100/300 AREA UNIT MANAGER MEETING
ATTENDANCE AND DISTRIBUTION
May 8, 2008

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100/300 AREA UNIT MANAGERS MEETING
APPROVAL OF MINUTES
May 8, 2008

APPROVAL: ______________________ Date 6/12/08
Rudy Guercia, DOE/RL (A3-04)
River Corridor Project Manager

APPROVAL: ______________________ Date 6/12/2008
Briant Charboneau, DOE/RL (A6-33)
Groundwater Project Manager

APPROVAL: ______________________ Date 6/12/2008
John Price, Ecology (H0-57)
Environmental Restoration Manager

APPROVAL: Larry Gadbois Date 6-12-2008
Larry Gadbois, Rod Lobos, or Laura
Buelow, EPA (B1-46)
100 Aggregate Area Unit Manager

APPROVAL: ______________________ for Date 6/12/08
Alicia Boyd, EPA (B1-46)
300 Aggregate Area Unit Manager

100 & 300 AREA UNIT MANAGER MEETING MINUTES

Groundwater, Source Operable Units, Facility (D4 and ISS), and Mission Completion

May 8, 2008

Washington Closure Hanford (WCH) Building, 2620 Fermi Drive, Richland, Washington

ADMINISTRATIVE

- Next Unit Manager Meeting (UMM) - The next meeting will be held June 12, 2008 at the Washington Closure Hanford (WCH) Office Building, 2620 Fermi Avenue, Room C209.
- Attendees/Delegations - Attachment A is the list of attendees. Representatives from each agency were present to conduct the business of the UMM. Attachment B documents any delegations received from the agencies.
- Approval of Minutes – The April 2008 meeting minutes were approved by the U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and U.S. Department of Energy, Richland Operations Office (RL).
- Action Item Status - Status of action items was performed, and updates provided (Attachment C).
- Agenda: Attachment D is the meeting agenda.

EXECUTIVE SESSION (Tri-Parties Only)

No executive session was held.

100/300 AREA GROUNDWATER

Attachment 1 provides a status or information. No issues were identified, and no actions were documented. .

Agreement 1: Attachment 2 is a copy of the "Treatability Test Plan Addendum for 100-NR-2 Groundwater Operable Unit," DOE/RL-2005-96, Addendum. This addendum was approved by RL and Ecology. Also provided in Attachment 2 is the "Field Test Instruction."

Agreement 2: Attachment 3 documents EPA approval of and Ecology concurrence with the identified 100-KR-4 pump and treat system expansion well locations.

SYSTEMATIC PLANNING PROCESS FOR RIVER CORRIDOR

No updates provided. No issues were identified, no agreements were documented, and no actions were documented.

MISSION COMPLETION PROJECT

Attachment 4 provides a status or information. No issues were identified, no agreements were documented, and no actions were documented.

GROUNDWATER/SOURCE INTEGRATION

Attachment 5 provides a status or information on the action items from the 5-year review. No issues were identified, no agreements were documented, and no actions were documented.

100/300 AREA FIELD REMEDIATION CLOSURE (FR)

Attachments 6 through 12 provide a status or information on various Field Remediation Project Areas, as well as agreements. Attachment 6 covers 100-F. Attachment 7 documents an agreement. Attachment 8 covers 300-FF-2. Attachment 9 covers 100-B/C. Attachment 10 covers 118-K-1. Attachment 11 covers 100-D. Attachment 12 covers the schedule for sampling and design. No issues were identified, and no actions were documented.

Agreement: Attachment 7 documents EPA approval to backfill 118-F-6.

DEACTIVATION, DECONTAMINATION, DECOMMISSION, DEMOLITION (D4)/ INTERIM SAFE STORAGE (ISS)

Attachment 13 provides a status or information for the 100 Area and Attachment 16 provides a status or information for the 300 Area. No issues were identified, and no actions were documented.

Agreement 1: Attachment 14 documents RL and Ecology agreement on changes to the "Removal Action Work Plan for 105-N/109-N Building Interim Safe Storage and Related Facilities," DOE/RL-2005-43. These changes focus on providing additional language to the subject plan regarding materials and equipment handling methods within the safe storage enclosure.

Agreement 2: Attachment 15 documents EPA approval for air monitoring requirements during 100-B reactor roof replacement.

SPECIAL TOPICS

No special topics were discussed.

Attachment A

Lobos, Rod	LOBOS.ROD@EPA.GOV	B1-46	EPA	
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Attachment B

Attachment C

100/300 Area UMM
Action List
May 8, 2008

Open (O)/ Closed (X)	Action No.	Co.	Actionee	Project	Action Description	Status
O	300-008	RL	T. Post	100/300 Area	RL shall develop the instructions for documenting D4 completions in the 100 and 300 Areas where no known waste site is under the building, and no releases to soil are documented or expected based on existing data. These instructions shall be added into the respective Removal Action Work Plans after review and approval from the respective lead regulatory agency for the specific Removal Action Work Plans in the 100 and 300 Areas.	Open: 4/12/07; Action: Ongoing action, and are still under development. Instructions are developed and is complete for the 300 Area. RL will submit a TPA Section 9.0 document change notice for the 100 Area.
O	100-149	RL	J. Hanson	100-H	RL/Fluor Hanford Inc. (FH) will review the extraction network for the 100-H pump and treat system, and provide recommendations to Ecology for optimization.	Open: 1/10/08; Action: RL will provide Ecology with the entire 100-HR-3 optimization in the fall 2008. RL plans to meet with Ecology by end of May 2008 on efficiency options.
O	100-150	RL	M. Thompson	300-FF-5	RL shall provide EPA with an updated Sampling and Analysis Plan (SAP) for the 300-FF-5 Operable Unit.	Open: 1/10/08; Action: Internal reviews are complete, and RL plans to provide to EPA by end of May 2008.
O	100-152	RL	T. Post	100-N	RL will schedule a meeting with Ecology on coordinating between D4 and FR activities at the 100-N Area.	Open: 1/10/08; Action: Meeting has not been scheduled.

