environmental
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August 2, 2019

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Re: Proposed Revisions to In-Process Monitoring and Waste Characterization
in Facility Decommissioning Plan – Rev 1

Dear Sirs:

The February 28, 2019 requests for supplemental information issued by the Nuclear Regulatory Commission (NRC), in conjunction with meetings conducted at NRC headquarters on April 4-5, 2019 and subsequent conversations, identified several issues which need to be addressed in *Facility Decommissioning Plan – Rev 1* (the DP). These include in-process monitoring of the water treatment systems and characterization of several waste streams which had only been summarily addressed in the DP.

Solely in its capacity as Trustee of the Cimarron Environmental Response Trust (the CERT), Environmental Properties Management, Inc. (EPM) submits herein proposed revisions to *Facility Decommissioning Plan – Rev 1*. These revisions incorporate the following into the existing monitoring program:

- Monitoring the concentration of uranium in sediment filtered from groundwater prior to treatment at the Burial Area #1 Treatment Facility (BA1TF)
- Monitoring the concentration of both uranium and Tc-99 in:
    - Groundwater influent to the Western Area Treatment Facility (WATF)
    - Sediment filtered from groundwater prior to treatment at the WATF
    - Spent ion exchange resin and bioreactor waste sludge generated by the WATF

Proposed in-process monitoring protocols are described in this submittal under the heading "Proposed Revisions to Sections 8.5 through 8.7 of the DP". A proposed revision related to the

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characterization of spent or partially-spent resin prior to demobilization was added to Section 8.9 of the DP. Attachment 1 to this letter contains the proposed DP revisions for Section 8 in tracked-changes format. Proposed waste characterization and disposal protocols are described in this submittal under the heading "Proposed Revisions to Section 13.1, 'Radioactive Waste Management'". Attachment 2 to this letter contains the proposed revisions in tracked-changes format. Attachment 3 to this letter contains proposed revisions to Tables 8-3a through 8-3d from the DP as described in the following sections.

Technetium-99 in Influent

Technetium-99 (Tc-99) was present in the liquid waste stream discharged to Uranium Pond #1 (UP1) and Uranium Pond #2 (UP2) during historical Cimarron facility operations. Data from the limited Tc-99 groundwater monitoring performed at the site has indicated that Tc-99 impact to groundwater is associated with releases from UP1 and UP2 and is therefore limited to areas near and downgradient of UP1 and UP2. There is no evidence that the solid waste buried in former burial trenches at site contained Tc-99. Consequently, Tc-99 is only expected to be present in the WATF influent stream. Additional groundwater sampling and analysis is planned to confirm the nature and extent of Tc-99 in groundwater at the site.

Ion exchange treatability tests conducted in 2013 indicated that Tc-99 present in the influent groundwater was adsorbed by the ion exchange resin. However, those data were insufficient to determine the degree of Tc-99 concentration reduction. Residual Tc-99 present in the ion exchange effluent is expected to be absorbed by the biomass and/or precipitated solids (collectively referred to herein as "biomass") generated by the WATF biodenitrification system. Monitoring the concentration of Tc-99 in WATF influent, ion exchange effluent, spent ion exchange resin, biomass, and biodenitrification effluent must be addressed in the DP. Disposition of the biomass, should characterization determine that it is radioactively contaminated, also needs to be addressed in the DP.

Filtered Sediment

Section 8.6.2 of the DP stated, "Sampling ports will be located between the pre-filter and the lead resin vessel." The pre-filter was not specified and the location of the filter between the influent tank and the lead vessel was not shown in the 60% design because neither the size nor the quantity of particles that would be produced by extraction components was known.

In advancing the water treatment system design to the 90% design stage, VNS – Federal Services (VNSFS) determined that the removal of solids exceeding 10 microns in diameter from the influent stream would minimize the potential for suspended solids to plug pore spaces in the ion exchange resin bed, negatively impacting treatment performance. The quantity of suspended

solids in groundwater produced from a properly developed extraction well installed in an alluvial formation with an engineered, properly constructed filter pack is expected to be minimal (i.e., less than 5 milligrams per liter [mg/L] total suspended solids [TSS]). However, TSS concentrations in groundwater produced by extraction trenches, while still anticipated to be minimal, are less certain due to the fine-grained nature of the formation in which trenches will be installed, and constraints on filter pack construction and development methods.

Although the volume of sediment generated by WATF and BA1TF prefiltration systems is anticipated to be small relative to other waste streams, the removal of this sediment will produce a solid waste that was not accounted for in the DP. Consequently, the characterization and disposition of this waste must be addressed in the DP.

Proposed Revisions to Sections 8.5 through 8.7 of the DP

Section 8.5, "Treated Water Discharge"
This section addresses the collection and analysis of samples of the effluent discharged from both water treatment facilities. This section references Table 8-3c, "Discharge and Injection System Monitoring". Proposed revisions to this table include:

- The location of the sample port associated with each sample is listed under the heading "Instrument/Sample Port ID".
- The DP Appendix containing the drawing showing the location of the sample port is listed under the heading "Appendix".
- The Drawing and Sheet number, followed by the coordinates of the sample port on the drawing, is listed under the heading "Drawing".
- Permit limits for uranium, nitrate, and fluoride have been added.
- Sample IDs "TK-102" and "TK-202" were removed from the table because Sample "Outfall 001" is identical to Sample "TK-102", and Sample "Outfall 002" is identical to "TK-202".

As discussed above, the BA1TF influent groundwater stream is not expected to contain Tc-99. Tc-99 present in the WATF influent is expected to be adsorbed either by the ion exchange resin or the biomass generated by the biodenitrification system. Consequently, Table 8-3c does not prescribe Tc-99 analysis for the effluent associated with either outfall.

Section 8.6.2, "Water Treatment Monitoring"
This section references all four of the Table 8-3 tables. In addition to editorial changes made for clarification, this section was revised to clarify that sediment, spent resin (mixed with absorbent), and biomass will be sampled for laboratory analysis to characterize the waste and properly manifest, ship, and dispose of the waste.

Under the headings "Uranium Treatment Monitoring" and "Nitrate Treatment Monitoring", the text references Tables 8-3a and 8-3b. No revisions to the text were needed.

Proposed revisions to Table 8-3a include:

- The meter/instrument transmitting in-line measurements is listed under the heading "Instrument ID".
- The DP Appendix containing the drawing showing the meter/instrument location is listed under the heading "Appendix".
- The Drawing and Sheet numbers, followed by the coordinates of the meter/instrument location on the drawing are listed under the heading "Drawing".
- A note clarifying that "Sample IDs" are not assigned to in-line monitoring locations because samples are not collected at those locations has been added. In-line meters/instruments provide continuous real-time data to the process control system.

Significant revisions to Table 8-3b were required because sample ports designations corresponding the vessel position (i.e., lead, lag, and polish) change (i.e., rotate) each time the lead resin vessel is exchanged. Resin vessel position rotations are referred to as "cycles" in Table 8-3b. Proposed revisions to Table 8-3b include:

- The location of each sample collected is listed under the heading "Sample Port ID".
- The DP Appendix containing the drawing showing the sample port location is listed under the heading "Appendix".
- The Drawing and Sheet numbers, followed by the coordinates of the sample port location on the drawing are listed under the heading "Drawing".
- The Sample ID for each "vessel effluent" sample for the initial loading of the lead resin vessel (and every third rotation thereafter) is shown in blue highlighting.

