wells and the collection container during extraction operations
- Injecting potable water for well maintenance and well development (typically less than 1000 gallons)
- Collecting samples of perched water from monitoring wells

Field sampling activities are described in DOE/RL-2014-51, *Sampling and Analysis Plan for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*. If the vacuum-enhanced recovery and/or pore water extraction phases are implemented, any additional well field activities will be described in a supplemental sampling and analysis plan (SAP) or SAP addendum. If vacuum-enhanced recovery is used, air emissions will be monitored in accordance with the air emission plan for 200-DV-1 OU vacuum-enhanced recovery/pore water extraction (Appendix C of this RAWP).

2.2.2 Perched Water Transportation Activities

The 200-DV-1 OU extracted perched water will be pumped from the collection container located in the well field into a tank truck. The truck will transport the water to the 200 West P&T, where the water will be pumped into a holding tank. When available as an alternative, 200-DV-1 OU perched water will be conveyed by pipeline to the 200 West P&T. The water will be periodically drained from the collection container to the pipeline. The pipeline from the 200-DV-1 OU perched water wells will feed into the transfer pipeline for the 200-BP-5 OU extraction wells. The tank truck route and planned pipeline route are depicted in Figure 6.

2.2.3 Perched Water Treatment and Disposal

The 200-DV-1 OU extracted perched water will be treated at the 200 West P&T to reduce COC concentrations (with the exception of tritium) to below MCLs. A treatment method is not available for tritium; however, the resulting combined discharge concentration from 200 West P&T is expected to be below the MCL with the exception of nitrate, for the duration of the 200-ZP-1 optimization study plan (DOE/RL-2019-38). The treatment approach involves multiple steps to remove the various COCs. The 200 West P&T treatment steps are shown in Figure 7. The treatment process is summarized in this section, and additional details are provided in DOE/RL-2009-124, *200 West Pump and Treat Operations and Maintenance Plan*.

Influent contaminated water is first filtered to remove fine particulate matter. The 200-DV-1 OU extracted perched water is blended with uranium-contaminated groundwater from the 200-UP-1 OU and 200-BP-5 OU extraction wells, and with other potential sources, in the blended water feed tank. The blended water then flows through the uranium ion exchange (IX) vessels to remove the uranium. Water from the uranium system is then combined with groundwater from the 200-ZP-1 OU and other technetium-99-contaminated groundwater that did not contain uranium contamination. This combined water then passes through another set of filters to remove fine particulates and then flows through the technetium-99 IX vessels to remove technetium-99. The water then passes through a final set of filters before being transferred to the central treatment facility for biological treatment of nonradionuclide COCs.

microorganisms attach and grow. Within the fluidized bed reactor, nitrate is converted to nitrogen gas (denitrification), hexavalent chromium is converted to the trivalent form, and carbon tetrachloride (a 200-ZP-1 OU and 200-UP-1 OU contaminant) is degraded by the microorganisms under anoxic conditions (i.e., in the absence of dissolved oxygen). An optimization study (DOE/RL-2019-38) has been implemented that suspended the biological treatment of nitrate for the duration of the study.

Effluent from the fluidized bed reactor flows by gravity to aerobic membrane tanks for removal of total suspended solids, including precipitated chromium. The water passes through other process components to remove sludge and optimize treatment operations. The treated water is collected in an effluent holding tank and then piped to 200 West P&T injection wells and injected into the aquifer below the 200 West Area.

The anticipated blended influent concentrations will be within the design envelope for the influent to the 200 West P&T. The anticipated influent concentrations for the 200 West P&T are provided in Table 3. Periodic re-evaluation of perched water concentrations will be performed as needed. The operations and maintenance plan (DOE/RL-2009-124) was modified to incorporate operational and monitoring changes based on receiving the 200-DV-1 OU extracted water for treatment. The treated effluent will meet the treated effluent injection ARARs identified in the 200-ZP-1 OU ROD (EPA et al., 2008, *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*) and 200-UP-1 OU ROD (EPA et al., 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*).

Table 3. Estimated Influent Water Quality to 200 West P&T Unit Processes

Analyte	Average Uranium Pre-Treatment	Average Technetium-99 Pre-Treatment	Average Main Treatment Facility
COCs*			
Carbon tetrachloride	79 µg/L	548 µg/L	716 µg/L
Trichloroethene	1.0 µg/L	3.1 µg/L	3.3 µg/L
Chromium (total)	24 µg/L	39 µg/L	23 µg/L
Hexavalent chromium	14 µg/L	32 µg/L	20 µg/L
Nitrate as nitrogen	101 mg/L	64 mg/L	31 mg/L
Radionuclide COCs*			
Iodine-129	1.82 pCi/L	0.90 pCi/L	0.37 pCi/L
Technetium-99	4,374 pCi/L	928 pCi/L	70 pCi/L
Tritium	8,002 pCi/L	6,717 pCi/L	2,864 pCi/L
Uranium	1,371 µg/L	5.6 µg/L	2.5 µg/L
Other Constituents*			
Alkalinity (as $CaCO_3$)	132 mg/L	114 mg/L	104 mg/L
Calcium	104 mg/L	81 mg/L	68 mg/L
Chloride	43 mg/L	28 mg/L	31 mg/L
Chloroform	0.002 mg/L	0.006 mg/L	0.09 /L

C1 Introduction

This air emissions plan supports the removal action work plan (RAWP) that implements the 200-DV-1 Operable Unit (OU) perched water removal action as specified in DOE/RL-2014, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction.* The action memorandum (AM) was prepared to document the selected alternative presented in DOE/RL-2013-37, *Engineering Evaluation/Cost Analysis for Perched Water Pumping/Pore Water Extraction*, as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA).

The scope of the RAWP is limited to the extraction, transport, treatment, and disposal of contaminated perched water from the 200-DV-1 OU. The perched water contains uranium, technetium-99, nitrate, total chromium, hexavalent chromium, and tritium at concentrations that exceed the maximum concentration limits and represent the primary risk to human health and the environment. Removal and treatment of these contaminants from perched water at the 200 west Area Pump and Treat (P&T) meet the requirements of the AM (DOE/RL-2014-34) and the RAWP. There is not treatment for tritium, however, the resulting combined discharge concentration from the 200 West P&T is expected to be below the maximum contaminant level. Biological treatment of nitrate will be suspended for the duration of the 200-ZP-1 optimization study plan (DOE/RL-2019-38).