100/300 Area UMM
Action List
May 8, 2008

Open (O)/ Closed (X)	Action No.	Co.	Actionee	Project	Action Description	Status
O	100-153	RL	C. Smith	100 Area	RL shall schedule a meeting with EPA and Ecology to discuss potential additional institutional controls at specific waste sites (e.g., concrete or other physical markers at 118-B-1 burial ground).	Open: 1/10/08; Action: No meeting scheduled yet.
O	300-009	RL	R. Guercia	300 Area	RL shall brief EPA and Ecology on alternative exposure scenarios for the 300 Area.	Open: 1/10/08; Action: RL has scheduled a meeting.
X	100-154	RL	J. Hanson	100-K	RL will commit to sample wells 199-K-27 and 199-K-109A prior to decommissioning the wells; Sr-90 is specifically requested from EPA.	Open: 2/14/08; Action: Wells were sampled and data results pending. Data was provided, and item closed at 4/10/08 UMM.
X	100-155	RL	Charboneaus	All	RL shall meet with the EPA project managers on project specific funding for Fiscal Year 2009.	Open: 2/14/08; Action:RL reported this is actively being worked. Item closed at 4/10/08 UMM.
X	100-156	RL	J. Hanson	100-H/100-K	RL will provide EPA and Ecology a draft of the proposed non-significant change (i.e., letter to file) to the 100-HR-3/100-KR-4 Record of Decision regarding the continued use of the In-Situ Redox Manipulation (ISRM) lined-pond.	Open: 3/13/08; Action: A draft was provided, and item closed at 4/10/08 UMM.
X	100-157	EPA	R. Lobos	100-F	RL requested EPA to provide direction or assist in determining a path forward for addressing 128-F-2 below the ordinary high-water mark.	Open: 3/13/08; Action:Item was closed at 4/10/08 UMM.

100/300 Area UMM
Action List
May 8, 2008

Open (O)/ Closed (X)	Action No.	Co.	Actionee	Project	Action Description	Status
O	100-158	ECY	J. Price	General	Ecology will schedule a meeting with RL to discuss well variances, and RL will provide information to Ecology beforehand.	Open: 4/10/08; Action: Item remains open, & Ecology still awaiting information.

Attachment D

100/300 Area Unit Manager Meeting
May 8, 2008
Washington Closure Hanford Building
2620 Fermi Avenue, Richland, WA 99354
Room C209; 1:00-4:30 p.m.

1:00 - 1:30 p.m. **Executive Session (Tri-Parties Only):**

- None

1:30 p.m. - 1:45 p.m. **Administrative:**

- Approval and signing of previous meeting minutes (April 2008)
- Update to Action Items List
- Next UMM (6/12/2008, Room C209)

1:45 - 4: 30 p.m. **Open Session: Project Updates:**

- 100/300 Area Groundwater (Jim Hanson/Ann Shattuck)
- Systematic Planning Process (B. Charboneau)
- Mission Completion (Jamie Zeisloft/John Sands/Jeff Lerch)
- Groundwater/Source Integration (All)
  - 5-year review update (Jim Hanson/Alicia Boyd)
- 100/300 Area Field Remediation and Closure (FR)
  - 100-F (Chris Smith/Rex Miller)
  - 300-FF-2 (Chris Smith/John Darby)
  - 618-10/11 (Chris Smith/Scott Parnell)
  - 100-B/C (Chris Smith/Dean Strom)
  - 118-K-1 (Chris Smith/Nelson Little)
  - 100-D (Tom Post/Mark Buckmaster)
  - 100-H (Tom Post/Mark Buckmaster)
  - 100-IU-2/IU-6 (Chris Smith/Rich Carlson)
  - Sampling and FR Design (Chris Smith/Jason Capron/Rich Carlson)
- D4/ISS
  - 300 Area D4 (Rudy Guercia/Megan Proctor)
  - 100 Area D4 & ISS (Tom Post/Chris Smith/Dan Saueressig)
- Special Topics

Attachment 1

100/300 Areas Unit Managers Meeting,
May 8, 2008

100-NR-2 Groundwater OU - Russ Fabre

- Apatite Barrier Injections
  - Comments have been incorporated to the Addendum to the Treatability Test Plan DOE/RL-2005-96 Revision 0.
  - Construction of the six Ringold formation wells was completed on May 2, 2008.
  - Interim report on the low concentration injections has been completed and is in internal review. Data gaps were identified and are being corrected. Document should be available for external review May 19, 2008.
  - Infiltration gallery and phyto remediation contract releases have been issued to PNNL, research work to continue.
  - Eco-Risk assessment report comments by Ecology are being reviewed and will be dispositioned.
  - Planning for the first three pilot injection wells is ongoing with the planned injection date of May 28, 2008.

100-KR-4 Groundwater OU - Julie Robertson

- Monthly monitoring of cultural resources for 100-KR-4 was performed on 4/25/08. A pair of vehicle tracks was observed going about three feet off the north side of a KX extraction well pad and into undisturbed soil on the lower terrace. No cultural resources were observed. The project is evaluating installation of a physical barrier to prevent similar events from occurring in the future.

- 100-KR-4 Remediation Treatment Status
  - For the period of April 1-30, 2008:
    - System operated normally.
    - Total average flow through the system was approximately 278 gpm.
    - Average influent hexavalent chromium concentration was 41 μg/L.

- KR-4 Expansion
  - Construction is proceeding at KX. Construction activities have focused on road crossings and work at the KX main process building during April. Delivery of the KX ion exchange trains is anticipated to occur in May.

  - Drilling and well completion activities have concluded at all 19 existing KX wells. The Tri-Party Agencies agreed upon locations for four replacement KX injection wells on April 15, 2008. The proposed locations and piping routes were walked down with archaeologists and Tribal representatives on April 23, 2008. Some concerns were identified regarding the piping routes, and changes were proposed during the walk down to respond to the concerns. The cultural review process is ongoing.

  - A TPA change notice related to the start-up of the KX system has been drafted and is in RL review. A TPA change notice to add the four new KX injection wells to the HR3/KR4 waste management plan (DOE/RL-97-01) has also been drafted and is in RL review.

- KW Groundwater Remediation

- KW remediation treatment status for the period of April 1-30, 2008.
  - System operated normally.
  - Total average flow through the system was approximately 100 gpm.
  - Average influent hexavalent chromium concentration was 81 µg/L.
- The Sampling and Analysis Plan for drilling four new wells in the vicinity of the 105-KW reactor has undergone RL review. RL comments are being incorporated.
- On April 24, 2008, RL and EPA agreed upon locations for the four new wells.