- The Sample ID for each "vessel effluent" sample for the loading of the second lead resin vessel (and every third rotation thereafter) is shown in pink highlighting.
- The Sample ID for each "vessel effluent" sample for the loading of the third lead resin vessel (and every third rotation thereafter) is shown in yellow highlighting.

Section 8.7, "Treatment Waste Management"
The second bullet in Section 8.7.2 erroneously stated, "A sample of the spent resin will be extracted from the vessel via a sample port located on top of the vessel. A sample thief will be used to draw a composite sample through the entire thickness of the resin bed. The sample will be analyzed for isotopic uranium mass concentration." This statement is a holdover from the 2015 decommissioning plan. Uranium will be quantified for inventory purposes using in-process treatment system monitoring data. In the WATF, spent resin cannot approach the fissile exemption criterion, so only enough absorbent needs to be added to absorb free liquid. In the BA1 treatment facility, the lead resin bed will be changed out before the fissile exemption criterion is reached, so once again only enough absorbent needs to be added to absorb free liquid. For waste characterization, the mass and concentration of uranium and U-235 in the spent resin mixture will be based on samples collected from each drum of resin/absorbent mixture, so there's no reason to sample the resin in the vessel.

The WQD has informed EPM that the sediment removed from the influent prior to water treatment (i.e., prefiltration) will not be considered an industrial waste; rather, it will be considered soil subject to regulation by the Land Protection Division (LPD) of the DEQ. Sediment that must be disposed of as radiologically impacted soil will be addressed, as described below, by revising a portion of Section 13, "Radioactive Waste Management".

Section 8.7.3, "Spent Resin Packaging and Storage" references Table 8-3d "Waste Characterization Sampling". A proposed revision to the DP text addresses the reduction in sampling frequency once homogeneity of the blended resin mixture is established. Proposed revisions to Table 8-3d include clarification of the naming convention for samples collected from the spent resin/absorbent mixture drums associated with each lead resin vessel changeout.

Proposed revisions to Section 8.7.5 "Biomass Packaging and Storage" include a reference to Table 8-3d and clarify that the biomass solids will be analyzed for uranium and Tc-99. Revisions also clarify that the biomass will be disposed of as radioactively contaminated waste if it contains detectable concentrations of uranium or Tc-99. Biomass that must be disposed of as radioactively contaminated industrial waste will also be addressed, as described below, by revising a portion of Section 13, "Radioactive Waste Management".

Proposed Revisions to Section 8.9 of the DP

Section 8.9, "Demobilization"
This section describes the shutdown, dismantling, and disposal of groundwater treatment systems once uranium concentrations have demonstrated compliance with the NRC Criterion throughout a post-remediation monitoring period. Section 8.9.2, "Uranium Treatment Trains" addresses the collection and analysis of samples of the resin that contained in ion exchange system vessels for demobilization.

During meetings conducted at NRC headquarters on April 4-5, 2019, NRC personnel questioned the basis for selecting 2 pCi/g total uranium as a criterion for determining whether resin would be disposed of as solid waste or as LLRW. Due to Oklahoma's statutory prohibition of the disposal of radioactive material in solid waste landfills, this was revised to state that six samples of unused resin would be analyzed to determine the range of uranium concentrations in the resin. The maximum uranium concentration from those samples would represent the maximum concentration of uranium in resin that could be disposed of in a solid waste landfill. Resin yielding more than this concentration of uranium will be disposed of as LLRW.

Proposed Revisions to Section 13.1, "Radioactive Waste Management"

Proposed revisions to Section 13.1 are shown in tracked-changes format in Attachment 2 to this letter.

Section 13.1.1, "Spent Anion Resin"
This section of the DP referenced Table 8-3d, and stated, "Initially, a sample collected from each drum will be analyzed for isotopic concentration. The collection of multiple samples from a single batch provides the data needed to assess the homogeneity of the mixture." The homogeneity of the mixture leaving the ribbon blender will be assessed to determine when the material has been mixed long enough for one sample to adequately represent the mixture for waste characterization and manifesting.

However, the term "initially" is not defined, nor is there any discussion of how the sampling plan will change after the "initial" period. The proposed revision to the text explains how homogeneity is calculated, the acceptance criteria for homogeneity, and how sample collection and analysis will be changed once the homogeneity of the mixture achieves the acceptance criterion.

Proposed revisions to Table 8-3d include clarification that once the homogeneity of uranium in the processed resin has been established, the frequency of sample collection for waste characterization will be reduced to one sample per resin vessel.

Section 13.1.2, "Potentially Contaminated Material"

Filtered Sediment

As discussed above, the disposition of sediment filtered from the influent streams will be governed by the LPD. A letter dated June 21, 1995 presented the concentration of uranium in background soil samples. Background soil yielded uranium concentrations varying from 1 to 2.9 pCi/g, with a mean value of 1.8 pCi/g and a "mean plus two sigma" value of 2.8 pCi/g. The LPD informed EPM that if the sediment contains detectable Tc-99 or uranium exceeding the "mean plus two sigma" value for background soil, it cannot be disposed of in a landfill in the State of Oklahoma.

A proposed revision to Section 13.1.2 discusses the disposition of sediment that exceeds these criteria under a new heading entitled "Filtered Sediment".

Biomass

As stated above, residual Tc-99 present in the ion exchange effluent is expected to be adsorbed in the biomass generated in the biodenitrification system. Dewatered biomass will be transferred on nearly a daily basis to a roll-off container located south of the WATF building until it is full, at which time it will be transported offsite for disposal. Samples of the biomass will be collected and analyzed to determine if the biomass contains detectable concentrations of uranium or Tc-99.

Because the biomass is a byproduct of water treatment, the OPDES permit requires that it be disposed of as industrial waste. If the biomass contains detectable uranium or Tc-99, it will be considered radioactively contaminated industrial waste. A proposed revision to Section 13.1.2 discusses the disposition of biomass that exceeds these criteria. The revision is provided under a new heading entitled "Biomass".

Miscellaneous Potentially Radioactively Contaminated Material

Section 13.1.2 of the DP previously addressed only miscellaneous potentially contaminated materials, such as gloves, tubing, and other solid waste that may become radioactively contaminated but are impractical to survey for unrestricted release. This text was retained under a proposed new heading entitled "Miscellaneous Potentially Contaminated Material". Another proposed revision to the text states that this material is expected to constitute less than 15% of the total volume of radioactively contaminated waste.

Proposed revisions to the DP text and Tables 8-3a through 8-3d address significant aspects of in-process monitoring of the treatment process, as well as the characterization and disposition of both low level radioactive waste and potentially radioactively contaminated wastes. Consequently, review of these proposed changes should be completed prior to the issuance of Requests for Additional Information.

Should you have any questions or desire clarification, please contact me at (405) 641-5152.

Sincerely,

Jeff Lux, P.E.
Project Manager

cc: NRC Public Document Room (filed electronically)

environmental
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ATTACHMENT 1
PROPOSED REVISIONS TO SECTIONS 8.5 THROUGH 8.7
AND SECTION 8.9 OF THE DP

8.5 TREATED WATER DISCHARGE

All treated water not utilized for injection will be discharged to the Cimarron River in accordance with OPDES permit OK0100510. The OPDES permit authorizes the discharge of treated water from two constructed outfalls at the site: one for discharge of WATF effluent, and a second for discharge of BA1 Treatment Facility effluent. Locations of the two outfalls (Outfall 001 and Outfall 002) are shown on Drawings C002, C003, and C005 (Appendix J-2). Outfall details are presented on C107 (Appendix J-6). Table 8-3c lists the analytes, analytical methods, and frequency of sampling required by the OPDES permit. Permit limits for both outfalls are maximum values of 30 µg/L uranium, 10 mg/L fluoride, and 10 mg/L nitrate. The pH of discharged water must be between 6.5 and 9 standard units. Discharge monitoring results must be reported on Discharge Monitoring Report forms on a monthly basis.