<u>100-KR-4: K-Basins Monitoring Task—Duane Horton (FH)</u>

- Leak Detection Monitoring Results:
  - The most recent results for monthly sampling of wells close to the KE Basin are for samples collected in March 2008. Results are on level concentration trends with recent data.
  - The April monthly sampling for three wells downgradient of the KE Basin did not occur due to the large number of wells scheduled and limited resources during the month.
  - There is no indication of groundwater impacts attributable to leakage of shielding water from either Basin.

- Monitoring Well Network:
  Routine quarterly sampling of K-Basins network wells did not occur in April as scheduled due to the large number of wells scheduled for the month and limited resources. The wells are being sampled this week.
  - The next routine quarterly sampling of K-Basins network wells is scheduled for July 2008.
  - Results from the routine quarterly sampling in January 2008 are on trend with previous results.
    - Nitrate exceeds MCL in four wells, tritium exceeds the MCL in two wells, chromium, exceeds the MCL in three wells, strontium-90 exceeds the MCL in two wells, and gross beta exceeds the MCL in two wells.

- Reporting:
  - The most recent quarterly, RCRA groundwater report was for July, August, and September 2007 (SGW-36499). The fourth quarter report is in external review.
  - The fiscal year 2007 annual groundwater report (DOE/RL-2008-01) is available at http://www.hanford.gov/cp/gpp/library/gwrep07.

<u>100-HR-3 Groundwater OU - Ron Jackson</u>

- Remediation Treatment Status
  - For the period April 1-30, 2008:
    - The system operated normally. Extraction wells H4-4 and H4-63 were down for two to four days due to either low river stage or faulty AFD problem.
    - Total average flow through the system was approximately 166 gpm.
    - Average influent hexavalent chromium concentration for H Area was approximately less than 0.018 mg/L.
    - Average influent hexavalent chromium concentration for D Area was approximately 0.155 mg/L.

100/300 Areas Unit Managers Meeting,
May 8, 2008

- Remediation Optimization Process
  - The internal review of the draft DR-5 performance evaluation report is planned to start in mid-May.
  - RPO team currently reviewing project documents associated with the various remedial actions and treatability test to support the 100-D Area technology/cost evaluation report and above ground process optimization. This review will integrate components of the 100-D Area CSM.
  - Provided to RL an evaluation of potential modifications to the HR-3 pump and treat system in terms of adding additional extraction and/or injection wells.
  - A Chromium Remediation Technology Exchange Workshop was held on April 9-10. A workshop summary report is due in July 2008.
  - A Groundwater-Columbia River Interactions Technical Workshop was held on April 16-18. The results and recommendations will be provided in workshop summary report which is due in July 2008.

- DR-5 Treatment Status
  - For the period April 1-29, 2008:
    - Extraction well 199-D5-20 was down for approximately 10 days in April due to pressure transducer problems. The well was redeveloped during this period.
    - Total average flow through the system was approximately 41 gpm.
    - The average influent hexavalent chromium concentration was approximately 0.725 mg/L.
    - A process optimization effort is underway to identify actions required to modify the DR-5 processing system to eliminate discharge to the ISRM pond. Initial results show that the current 400% excess phosphate can be reduced to ~15% and the neutralization endpoint should be adjusted from 9.0 to ~10.5, reducing setting time and increasing precipitation efficiency. Tests to evaluate the effect of temperature were completed demonstrating that the temperature had no effect on the precipitation rate of efficiency.

- "Horn" Investigation
  - The second round of groundwater samples from the recently installed monitoring wells (21) is underway.
  - Continue to install pressure transducers as we received equipment from the vendors.
  - Continue to gather data and prepare figures in preparation of the "Horn" investigative report. This report is due to RL in September.

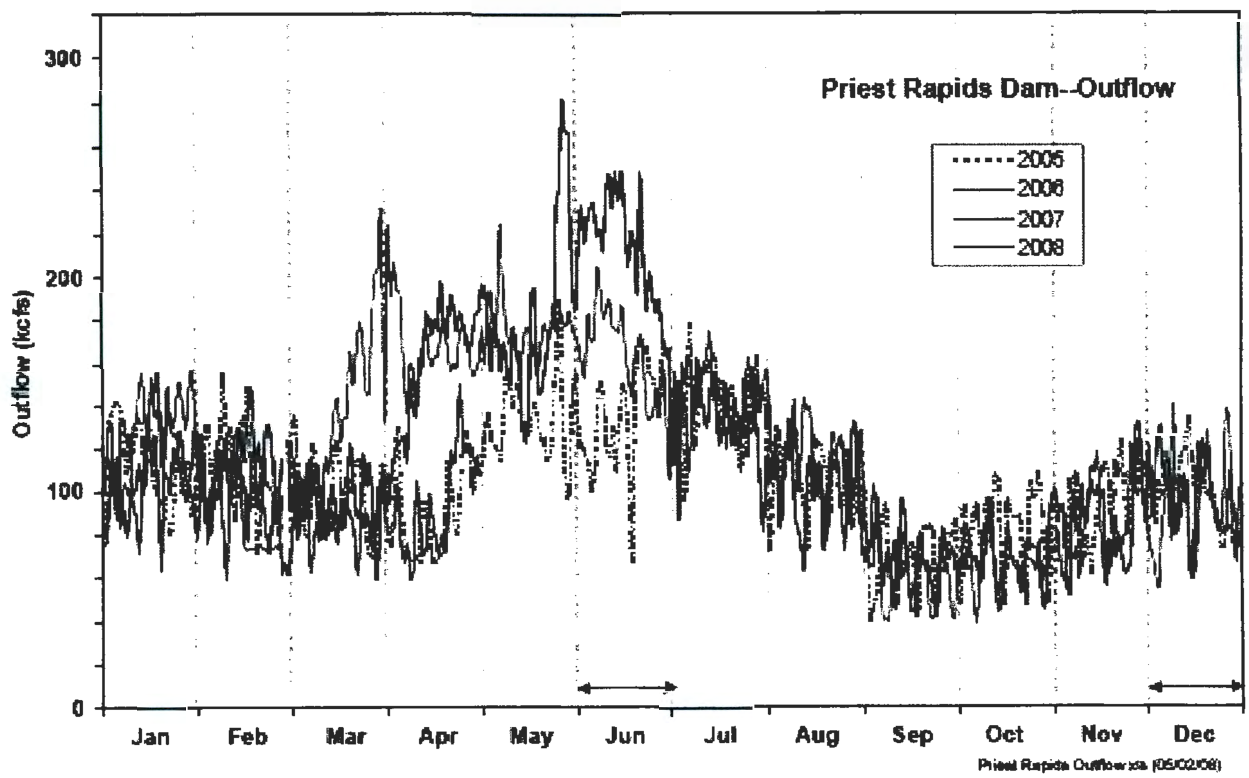
- Summary of ISRM Status
  - 31 ISRM wells were sampled in March and April. Hexavalent chromium concentrations were slightly greater in most wells compared to the same period last year and February 2008 quarterly results. The River remained low during this period.