8.5.1 Outfall 001

Assuming all WA groundwater extraction systems operate at nominal capacity and no treated water is injected, a maximum of 250 gpm of treated water would be discharged to the Cimarron River through Outfall 001. The discharge pump for the WATF has been sized to maintain the maximum discharge flow rate (250 gpm) under 100-year flood conditions.

As previously stated, groundwater extracted from the WAA and WU will be treated to reduce concentrations of uranium, nitrate, and fluoride to less than stipulated permit limits prior to discharge. Samples of discharged water will be collected for analysis twice monthly, as stipulated in the OPDES permit.

8.5.2 Outfall 002

Assuming all BA1 groundwater extraction and injection systems operate at nominal capacity and no treated water is injected, a maximum of 100 gpm of treated water would be discharged to the Cimarron River through Outfall 002. The discharge pump for the BA1 Treatment Facility has been sized to maintain the maximum discharge flow rate (100 gpm) under 100-year flood conditions.

Groundwater extracted from BA1 will be treated to reduce the concentration of uranium to less than the stipulated permit limit. Samples of discharged water will be collected for analysis twice monthly, as stipulated in the OPDES permit.

8.6 IN-PROCESS MONITORING

This section addresses the in-process monitoring that will be performed to optimize the groundwater extraction and treatment processes, to determine when remediation can be discontinued, and to identify when groundwater extraction and treatment can cease, and post-remediation monitoring can begin. In-process monitoring of radiological conditions is addressed in Section 11, Radiation Safety Program.

8.6.1 Groundwater Extraction Monitoring

In-process monitoring of groundwater extraction systems will consist of recording, logging, and evaluating well field data including pumping rates and pressures, groundwater elevations in extraction trenches and wells, and pump run times. Transducers will be installed in all groundwater extraction wells and trench sumps to monitor the drawdown achieved at the initial extraction rates. This well field instrumentation will provide real-time measurements and the control system will store the data.

In-process groundwater monitor wells for each remediation area are listed on Table 8-2. Figure 8-8 shows the locations of in-process monitor wells in the western remediation areas. Figure 8-9 shows the locations of in-process monitor wells in BA1.

Groundwater elevations will also be measured manually in those monitor wells scheduled to be sampled on a quarterly basis (see Table 8-2). Groundwater elevation measurements will be recorded daily for the first week, weekly for the second through the fourth week, and after two and three months of operation. After the first three months of operation, groundwater elevation will be recorded on a quarterly basis for all monitor wells which remain on site. This will provide the data needed to assess drawdown and hydraulic influence throughout the plumes targeted for remediation.

The data and assessments described above will be used to adjust groundwater extraction rates for individual wells and/or trenches to optimize COC removal rates, capture of groundwater plumes, and operational efficiency. Individual pumping rates will also be adjusted to maintain the influent flow rates required for proper operation of the groundwater treatment systems.

In-process groundwater elevation measurements will also provide feedback on the capacity for injection wells and trenches to deliver treated water to Sandstones A and B. Injection rates may be adjusted as appropriate to maintain plume capture.

In both the WAA U>DCGL and BA1-B areas, the "groundwater extraction" issue of greatest concern is the potential to create stagnation zones between extraction wells, in which COC concentrations decline very slowly or not at all. In-process groundwater monitoring will provide the data needed to confirm that the concentration of uranium declines in these apparent stagnation zones at approximately the same rate as in other monitor wells located at similar distances from extraction wells.

In the WAA-BLUFF area, the "groundwater extraction" issue of greatest concern is the potential inability of extraction wells to effectively capture the impacted water being driven to the alluvium by the injection of treated water in WU-UP1 and WU-UP2 areas. Groundwater elevation data will be measured in Monitor Wells T-85 through T-88, and in monitor wells spaced between Extraction Wells GE-WAA-06 through GE-WAA-13. If the groundwater elevations in the second set of wells is lower than the groundwater elevation in currently-downgradient Monitor Wells T-85 through T-88, groundwater must be moving toward the bluff, and not away from the bluff through the line of extraction wells.

8.6.2 Water Treatment Monitoring

In-process monitoring of the groundwater treatment processes will provide information needed to monitor the effectiveness of the treatment systems, determine when ion exchange resin vessels require replacement/reconfiguration, to maintain compliance with license possession limits, to determine when accumulated biomass requires removal from denitrification bioreactors, to determine when influent concentrations decline to the point that treatment is no longer needed, to document compliance with disposal requirements for spent resin, and to evaluate compliance with discharge and injection criteria.

Tables 8-3a through 8-3c presents the in-process monitoring program that will be implemented to monitor and operate the water treatment systems. Table 8-3a presents the critical continuous in-line monitoring inputs. Table 8-3b presents the samples collected and analyses that will be ~~requested~~ performed on a weekly basis. Table 8-3c presents the samples collected and analyses that will be ~~requested~~ performed on a bimonthly basis to monitor (and report compliance with) discharge permit parameters and underground injection control program requirements. Table 8-3d presents the samples collected and the analysies performed ~~used~~ to ~~monitor and~~ characterize the following wastes:

- ~~s~~Spent resin/absorbent mixture packaged for disposal (upon each changeout)~~.~~, and

- Biomass generated during the biodenitrification process.

Uranium Treatment Monitoring

Pumping rates, pressures, and float switches will be continuously monitored to maintain a nominal flow of no more than 250 gpm to each uranium treatment skid in the WATF, and no more than 100 gpm to the uranium treatment skid in BA1.

The pH of the influent coming from TK-101 and TK-201 will be continuously monitored and electronically transmitted to the treatment control system. Speed controllers on the pumps which control the rate of acid addition will automatically adjust the pH of the influent to each ion exchange skid. The pH of influent water entering the ion exchange skids will be continuously monitored prior to the in-line mixer where acid is added for pH adjustment (see Drawing P-215, Appendix K-7, which is representative of each UIX treatment skid). After the mixer, the pH is continuously monitored to verify that the influent to the ion exchange vessels is 6.8 – 7.0 standard units. A sample port is in the process line both upstream and downstream of the in-line mixer to enable secondary check of the pH. Table 8-3a identifies the in-line sensors that provide data to control the treatment system.

Sampling ports will be located between the pre-filter and the lead resin vessel, prior to the lag and polishing vessels, and at the effluent from the polishing vessel. See Drawing P-215 (Appendix K-7) for the specific location of sample ports; the configuration of this UIX treatment system is representative of all UIX treatment systems. Samples will be collected from each sampling port on a weekly basis and analyzed for uranium concentration. The volume of groundwater (operating time multiplied by the volumetric flowrate) multiplied by the difference between the influent and effluent concentrations (mass of total uranium per volume of groundwater) will yield the mass of uranium contained in each resin vessel. The U-235 enrichment is used to determine the U-235 content with a vessel. The data obtained through the first two changeouts of each treatment train may indicate that the frequency of sampling may be reduced to every two weeks instead of weekly. Table 8-3b shows the locations from which samples will be collected.

Exchange and replacement of the lead vessel will be triggered when the uranium concentration in the effluent from the lead vessel exceeds 80% of the uranium concentration in the influent. This trigger criterion will be evaluated and modified as appropriate during

operations to maximize the utilization of the resin capacity and minimize the volume of solid waste generated for disposal.

Calculations indicate that no resin vessel will ever accumulate more than 500 grams of U-235, because as the uranium concentration of influent groundwater declines, the adsorption capacity of the resin declines. Consequently, a single resin vessel will not be able to adsorb sufficient uranium to contain 1,200 grams of U-235. Figure 8-6 presents the calculated U-235 loading for each uranium treatment train. Figure 8-6 also shows that the total mass of U-235 in all treatment trains combined is not expected to exceed 800 grams.

Nitrate Treatment Monitoring

The design includes provision for addition of a nitrate source (such as sodium nitrate solution) into the MBBR system to establish the initial microorganism culture. This start-up period is expected to take four to eight weeks depending on the specific commercial denitrification microorganism culture selected and the rate at which nitrate and other nutrients are added.

During the start-up and throughout normal operation, nitrate is continuously monitored via a probe immersed in a sample sink (see Drawing P200 in Appendix K-5). A slip stream from the process continuously overflows into the area sump. The currently identified probe, which is not suitable for placement in the process pipe, provides feedback to the control system to adjust the feed rate of methanol addition. A similar arrangement is used after the drum filter to check that the treatment goal for nitrate has been met (see Drawing P207 in Appendix K-5). Should measurement indicate the effluent goal has not been met, the flow is directed back to the Buffer Tank for re-processing instead of sending the flow to the Effluent Tank. Table 8-3a identifies the in-line sensors that provide data to control the treatment system.

Samples of influent to the uranium treatment system, influent to the biodenitrification system, and effluent from the biodenitrification system, will be collected on a weekly basis, and analyzed for nitrate/nitrite. Evaluation of the data obtained over time may justify reducing the frequency of sampling to once every two weeks. Table 8-3b shows the locations from which samples will be collected.

Sample points are provided at multiple locations along the biodenitrification treatment process as shown on the various P&ID drawings provided in Appendix K5.

An external source of water and nitrate will be used to establish a sufficient biomass; uranium treatment will not begin until this inoculation is complete. In-process monitoring of the ion exchange systems will begin when uranium treatment begins.

Radiological Monitoring

Radiological monitoring of the treatment facilities and processes will consist of monitoring dose rates to ensure compliance with regulatory exposure limits, as well as monitoring the mass and enrichment of uranium accumulated in each ion exchange resin and biomass to assess compliance with license-stipulated possession limits. Radiological monitoring is addressed Section 11, Radiation Protection Program, and Section 15, Facility Radiation Surveys.

Current estimates are that no resin vessel will ever accumulate more than 500 grams of U-235, because as the uranium concentration of influent groundwater declines, the adsorption capacity of the resin declines. Consequently, a single resin vessel will not be able to adsorb sufficient uranium to contain 1,200 grams of U-235. Figure 8-6 presents the calculated U-235 loading for each uranium treatment train. Figure 8-6 also shows that the total mass of U-235 in all treatment trains combined is not expected to exceed 800 grams.

8.6.3 Treated Water Injection and Discharge Monitoring

Injection System Monitoring

For the WU-BA3, WU-UP1, and WU-UP2 remediation areas, initial treated water injection rates were estimated from injection tests and the results of packer tests conducted during previous investigation activities. As previously stated, the injection of treated water into the bedrock aquifer units will be accomplished by gravity flow (i.e., the wells will not be pressurized). Injection rates will initially be adjusted to maintain water levels within injection wells and trenches at the desired elevations. Water level elevations will not be allowed to rise above 2 ft bgs.

In-process monitoring of groundwater injection systems will consist of recording, logging, and evaluating well field and injection process data including injection rates and pressures, injection manifold valve positions, and groundwater elevations in injection wells. Well field and injection process instrumentation will provide real-time measurements for these data and the control system will store data records for future access, trending, and reporting. Groundwater elevations will also be periodically recorded in monitor wells located in each

remediation area containing groundwater injection wells and/or trenches; however, these measurements will be recorded manually. The data described above will be used to adjust groundwater injection rates to maximize the flushing of COCs from the targeted upland sandstone units.

Transducers will be installed in all treated water injection wells to monitor the potentiometric head maintained at the initial injection rates. In-process groundwater monitor wells for each remediation area are listed on Table 8-2 and Figures 8-8 and 8-9 show the locations of in-process monitor wells.

Groundwater elevations will also be measured manually in those monitor wells scheduled to be sampled on a quarterly basis (see Table 8-2). Groundwater elevation measurements will be recorded daily for the first week, weekly for the second through the fourth week, and after two and three months of operation. After the first three months of operation, depth to groundwater measurements will be recorded on a quarterly basis for all monitor wells on-site.

In-process groundwater elevation data will be used to maximize the driving head from areas of upland COC impact toward groundwater extraction features, while minimizing the potential for contaminant displacement to areas outside the boundaries of capture zones.

Discharge Monitoring

The flow rate to each outfall will be recorded, and samples of treated water being discharged via each outfall will be collected for laboratory analysis, on a bi-weekly basis. Discharge monitoring reports will report this data to DEQ on a monthly basis in accordance with the OPDES discharge permit. Parameters and locations for in-process discharge monitoring are presented in Table 8-3c.

8.6.4 Groundwater Remediation Monitoring

Concentrations of groundwater COCs requiring remediation will be monitored to evaluate progress toward remediation goals and to determine when remediation within a given area or area should be discontinued and post-remediation groundwater monitoring should begin. In-process monitor wells used to evaluate remediation progress are the same as those previously specified for groundwater extraction and injection performance monitoring. Locations of the in-process monitor wells are depicted on Figures 8-8 and 8-9. Table 8-2 lists the wells by remediation area and identifies the COCs to be analyzed for groundwater samples collected from each well.

In-process monitoring of COC concentrations in groundwater will consist of the sampling and analysis of select monitor wells in each subarea. Monitoring COC concentrations within each remediation area will provide the information needed to adjust remediation process parameters, primarily extraction and injection flow rates, assess progress toward remediation goals, evaluate when operation of specific wells or trenches can be discontinued, and determine when remediation in a specific area can cease and post-remediation monitoring can begin. Post-remediation groundwater monitoring is addressed in more detail in Section 8.8, Post-Remediation Groundwater Monitoring.

In-process groundwater monitoring will provide several years of data which can be used to evaluate the rate of decline of COC concentrations in groundwater. Section 8.1.7 states that post-remediation monitoring will begin when at least three consecutive months of in-process monitoring data shows that all wells yield uranium concentrations below 180 pCi/L. However, evaluation of in-process monitoring data may indicate that treatment should continue to reduce the risk of exceeding those criteria during post-remediation monitoring.

In addition to evaluating remedial progress, in-process groundwater monitoring results will be used to assess the effectiveness of specific remediation components in each area. Based on the results, groundwater extraction and injection system operations may be adjusted to focus efforts on areas with higher levels of impact, maximizing COC mass recovery and concentration reduction, while remediation efforts in areas of lesser impact may be reduced. The data will also be used to maximize operational efficiency (e.g., minimize power consumption) and inform decisions regarding system modifications (e.g., shut down or cycling of individual extraction wells or trenches).

Groundwater remediation monitoring samples will be collected immediately prior to startup of groundwater extraction and injection. The quarterly analysis of specific COCs for groundwater samples collected at specific locations will be discontinued once the concentration of that COC is below the corresponding State Criterion for four consecutive quarters. For example, groundwater from Monitor Well T-63 will be analyzed for uranium, nitrate, and fluoride each quarter. Should the concentration of fluoride be the first to drop below its State Criterion for four consecutive quarters, analysis for fluoride will be discontinued; analysis for uranium and nitrate would continue until one of these constituents has dropped below the respective State Criterion.