- EM-22 Technology Projects
  - Investigation for mending ISRM Barrier: Detailed laboratory geochemical and iron injection tests have been completed. Reports on this work are being prepared, and design of the injection system has been initiated.

- EC Treatability Test: The Treatability Test report is being revised to incorporate RL comments. The decisional draft will be submitted to RL for review by their consultant.
- Began drilling the third of four new wells planned to further refine the chromium source in 100-D. No significant vadose zone contamination has been encountered. The second well drilled, between the two "hot" wells, had approximately 5,000 ug/L hexavalent chromium in a sample collected after well development.
- A draft Field Investigation Plan for investigation of chromium sources in the northern 100-D plume was submitted to Ecology for their review, comment, and approval on April 30th.
- Groundwater around the biostimulation wells is being sampled twice a month. The groundwater is maintaining a reduced condition.

<u>300-FF-5 Operable Unit</u>—Bob Peterson and Ron Smith

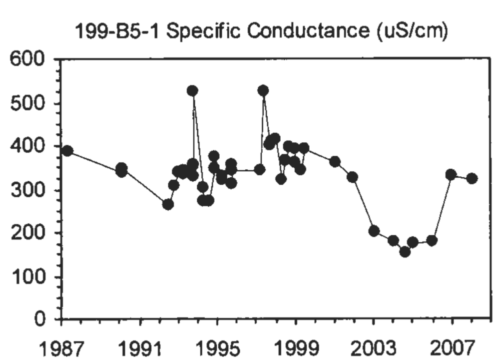
- Operations and Maintenance Plan Activities
  - *300 Area Subregion:* Additional lab results for the December 2007 sampling event continue to be loaded into HEIS. Quarterly sampling occurred during March, and monthly sampling continues at several wells that support the RCRA program. No new information on conditions downgradient of the 618-7 burial ground, where remediation activities began in February. (A January result for uranium in groundwater at well 399-8-5A is elevated compared to historical trends.)
  - *618-11 Burial Ground Subregion:* The most recent contaminant of concern results are for samples collected in January 2008. (Tritium at 699-13-3A, adjacent to the burial ground, has remained in the range 900,000 ~ 1,000,000 pCi/L for the last several sampling events.) Some results are now becoming available for samples collected in March.
  - *618-10 Burial Ground Subregion:* Results are now becoming available for samples collected in February. (Uranium remains well below the drinking water standard, and tributyl phosphate remains very low or nondetected.)
  - *Update to Sampling and Analysis Plan (DOE/RL-2002-11, Rev. 1):* Final revisions are being made.
- Remediation Strategy Development (formerly the Phase III Feasibility Study)
  - A report describing the remediation strategy for uranium in groundwater beneath the 300 Area is in draft form and scheduled for delivery to Fluor in early June.
- Other Activities
  - *VOC Investigation:* Work continues on a report describing the results of this investigation. The report will include the results of some very recent sampling in the river environment.
  - *Systematic Planning for the 300 NPL Site:* Preliminary discussion has been held on a) key issues/information needs, b) working assumptions, and c) a timeline leading to developing the RI/FS work plan. The initial systematic planning workshop is tentatively scheduled for June.
  - *Integrated Field-Scale Challenge Project, 300 Area*: A workshop involving all participants in this 300 Area test site was conducted on April 29-30, 2008, at the EMSL (contacts: John Zachara or Mark Freshley).

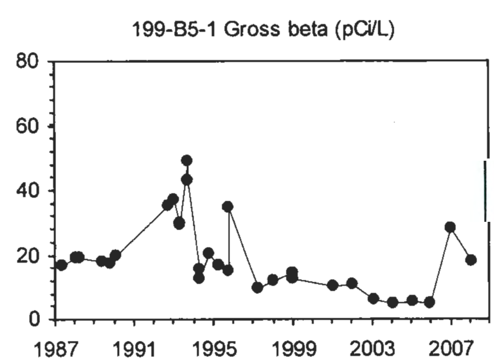


100-BC-5 Operable Units—Mary Hartman

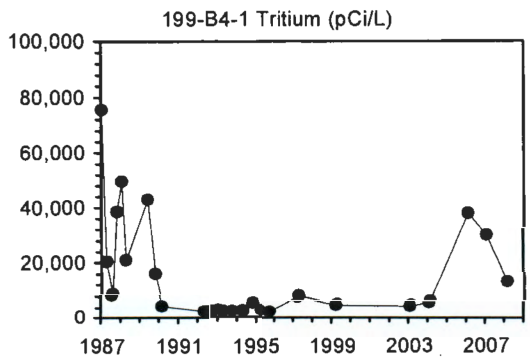
All of the wells have been sampled as scheduled. Data are being loaded into HEIS. The map on the following page shows well locations.

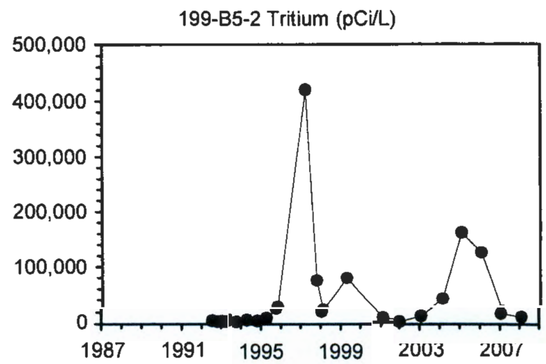
In well 199-B5-1, located in central 100-B/C Area, chromium (16 µgL), tritium (7,200 pCi/L), and specific conductance (319 µS/cm) remained comparable to last year. Gross beta declined from last year. This well showed evidence of dilution with clean water from 2002 to 2006.