The same procedures will apply for the analysis of COCs in groundwater collected from monitor wells on an annual basis, except that annual analysis will be discontinued once the COC concentration is below the corresponding State Criterion for two consecutive years.

8.7 TREATMENT WASTE MANAGEMENT

Section 8.3.2, Uranium Treatment Systems, describes the process whereby uranium is removed from groundwater by adsorption onto organic resin. This section describes the in-process monitoring that will be performed to monitor the mass of uranium adsorbed in the resin vessel, as well as the process whereby "spent" resin is removed from the treatment system and processed and packaged for shipment as LLRW.

Section 8.3.3, Biodenitrification Systems, describes the process whereby nitrate is removed from groundwater through an anoxic reaction. This section describes the in-process processing and packaging of biomass that is generated in the bioreactors. The influent to the biodenitrification system will consist of groundwater that has already been treated for uranium. The influent should contain non-detectable concentrations of uranium. The biomass filtered from the effluent of biodenitrification system will be processed and packaged for disposal as ~~solid~~ industrial waste.

8.7.1 Resin Vessel Replacement

Once it is determined that the resin in the lead vessel is "spent", the system will be shut down, and the lead vessel will be removed from the treatment train. As explained in Section 8.3.2, the valve alignment will be changed such that the lag vessel will become the lead vessel, the polishing vessel will become the lag vessel, and a new vessel filled with fresh resin will become the polishing vessel. This replacement process ensures that there will always be three vessels in series with the final (polishing) vessel containing fresh anion resin.

8.7.2 Spent Resin Processing

Unless noted otherwise, all drawings cited within this section are provided in Appendix K-4. Spent resin processing operations are shown on P&ID Drawing P-125. Spent resin processing involves the following steps:

- The spent resin vessel is removed from a uranium treatment train. Spent resin vessels from BA1 are transported to the WATF for processing.
- ~~A sample of the spent resin will be extracted from the vessel via a sample port located on top of the vessel. A sample thief will be used to draw a composite sample through the~~

~~entire thickness of the resin bed. The sample will be analyzed for isotopic uranium mass concentration.~~

- The ion exchange vessel will be moved to the Spent Resin Handling Area (see Drawing G-120).
- Spent resin will be sluiced out of the vessel and dewatered using a scrolling centrifuge. The water discharged from the scrolling centrifuge will then be routed back to the WATF influent tank TK-101.
- Solids (i.e., dewatered resin) from the centrifuge will be transferred by enclosed conveyor to a ribbon blender. The ribbon blender is sized to blend the contents of a resin vessel plus the maximum amount of inert material (absorbent) that may be needed to meet the transportation and waste acceptance criteria. The ribbon blender will produce a uniform final mixture that complies with the fissile exempt and waste acceptance criteria. If required, heat will be provided to dry the mixture enough to ensure that the packaged material contains no free liquid and will not produce free liquid during transportation.

The absorbent is the only consumable material used in the Spent Resin Handling System. Current calculations indicate that the WATF uranium concentration is such that the resin capacity is not great enough to reach the fissile exception limit for transportation. For BA1, the initial four to five resin vessels are projected to require early replacement to remain below the fissile limit; however, the design has the flexibility to incorporate the blending of additional adsorbent material, thereby enabling greater utilization of a vessel. A specific adsorbent material has not been identified; however, the material selected will be approved by the LLRW disposal facility. Absorbent is currently estimated to be added to the resin at a volumetric ratio of 1:10 (absorbent volume to resin volume).

Absorbent will be stored in a hopper with a volume equivalent to the super sack (~37 ft3) in which the absorbent will be delivered to the WATF. Usage is anticipated to be approximately one super sack per year, delivered by truck to the WATF. Absorbent may be delivered in containers other than super sacks to mitigate the potential for the absorbent to adsorb moisture from the air during the extended period (months) between vessel change out.

Once a resin vessel has been emptied, the vessel will remain in the Spent Resin Handling Area to be filled with fresh ion exchange media. A pre-determined quantity of new, fresh resin will be added to TK-301 utilizing a drum lifter to assist in positioning the drum to the elevated tank (see Drawing G-120, Appendix K-4). Using treated effluent, the resin is sluiced into the vessel; the

resin is retained within the vessel by internal screens located on the outlet line from the vessel (the same screens that maintain the resin in the vessel during normal operation). The operation is continued until visual observations into TK-301 show that the tank no longer contains resin (e.g. the resin has been added and retained in the vessel).

Because of the potential for residual contamination in a vessel, excess water will be collected and routed to influent tank TK-101 for processing. Once filled, the vessel will be stored in a designated area in the Spent Resin Handling Area until needed.

The Spent Resin Handling Area will be in the northeast corner of the WATF as shown on Drawing G-120. The processing equipment is based on commercial models selected for their processing function. Elevation views of the resin handling equipment is shown on Drawing G-121. Using a single station for both the removal of spent resin and the addition of fresh resin minimizes vessel movement.

8.7.3 Spent Resin Packaging and Storage

Initially, it is anticipated that spent resin from BA1 may contain sufficient uranium to exceed the fissile exception criterion. As the concentration of uranium in groundwater declines, and the observed adsorption capacity of the resin decreases, spent resin will not contain enough uranium to require the addition of a more absorbent than will be needed to ensure that free liquid will not be present upon delivery to the licensed disposal facility. The spent resin without the addition of absorbent will meet the fissile exception criterion.

The blended resin/absorbent mixture will be transferred from the hopper to 55-gallon drums equipped with a plastic liner. The liner provides contamination control and allows for transfer of material in a way that minimizes the potential for airborne suspension of particulates and does not expose the worker to direct contact with the material.

A sample collected from each drum will be analyzed for isotopic concentration. The collection of multiple samples from a single batch provides the data needed to assess the homogeneity of the mixture. Once homogeneity has been established as described in Section 13.1.1, sampling frequency will be reduced to one sample per batch. Analytical data will be the basis for shipping papers and manifests and will provide the data needed to document that transportation and disposal criteria have been met. Table 8-3d presents the sample identification and analytical method for samples of processed resin.

Filled drums will be labeled and placed in a designated area, separate from drums of waste for which data has been received and manifests have been generated, within the Secured Storage Facility located east of the WATF Building (see Drawing C-110, Appendix K-1) pending receipt of analytical results. The Secured Storage Facility is a Metal Building with a single roll-up door that will have removable bollards to additionally restrict access to the interior of the facility (see Drawings A-170 [Appendix K-6] and KC-110 [Appendix K-1], respectively).

Disposal of processed resin is addressed in Section 13.1, Solid Radioactive Waste. The yearly quantity of spent resin (including absorbent) projected to be generated is about 513 ft3 (BA1 ~166 ft3; WATF ~347 ft3), or approximately seventy 55-gallon drums per year.

8.7.4 Biomass Solids Processing

Unless otherwise noted, drawings referenced in this section are in Appendix K-5. The drum filter within the biodenitrification system described in Section 8.3.3 will wash solids off the filter into a backwash sump. From the backwash sump, the water will be pumped to a sludge thickener tank, TK-1250 (see Drawings P210 and P211). Coagulant and polymer will be added in line with a static mixer. This will condition the solids as they enter the thickener. The chemical dosing of the coagulant and polymer will turn on and off with the backwash sump pump. If either chemical dosing system fails due to equipment malfunction or lack of chemical, the dewatering process will continue but will be less efficient.