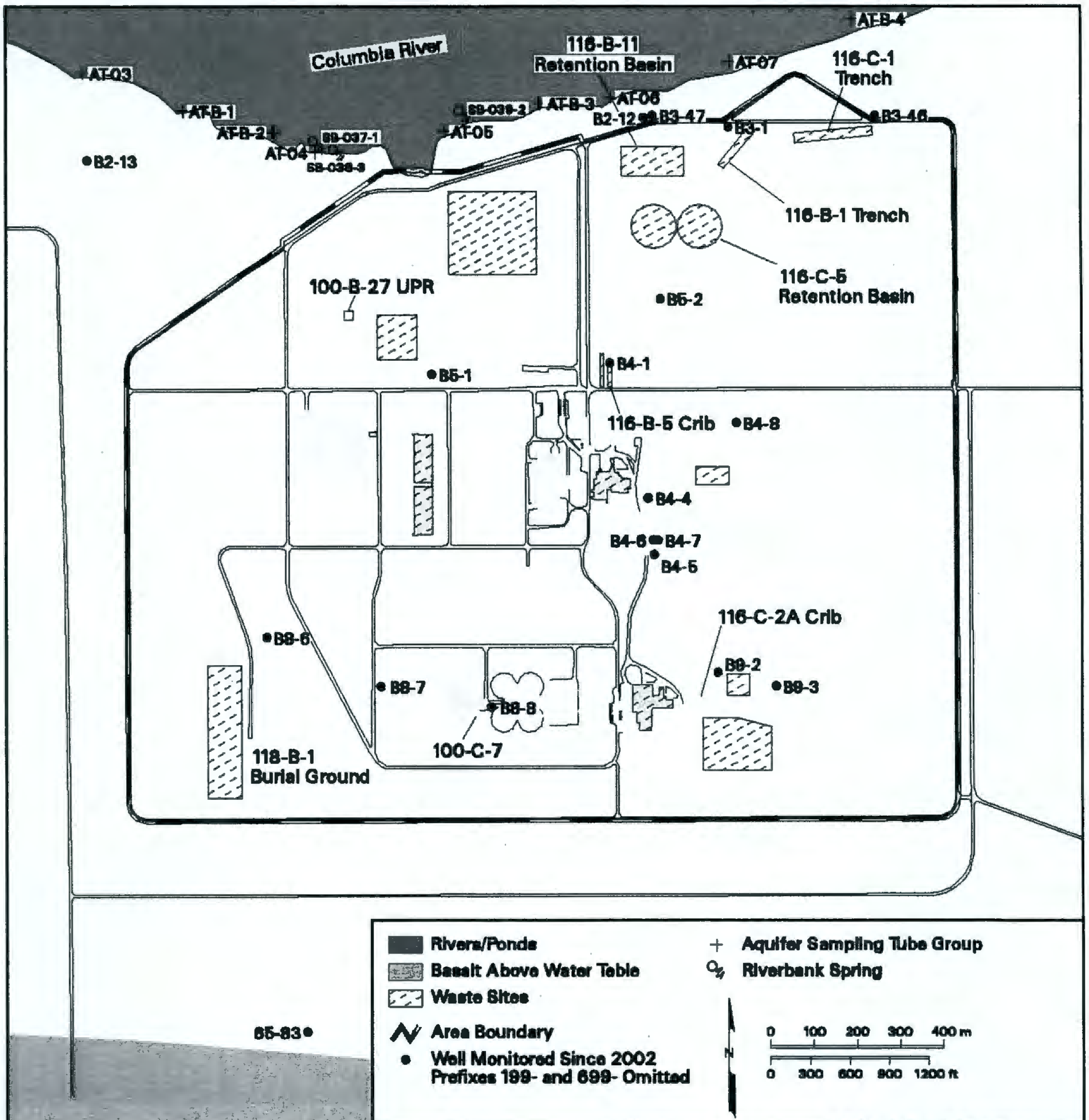


Tritium concentrations continued downward trends in two wells in northeast 100-B/C Area that previously showed "spikes" in tritium. The concentrations were 13,000 pCi/L in well 199-B4-1 and 12,000 pCi/L in well 199-B5-2. The cause of the previous spikes has not been identified.





100/300 Areas Unit Managers Meeting,
May 8, 2008



can_gwf07_61 November 13, 2007 3:01 PM

100/300 Areas Unit Managers Meeting,
May 8, 2008

<u>100-FR-3 Operable Unit</u>—Mary Hartman

New aquifer tubes have been installed at five locations along the 100-F Area shoreline. Two of these locations were sampled in April and the others are being sampled this week. Some of the data from the April samples have been loaded (mostly field data): C6302/C6203 and C6306/C6307. These sites are located generally downgradient of the 116-F-9 trench. Results are consistent with nearby wells and aquifer tubes. Tritium and strontium-90 were undetected in the one tube reported so far (C6307).