An air sparging system in the thickener will operate intermittently. This will both prevent the wastewater from becoming septic and reduce the potential for odors. The thickener has a capacity of three days' sludge production to enable the system to continue working throughout the weekend without dependence upon an operator. The overflow from the thickener will flow by gravity to the Area Sump, from where it will be routed back to the buffer tank in front of the MBBRs. A scraper at the bottom of the thickener will move the sludge toward the center, from where it will be pumped to the filter press.

At the beginning of each filter press cycle, before sludge is pumped to the filter press, perlite will be mixed with water in TK-2300 to create a slurry. The slurry will be pumped into the filter press, creating a pre-coat layer on the cloth filter of each plate. The pre-coat minimizes the potential for blinding of the filter press cloths, resulting in more efficient dewatering and dryer sludge cake. Pre-coat also enhances the release of the sludge cake from the filter cloth. The filtrate during this step will be recycled to the perlite feed tank.

The valves will then pump sludge from the bottom of the thickener. Solids will be captured between the plates; the filtrate will discharge to the Area Sump. At the end of each press cycle, compressed air will be blown through the filter press to remove most of the remaining water. The plates of the filter press will be separated, and the filter cake will be dropped into a sludge cart (or equivalent) for transfer to the disposal container. Each filter press cycle takes two to four hours.

The perlite precoat will increase solids capture as well as help produce drier sludge cake. If the perlite system does not work, the filter press cycle can be delayed for maintenance. If the filter press fails due to mechanical reasons, the water in the press will go to the Area Sump, and the ample storage time in the thickener should be sufficient to perform the required maintenance. Again, this is not expected to occur frequently, but the provision is in place to ensure the smooth operation of the plant.

The following is a summary of the chemical usage for the biomass solids process, based on a 250 gpm flow rate and an inlet nitrate concentration of 100 mg/L NO_3-N:

- Emulsion Polymer (for Thickener Tank): Usage is anticipated to be less than one tenth of a gallon/day, supplied by a drum, which will be replaced every 6-months by delivery to the WATF by truck. Storage of replacement drums of polymer is not expected to be more than 1-2 weeks and will be in a designated area with appropriate controls to limit any interaction with other chemicals.
- Ferric chloride (for Thickener Tank): Usage is anticipated to be approximately 12-gallons/day, fed from a 320-gallon double-walled tote, which will be co-located with its feed pump on a skid within the WATF near TK-1250. The tote is expected to be refilled once a month via chemical tote delivered by truck. The new tote will be stacked on the empty supply tote to gravity fill it.
- Perlite (for filter press): Usage is anticipated to be about 60 pounds (lbs)/cycle. Perlite will be received on pallets as dry material in bags that can be handled by an operator. Delivery frequency will be approximately monthly, with a storage location to be determined within the WATF for the perlite pallets.

8.7.5 Biomass Packaging and Storage

The sludge cart will be emptied into a disposal container that complies with transportation requirements. Solids remaining in the sludge cart may be washed out with a hose and drained

into the Area Sump to prevent biogrowth on the cart. The performance criterion for the sludge dewatering process is "no free liquids", (based on the paint filter test) for landfill disposal.

~~The biomass solid will be disposed as non-hazardous industrial waste at an industrial waste landfill.~~ The maximum d~~D~~aily sludge production is anticipated to be approximately ~~450~~600 lb (dry solids), or approximately 1.5 tons of wet cake (at 20% solids content). The filter press has a volume of 30 ft^3, which is adequate to dewater the amount of sludge produced each day in a single cycle. Additional cycles can be run within a day if sludge accumulates in the thickener over several days.

The disposal container is anticipated to be removed on a weekly basis. This is both a function of the biomass solids generation rate and requirements of an industrial waste landfill operator. As nitrate concentrations decline, waste generation will decline.

The biomass solids will be analyzed for uranium and Tc-99 as shown in Table 8-3d. If the biomass solids do not contain detectable uranium or Tc-99, it will be disposed of as non-hazardous industrial waste at an industrial waste landfill. If they do contain detectable uranium or Tc-99, they will be disposed of as radiologically contaminated waste. This may require mixing with additional absorbent material to satisfy the waste acceptance criteria.

8.9.2 Uranium Treatment Units

Six samples of fresh resin will be analyzed for uranium concentration to develop a background concentration for resin. The maximum value for unused resin will represent the upper limit for unimpacted resin. Prior to demobilization of each uranium treatment train, the resin in all three vessels (lead, lag, and polishing) will be sampled and analyzed for uranium concentration~~activity~~. ~~Samples of fresh resin will be analyzed for uranium concentration and activity to develop a background concentration for resin.~~ Resin yielding a ~~total~~ uranium ~~activity~~ concentration less than ~~2 pCi/g above background~~this maximum value will be disposed of as solid waste. Resin yielding ~~total~~ a uranium activity greater than ~~2 pCi/g above background~~this maximum value will be processed as described in Sections 8.6.3 and 8.6.4 and shipped for disposal as LLRW. Vessels in the WA Treatment Facility may also be transferred to the BA1 Treatment Facility if the concentration of uranium in the resin indicates it may still be able to adsorb uranium from BA1 groundwater.

Once all resin has been removed from the vessels, empty resin vessels and/or ~~all~~ process equipment that cannot be practically surveyed for unrestricted release will be packaged and shipped for disposal as LLRW. Empty resin vessels and ~~all~~ process equipment that can be surveyed for unrestricted release will be surveyed and either released, decontaminated for release (if practical), or packaged and shipped for disposal as LLRW.

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ATTACHMENT 2
PROPOSED REVISIONS TO SECTION 13.1 OF THE DP

13.1 SOLID RADIOACTIVE WASTE

Solid radioactive waste generated by groundwater remediation activities will fall into one of several categories:

- Spent anion resin
- Potentially contaminated material (e.g., protective clothing, materials, and equipment) used to maintain the systems and process groundwater (i.e., dry active waste, or DAW)
- Contaminated piping and equipment removed from ion exchange treatment systems

~~Biomass from biodenitrification systems is not anticipated to contain detectable concentrations of uranium and will not be managed as solid radioactive waste.~~

13.1.1 Spent Anion Resin

Anion resin beds will contain approximately 750 kg resin. Estimates based on concentrations in groundwater indicate that no resin vessel will ever accumulate more than 500 grams of U-235, because as the uranium concentration of influent groundwater declines, the adsorption capacity of the resin declines. Consequently, a single resin vessel will be unable to adsorb sufficient uranium to exceed the U-235 possession limit of 1,200 g. The total mass of U-235 in all treatment trains combined is not expected to exceed 800 grams at any given time. In addition, the processed spent resin will contain less than one-gram U-235 per 2 kg non-fissile material.

The resin processing operation involves blending spent resin with non-fissile material in a ribbon blender. No chemicals will be used, as the non-fissile material will consist of an inorganic absorbent. This will result in uniform distribution of SNM throughout the resin/additive mixture (blended waste) in compliance with transportation requirements. The blended waste will be packaged in 55-gallon drums (or other suitable containers as required).

Uranium activity concentrations and consignment activities in the processed resin waste will exceed DOT's 49 CFR 173.436 threshold for radioactive material (i.e. Class 7) and will therefore be transported in accordance with the transportation requirements for radioactive material. However, the waste will contain less than one-gram U-235 per 2 kg non-fissile material and, therefore, will be considered fissile excepted.

Initially, a sample collected from each drum will be analyzed for isotopic concentration. The collection of multiple samples from a single batch provides the data needed to assess the homogeneity of the mixture. Analytical data will be the basis for shipping papers and will

provide the data needed to document that transportation and disposal criteria have been met. Table 8-3d presents the sample identification and analytical method for samples of processed resin.

The homogeneity of the blended spent resin material will be assessed by conducting a process qualification on at least one batch. Multiple random samples will be taken from each batch of spent resin (typically one sample from each drum). Student's t-test will be used as the statistical measurement of homogeneity. If the individual sample results are not significantly different from the average for all the samples at the 90% level ($\alpha = 0.05$) for all the samples, the process will be qualified as producing a homogenous mixture.

Four 55-gallon drums will be loaded onto a pallet and the drums will be strapped together. Pallets of filled drums will be labeled and placed in a designated area within the Secured Storage Facility located east of the WATF Building (see Drawing C-110, Appendix K-1) pending receipt of analytical results. The Secured Storage Facility is a Metal Building with a single roll-up door that will have removable bollards to additionally restrict access to the interior of the facility (see Drawings A-170 [Appendix K-6] and C-110 [Appendix K-1], respectively).

Palleted drums will be stored in the secured storage facility until enough drums have been stored to constitute a full consignment. The spent resin mixture will then be shipped by common carrier to a licensed disposal facility for disposal as Class A, fissile excepted, low level radioactive waste.

The blended waste will be analyzed and certified in compliance with the WAC for the disposal site. The blended waste will comply with the following requirements:

- The SNM will be uniformly distributed throughout the matrix of the resin, a hydrocarbon material. This material is considered soil-like but is not a SiO2 matrix.
- The waste form will be in containers which will be disposed at the licensed disposal site in accordance with license requirements for containerized waste for the disposal site.

Discussions have been held with the proposed waste disposal site to confirm that the packaged waste will conform with the WAC. The analysis demonstrating that a potential criticality condition related to the transportation or disposal of the spent resin mixture is not credible has been incorporated into Appendix O.

13.1.2 Potentially Contaminated Material

Potentially Radioactively Contaminated Filtered Sediment

Sediment that is filtered from the influent streams prior to water treatment may or may not be considered radiologically contaminated material. The Water Quality Division (WQD) of the DEQ has informed EPM that the sediment removed from the influent prior to water treatment will not be considered industrial waste derived from the treatment of water, but as soil subject to regulation by the Land Protection Division (LPD) of the DEQ.

In a letter dated June 21, 1995, the previous licensee addressed the concentration of uranium in background soil. Analysis of 30 samples of background soil yielded uranium concentrations ranging from 1 to 2.9 pCi/g, with a mean value of 1.8 pCi/g and a "mean plus two sigma" value of 2.8 pCi/g. The LPD informed EPM that if the sediment contains detectable Tc-99 or uranium exceeding the "mean plus two sigma" value for background soil, it cannot be disposed of in the State of Oklahoma (unless DEQ approves on-site disposal of the sediment).

Sediment that exceeds these criteria will be packaged and disposed of at a facility that is licensed/permitted to receive radioactively impacted solid waste.

Potentially Radioactively Contaminated Biomass

Residual Tc-99 in the ion exchange influent is expected to be adsorbed in the biomass and/or precipitated solids (collectively referred herein as "the biomass") generated in the biodenitrification system. Samples of the biomass will be collected and analyzed to determine if the biomass contains detectable uranium or Tc-99 concentrations.

Because the biomass is a byproduct of water treatment, the OPDES permit requires that it be disposed of as industrial waste. If the biomass contains detectable uranium or thorium, it will be considered radioactively contaminated industrial waste. Biomass that exceeds these criteria will be packaged and disposed of at a facility that is licensed/permitted to receive radioactively impacted industrial waste.

Miscellaneous Potentially Radioactively Contaminated Material

Gloves, small diameter tubing, and other materials which may become contaminated during groundwater processing are not expected to absorb sufficient uranium to exceed surface contamination limits. However, since these cannot be surveyed practically to demonstrate this, they will be assumed to be radioactively contaminated, and segregated from other solid waste for disposal as radioactive waste. Potentially radioactively contaminated material will be packaged, shipped, and disposed in a licensed disposal facility as Class A fissile excepted waste. This waste is estimated to be less than 15% of the total volume of radioactively contaminated waste.

13.1.3 Storage of Solid Radioactive Waste

Spent anion resin and potentially contaminated material will be stored in sealed 55-gallon drums (or other strong tight transportation container) in a Secure Storage Facility until sufficient material has been accumulated to comprise a full shipment for disposal. The location of the Secure Storage Facility is shown on numerous drawings in Appendix K.

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ATTACHMENT 3
PROPOSED REVISIONS TO TABLES 8-3a THROUGH 8-3d OF THE DP

Table 8-3a
In-Process Treatment System Monitoring
In-Line System Monitoring

Process	Sampled Material	Flow (gpm)	pH	Nitrate (mg/L)	Instrument ID	Appendix	Drawing
WATF Ion Exchange	Tank 101 Influent (pre-acidification)		X		AE100	K-3	P115 SHT 1 - D6
	Train 1 Influent (post-acidification)	X			FIT100		P115 SHT 1 - D5
			X		AE101		P115 SHT 1 - D6
	Train 2 Influent (post-acidification)	X			FIT150		P115 SHT 2 - D5
			X		AE151		P115 SHT 2 - D7
WATF Biodenitrification	Nitrate System Influent	X			FE1005	K-5	P200-00 - C2
				X	AE1010		P200-00 - C2
	Train A Influent		X		AE1055A		P201-00 - E5
	Train B Influent		X		AE1055B		P201-00 - C5
	Nitrate System Effluent		X		AE1100		P203-00 - C5
				X	AE1210A		P207-00 - C5
BA1	Lead Vessel Influent (pre-acidification)		X		AE200	K-7	P215 SHT 2 - D6
	Lead Vessel Influent (post-acidification)	X			FIT 200		P215 SHT 2 - D5
			X		AE201		P215 SHT 2 - D6
	Outfall 002	X			FIT 202		P215 SHT 2 - D4

Note: "Sample IDs" are not required for real-time in-line measurements.
Definitions: gpm - gallons per minute
mg/L - milligrams per liter