<u>Aquifer Tube Installations – Jane Borghese</u>

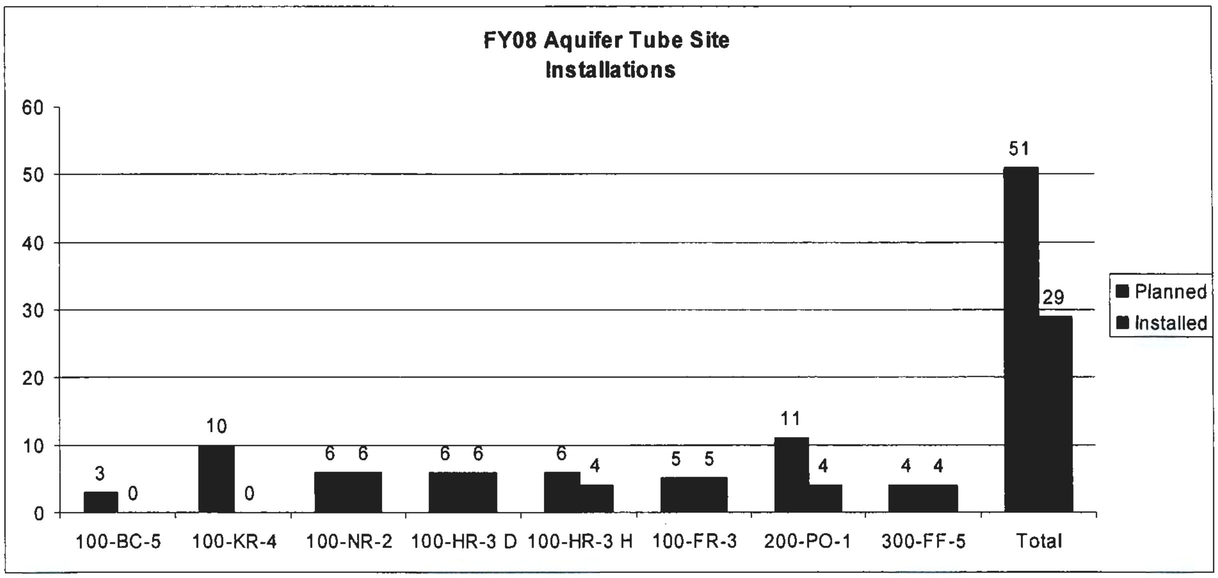


Chart is as summary through Monday May 5^{th}.
Sixty-four tubes have been installed as of May 5^{th}.
Unsuccessful at one of the PO-1 sites.

Attachment 2

2

DOE/RL-2005-96

Addendum

Treatability Test Plan Addendum for

100-NR-2 Groundwater Operable Unit

Issued

April 2008

100-NR-2 Apatite Treatability Test Plan Implementation

Concurrence to proceed with the Treatability Test Plan addendum for high concentration injections at 100-NR-2 Groundwater Operable Unit.

K. Michael Thompson Date 5/08/2008

K.M Thompson
DOE/RL

John B. Price (TPA Project Mgr) Date 5-8-2008

D. Goswami
Washington State Department of Ecology

1.0 Introduction

This addendum to the Strontium-90 Treatability Test Plan for 100-NR-2 Groundwater Operable Unit (DOE-RL-2005-96) describes the plan for conducting higher concentration injections for apatite formation at the 100-N Area Treatability Test site (see Figure 1-1). The injection solution consists of a mixture calcium, citrate, and phosphate (calcium chloride, trisodium citrate, sodium and ammonium phosphates, and a sodium bromide tracer). A low Ca-citrate-phosphate concentration solution for apatite formation was injected into the shallow aquifer in 10 injection wells shown in Figure 1-1 during FY06 and FY07 and performance monitoring is underway. The objective of the low concentration apatite solution injections was to stabilize the ^{90}Sr such that mobilization, and thus peak ^{90}Sr concentrations, are reduced during subsequent high concentration injections. The higher concentration formulation will be designed to provide for significant reductions in aqueous ^{90}Sr concentrations and long-term ^{90}Sr treatment. The Ca-citrate-phosphate solution causes temporary increases in the aqueous ^{90}Sr concentrations due to desorption of ^{90}Sr from the sediments which is controlled by the ionic strength of the solution, particularly the calcium concentrations. The two step process, low concentration injections followed by higher concentrations, was developed to minimize the increase in aqueous ^{90}Sr concentrations in the aquifer while providing for sufficient apatite for long-term ^{90}Sr treatment.

With the presentation of the *Evaluation of ^{90}Sr Treatment Technologies for the 100 NR-2 Groundwater Operable Unit* (Letter Report; Fluor/CH2M HILL, 2004) at the December 8, 2004, public meeting, U.S. Department of Energy (DOE), Fluor, Pacific Northwest National Laboratory (PNNL), and the Washington Department of Ecology (Ecology) agreed that a likely response scenario for groundwater remediation at 100-N is apatite sequestration as the primary treatment, followed by a secondary treatment, or polishing step, if necessary (most likely phytoremediation). Since that time, the agencies have worked together to identify which apatite sequestration technology has the greatest chance of reducing ^{90}Sr flux to the river, for a reasonable cost. In July 2005, aqueous injection, (i.e., the introduction of apatite-forming chemicals into the subsurface) was endorsed as the preferred method by the Innovative Treatment & Remediation Demonstration Program (ITRD) to undergo a Treatability Test under the Interim Record of Decision for 100-NR-2. Studies are in progress to assess the capability of aqueous injection to address both the vadose zone and the shallow aquifer along the 300 feet of shoreline where ^{90}Sr concentrations are highest.

The results of laboratory studies conducted with the Ca-citrate-phosphate solution and sediments from the 100-N Area are described in Szecsody et al. (2007). Laboratory experiments with higher concentration solutions are ongoing. An interim report on the 100-N Area treatability test site, field tests, and performance results to date for the low concentration Ca-citrate-phosphate injections conducted in 2006 and 2007 is currently being prepared and will be ready for public release in FY08.

Two pilot test sites at the east and west end of the treatability test site (see Figure 1-1), which are equipped with extensive monitoring well networks, were used for the initial low concentration formulation injections to develop the injection design for the remaining portions of the barrier. One (or both) of the pilot test sites will be used for the initial high concentration apatite injection to assess the side effects of the process prior to continuing with the remaining barrier well injections.

This addendum includes the following sections: the nominal design for field implementation for injections of the higher concentration solution, sampling and analysis plan, and schedule. Field test instructions will be developed prior to these high concentration injections that will incorporate results from ongoing laboratory experiments and design analysis and provide a detailed description of field test operational parameters and procedures.

2.0 Field Injections of High Concentration Ca-Citrate-PO4 Solution

The primary objective for development of the high concentration injection formulation is to maximize the amount of apatite formation providing long-term treatment while limiting the temporary increase in ^{90}Sr caused by the injection solution. The final low concentration injection solution used for barrier emplacement in 2007 is shown in Table 2.1. The nominal formulation for the high concentration injections is shown in Table 2.2. As indicated, the nominal reformulation concentrations are 4x that of the final low concentration formulation. The high-concentration formulation will be finalized prior to field deployment of the technology and documented in an injection specific field test instruction.