Table 8-3b
In-Process Treatment System Monitoring
Weekly Sampling for Analysis

Process	Sampled Material		Sample ID	pH (field)	U-235 & 238 by EPA 200.8	Nitrate by EPA 353.2	Fluoride by EPA 300.0	Tc-99 by HASL 300	Sample Port ID	Appendix	Drawing
WATF Ion Exchange	Train 1 Influent (pre-acid addition)		WATF Pre Acid/S1-1	X	X	X	X	X	S1-1	K-3	P115 SHT 1 - E7
	Train 1 Influent (post-acid addition)		WATF1 Post Acid/S1-2	X					S1-2		P115 SHT 1 - E5
	Train 1 Lead Vessel Effluent	First Cycle	WATF1 Lead Eff/S1-3		X			X	S1-3		P115 SHT 1 - D4
		Second Cycle	WATF1 Lead Eff/S1-4		X			X	S1-4		P115 SHT 1 - D3
		Third Cycle	WATF Lead EFF/S1-5		X			X	S1-5		P115 SHT 1 - D3
	Train 1 Lag Vessel Effluent	First Cycle	WATF1 Lag Eff/S1-4		X			X	S1-4		P115 SHT 1 - D3
		Second Cycle	WATF1 Lag Eff/S1-5		X			X	S1-5		P115 SHT 1 - D3
		Third Cycle	WATF1 Lag Eff/S1-3		X			X	S1-3		P115 SHT 1 - D4
	Train 1 Polish Vessel Effluent	First Cycle	WATF1 Polish Eff/S1-5	X	X	X		X	S1-5		P115 SHT 1 - D3
		Second Cycle	WATF1 Polish Eff/S1-3	X	X	X		X	S1-3		P115 SHT 1 - D4
		Third Cycle	WATF1 Polish Eff/S1-4	X	X	X		X	S1-4		P115 SHT 1 - D3
	Train 2 Influent (pre-acid addition)		WATF Pre Acid/S2-1	X	X	X	X	X	S2-1		P115 SHT 2 - E7
	Train 2 Influent (post-acid addition)		WATF2 Post Acid/S2-2	X					S2-2		P115 SHT 2 - E5
	Train 2 Lead Vessel Effluent	First Cycle	WATF2 Lead Eff/S2-3		X			X	S2-3		P115 SHT 2 - D4
		Second Cycle	WATF2 Lead Eff/S2-4		X			X	S2-4		P115 SHT 2 - D3
		Third Cycle	WATF2 Lead Eff/S2-5		X			X	S2-5		P115 SHT 2 - D3
	Train 2 Lag Vessel Effluent	First Cycle	WATF2 Lag Eff/S2-4		X			X	S2-4		P115 SHT 2 - D3
		Second Cycle	WATF2 Lag Eff/S2-5		X			X	S2-5		P115 SHT 2 - D3
		Third Cycle	WATF2 Lag Eff/S2-3		X			X	S2-3		P115 SHT 2 - D4
	Train 2 Polish Vessel Effluent	First Cycle	WATF2Polish Eff/S2-5	X	X	X		X	S2-5		P115 SHT 2 - D3
		Second Cycle	WATF2 Polish Eff/S2-3	X	X	X		X	S2-3		P115 SHT 2 - D4
		Third Cycle	WATF2 Polish Eff/S2-4	X	X	X		X	S2-4		P115 SHT 2 - D3
WATF Biodenitrification	WATF Effluent in Tank 102*		WATF Effluent	X	X	X	X	X	S-WAE		P115 SHT 3 - D5
BA1	Lead Vessel Influent (pre-acid addition)		BA1 Pre Acid/S3-1	X	X				S3-1	K-7	P215 SHT 1 - E7
	Lead Vessel Influent (post-acid addition)		BA1 Post Acid/S3-2	X					S3-2		P215 SHT 1 - E5
	Lead Vessel Effluent	First Cycle	BA1 Lead Eff/S3-3		X				S3-3		P215 SHT 1 - D4
		Second Cycle	BA1 Lead Eff/S3-4		X				S3-4		P215 SHT 1 - D3
		Third Cycle	BA1 Lead Eff/S3-5		X				S3-5		P215 SHT 1 - D3
	Lag Vessel Effluent	First Cycle	BA1 Lag Eff/S3-4		X				S3-4		P215 SHT 1 - D3
		Second Cycle	BA1 Lag Eff/S3-5		X				S3-5		P215 SHT 1 - D3
		Third Cycle	BA1 Lag Eff/S3-3		X				S3-3		P215 SHT 1 - D5
	Polish Vessel Effluent	First Cycle	BA1 Polish Eff/S3-5	X	X				S3-5		P215 SHT 1 - D3
		Second Cycle	BA1 Polish Eff/S3-3	X	X				S3-3		P215 SHT 1 - D4
		Third Cycle	BA1 Polish Eff/S3-4	X	X				S3-4		P215 SHT 1 - D3

Notes: Samples to be collected the first business day of each week.

First Cycle	Vessel configuration before changeout and after 3rd, 6th, etc. changeout
Second Cycle	Vessel configuration after 1st, 4th, etc. changeout
Third Cycle	Vessel configuration after 2nd, 5th, etc. changeout

*The WATF effluent will initially be sampled on a weekly basis; once consistent compliance with discharge criteria has been demonstrated, the WATF effluent sampling frequency will be reduced to semi-monthly (see Table 8-3c).

Table 8-3c
In-Process Treatment System Monitoring
Discharge and Injection System Monitoring

Sampled Material	Sample ID	Flow (gpm)	pH by EPA 4500	U-235/238 by EPA 200.8	Nitrate by EPA 353.2	Fluoride by EPA 300.0	Instrument/ Sample Port ID	Appendix	Drawing
Western Area Discharge	Outfall 001	X					FIT-102	K-3	P115 SHT 3 - D5
			X	X	X	X	S-WAE		P115 SHT 3 - D5
BA1 Discharge	Outfall 002	X					FIT-202	K-7	P215 SHT 2 - D4
			X	X	X	X	S-BAE		P215 SHT 2 - D5
Western Area Injection	GWI-UP2-01A	X	*(COC concentrations and pH from analysis of samples collected from Outfall 001 will be assigned to each injection well.)*						
	GWI-UP2-01D	X							
	GWI-UP2-02	X							
	GWI-UP2-03	X							
	GWI-UP2-04A	X							
	GWI-UP2-04B	X							
	GWI-UP1-01A	X							
	GWI-UP1-02A	X							
	GWI-UP1-03A	X							
	GWI-UP1-04A	X							
	GWI-WU-01A	X							
BA1 Injection	GWI-BA1-01A	X	*(COC concentrations and pH from analysis of samples collected from Outfall 002 will be assigned to each injection well.)*						
	GWI-BA1-02A	X							
	GWI-BA1-03A	X							

Notes: Discharge samples are collected on the first business day of the month and the first business day following the 14th day of the month.
Discharge monitoring reports are submitted by the 15th of the month.

Limits: pH - 6.5 - 9.0 standard units
Uranium - 30 micrograms per liter

Nitrate - 20 milligrams per liter

Fluoride - 10 milligrams per liter

Definitions: gpm - gallons per minute
COC - contaminant of concern

Table 8-3d
In-Process Treatment System Monitoring
Waste Characterization Sampling

Sampled Material		Sample ID	U-235 & 238 by EPA 200.8	Tc-99 by HASL 300
Resin Mixture from BA1	1st Batch of Spent Resin	BA1-01-01	X	X
		BA1-01-02	X	X
		↓	X	X
		BA1-01-XX	X	X
	2nd Batch of Spent Resin	BA1-02-01	X	X
		BA1-02-02	X	X
		↓	X	X
		BA1-02-XX	X	X
Resin Mixture from WATF Train 1	1st Batch of Spent Resin	WATF1-01-01	X	X
		WATF1-01-02	X	X
		↓	X	X
		WATF1-01-XX	X	X
	2nd Batch of Spent Resin	WATF1-02-01	X	X
		WATF1-02-02	X	X
		↓	X	X
		WATF1-02-XX	X	X
Resin Mixture from WATF Train 2	1st Batch of Spent Resin	WATF2-01-01	X	X
		WATF2-01-02	X	X
		↓	X	X
		WATF2-01-XX	X	X
	2nd Batch of Spent Resin	WATF2-02-01	X	X
		WATF2-02-02	X	X
		↓	X	X
		WATF2-02-XX	X	X
Sediment	Minimum of One Sample per Consignment		X	X
Biomass	Minimum of One Sample per Consignment		X	X

Notes: 1. For disposal of sediment as clean soil, Tc-99 must be non-detectable and the uranium concentration must be less than 2.8 picoCuries per gram.

2. Once homogeneity of uranium in processed resin has been established, one sample per resin vessel will suffice for waste characterization

3. For disposal of biomass as non-radiologically impacted industrial waste, both Tc-99 and uranium must be non-detectable.