The final high-concentration formulation will be determined from the laboratory tests currently in progress. The field implementation approach is to first use the high-concentration formulation in an injection in one (or both) of the pilot-test sites with monitoring in the wells at the site up to two weeks following the injection. A rapid turn-around for gross beta analysis will be used to assess the ^{90}Sr increase at the site. After reviewing the early results, a decision will be made by DOE/RL and concurred with by Ecology on whether to proceed with the high-concentration formulation injections in the remaining treatability test wells. This schedule is compressed in order to take advantage of the limited high river stage period.

2.1 High Concentration Formulation

Three different low concentration formulations were tested at the 100-N Area pilot test sites during 2006 and 2007, with the objective of maximizing the amount of phosphate while minimizing the temporary increase in ^{90}Sr concentration. Based on preliminary performance monitoring data, the low concentration formulation shown in Table 2.1 (i.e., final Ca-citrate-PO4 formulation) resulted in a mean peak ^{90}Sr concentration increase, relative to mean baseline measurements at the pilot test sites, of 2.75 times at the pilot #1 site (range of 0.66 to 6.9 times) and 2.33 times at the pilot #2 site (range of 0.41 to 5.53 times). These data are shown in Tables 2.3 and 2.4 for Pilot test #1 and Pilot Test #2, respectively. Some of the reduction in observed peak ^{90}Sr during the second injection at the pilot test sites may be attributed to apatite formation and ^{90}Sr inclusion from the earlier injections at these sites.

The nominal high concentration injection formulation of four times the final low concentration formulation was developed using the following rationale:

- field measurements at the pilot test sites for ^{90}Sr peak concentrations
- estimated 50% decreasing in peak ^{90}Sr concentrations for sediment treated with the low concentration formulation (preliminary results from sequential Ca-citrate-PO4 injections, see Table 5.2 and 5.27 in Szecsody et al., 2007)

Laboratory studies are in progress using 100-N Area sediment treated with low concentration Ca-citrate-phosphate solution in January 2007, and then subjected to a range of high concentration solutions to determine the final composition of the high concentration Ca-citrate-phosphate solution. These studies are focused on initial short term aqueous Sr concentration increases during solution injection (< 24 h), subsequent Sr decrease over 30 day groundwater injection period, and the amount of apatite formation that occurs, for different formulations over the range of concentrations (PO4 from 20 mM to 60 mM) listed in Table 2-2. Some column experiments are also investigating the addition of fluoride to increase the apatite precipitation rate.

2.2 Injection Volumes and Rates

Field testing at the 100-N Area Apatite Treatability Test Site showed that the barrier can be subdivided into two portions based on the overall well capacity and contrast between the Hanford and Ringold hydraulic conductivities. The upstream portion, between injection wells 199-N-138 and 199-N-141 (see Figure 1-1), had relatively lower overall well specific capacity estimated from well development data, which was also reflected in observed well efficiencies during the low concentration injection operations, and a smaller contrast in hydraulic conductivity between the Hanford and Ringold Formation (based on injection tests at the Pilot #1 Test site [199-N-148]). The downstream portion, between injection wells 199-N-142 and 199-N-137, had overall higher well specific capacity and a larger hydraulic conductivity contrast between the Hanford and Ringold Formations (with the Hanford hydraulic conductivity values greater in the downstream portion than the upstream portion) based on the well development data and injection tests at the Pilot #2 Test site (199-N-147). The hydraulic conductivity contrast is important because it controls the radial extent of the injected reagent in the Hanford and Ringold Formation when using injection wells that are screened across both formations.

Based on the results of the Pilot #1 Test Site injections, an injection volume of ~120,000 gallons is required for the injection wells in the upstream portion of the barrier for sufficient overlapping coverage for the 30-ft injection well spacing. Since the contrast between the hydraulic conductivity between the Hanford and Ringold formations is low in this portion of the barrier, these wells should be injected during high river stage conditions to treat the uppermost portion of the unconfined aquifer while also providing adequate treatment in the Ringold treatment zone.

Results of the Pilot Test #2 site injection and other injection wells over the downstream portion of the barrier demonstrated the need for injection wells screened only in the Ringold portion of the treatment zone (see Section 2.5). Low river stage injections over this portion of the barrier that were targeted on the Ringold formation resulted in excessive regent loss to the Hanford formation, thus requiring very large injection volumes which were inefficient and in many cases may have still resulted in poor treatment coverage in the Ringold. Additionally, springs appeared at the shoreline near some of these wells during low river stage injections. Based on these observations, the spatial extent of treatment within the Ringold formation over this portion of the barrier is in question. To improve treatment efficiency, injection wells screened only across the contaminated upper portion of the Ringold formation are planned for installation along the downstream portion of the barrier in the winter or early spring of 2008. Because these new wells should act to improve the spatial extent of treatment within the Ringold formation, peak ^{90}Sr concentrations associated with high concentration treatment may be higher than would be observed if this interval was first more effectively treated with the low concentration solution. However, it should be noted that baseline ^{90}Sr concentration depth profiles (from characterization well 199-N-121, N-122, and N-123) indicate that significantly more contamination resides within the Hanford portion of the profile, so limited pre-treatment of the Ringold formation sediments should have less impact to the overall ^{90}Sr mobilization during subsequent treatments than a similar limitation in the Hanford formation would be.

With this new well configuration over the downstream portion of the test site, it is estimated that injection volumes of approximately 60,000 gallons will be required during high river stage conditions to treat the Hanford formation. An estimated 60,000 gallon injection volume will also be required for each of the new Ringold-only injection wells in the downstream portion of the barrier. The injections in the Ringold-only wells can be conducted during any river stage condition; however periods with steep increases or decreases in river stage should be avoided due to the large hydraulic gradients generated during these times directed inland or towards the river.

Injection rates during the high Ca-citrate-phosphate injections should be approximately 40 gpm based on the results of the low concentration pilot test injections at the treatability test site. Higher injection rates in the upstream portion of the barrier caused large head build up in the Pilot #1 injection well with seeps appearing at the surface. Higher proportional injection rates may be possible for the injections in the downstream portion of the barrier targeting the Hanford Formation at high river stage. Lower injection rates may be required for treatment of the Ringold-only injection wells based on the results of specific capacity tests in the completed wells.

One additional field-implementation issue that will be explored prior to the high Ca-citrate-phosphate injections is the impact of density effects from this greater density solution. The relative importance of density effects is determined by both the fluid density contrast (reagent vs. ambient groundwater) and the formation permeability. Analysis of the potential impacts of density effects on the reagent plume will be conducted using the fluid densities in the range proposed for the high Ca-citrate-phosphate solution along with estimates of the hydraulic conductivities of the Hanford and Ringold Formation in the upstream and downstream portions of the site, as determined based on results from previous pilot-scale field tests at N-137 and N-138.

2.3 Field emplacement Approach

The schedule for field testing is constrained by the need to take advantage of high river stage conditions for most of the barrier well injections. Field testing with the final high concentration Ca-citrate-phosphate solution will first be conducted during high river stage conditions at one (or both) of the pilot test sites. Monitoring of the test site will be conducted for approximately two weeks after the injection to assess the ^{90}Sr concentration increases using this formulation. Gross beta analysis will be used for estimating ^{90}Sr concentrations to provide for quicker turn-around of the analytical results. The decision on whether to proceed with injections in the remaining wells at the 100-N Area treatability test site will be made based on the analysis of these monitoring results from the pilot-scale testing.

If the decision is made to proceed with additional high concentration Ca-citrate-phosphate solution injections, the remaining wells will be injected in 2 or more stages. To prevent interference from adjacent injection wells, one half of the wells will be injected during a high river stage period and followed by a two-week reaction time period before injecting the remaining wells, also during high river stage conditions. The wells screened in only the Ringold Formation do not need to be injected during the high river stage period.

Multiple high-concentration injections, as shown in Table 2.2, may be required for each injection well to achieve the longevity required for long term treatment of ^{90}Sr. The design lifetime for the barrier is approximately 300 years to allow for radioactive decay of ^{90}Sr (i.e. ~10 half lives). The number of high-concentration injections is dependent on the final concentrations used and the efficiency of apatite formation and ^{90}Sr incorporation resulting from the field injection process. Laboratory experiments indicate 10% Sr substitution for Ca can be achieved, and given that assumption, a total of 90 mM PO4 needs to be precipitated as apatite to achieve 300 years of ^{90}Sr incorporation capacity.

Detailed field instructions will be prepared prior to the test that will include chemical mass, injection volumes, injection rates, sampling and analysis requirements, and the sequence of injections for the treatability test wells.

2.4 Barrier Performance Assessment

Barrier performance will be assessed through groundwater monitoring following the high concentration Ca-citrate-PO4 injections and from laboratory analysis of core samples collected from boreholes in the barrier. These analyses will assess the effectiveness in the reduction of aqueous ^{90}Sr concentrations in the barrier and the amount of apatite formation in the sediments in the barrier created by this process, which will be used to estimate the treatment longevity.

Performance monitoring will be conducted in the injection wells, compliance wells, pilot test monitoring wells, and aquifer tubes along the barrier. The performance monitoring will assess the reduction in ^{90}Sr concentrations and potential side effects from the injections by comparison with pre-injection values. Details on the analytes and sampling frequency are provided in Section 3.

Sediment samples will be collected from the barrier for apatite analysis in the laboratory from boreholes following the high-concentration injections. These samples will be collected at least 6 to 12 months following the injections to provide time for the amorphous Ca-phosphate phases to crystallize to hydroxyapatite. The sediment samples will be collected from the pilot test sites since these sites have the largest amount of monitoring data collected during the injections. Samples will be collected from multiple depths in both the Hanford and Ringold formations to assess the vertical variations in apatite formation. Laboratory experiments with the sediment will include determination of the amount of apatite formed, the amount of Sr and ^{90}Sr incorporated, and the treatment capacity through a combination of batch and column experiments. Sequential extractions of Sr and ^{90}Sr from the sediment cores will be used to determine the amount in the aqueous phase, adsorbed to the sediment by ion exchange, and incorporated into apatite. The treatment capacity will be used to calculate the barrier longevity. Sediment samples are also planned to be collected during drilling at the barrier in the winter of 2008 for the Ringold-only injection wells for use in preliminary laboratory analysis of the apatite formation from the low concentration injections, sequential Sr and ^{90}Sr extractions, and development/testing of analysis techniques.

2.5 Ringold Formation Injection Well Installation

Previous injection experience indicated that six (6) additional wells completed in the Ringold formation would be required. The project location map and site map with the locations of the new wells are provided as Figures 2-1 and 2-2. Table 2-5 lists the well identification numbers and the well names. The wells will be drilled as a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) activity and all waste generated during drilling will be managed as CERCLA investigation-derived waste.

Figure 2-3 presents the proposed well design and illustrates the construction details for the six new 100-NR-2 OU injection wells. The design of the wells must meet the minimum standards required in WAC 173-160 for construction of resource protection wells. All wells shall be 6-in. diameter and completed using Schedule 10 Type 304 or 316L stainless steel casing, with an end cap of the same material. The well screen will be 6-in., 0.020 in (20-slot), Type 304 or 316L stainless steel, V-wire, continuous wire-wrap screen and will be 7 ft in length. The filter pack will consist of 10-20 mesh Colorado silica sand. An environmentally compatible non-petroleum lubricant such as Jet-Lube Well Guard thread compound or equivalent may be used for lubricating the threads of the stainless steel while installing the casing. Table 2-6 provides a general summary of proposed well construction parameters for this well, including the estimated water level, well depth, screen interval, sand pack interval, bentonite seal intervals, and cement surface seal interval. Final well construction details will be confirmed by the BTR and/or FH field geologist/hydrogeologist prior to construction.

Final placement of the well screen will be at the direction of the BTR and/or FH field geologist/hydrogeologist. The well casing/screen string must be maintained in tension (i.e., the weight of the string is suspended from the top and not allowed to rest on the bottom of the borehole) to maintain straightness of the completed well. The filter pack will be placed from the bottom of the borehole to 1 ft above the top of screen. The filter pack will be composed of 10-20 mesh Colorado silica sand and will be settled by the dual surge block method and bailing technique per the well construction Statement of Work. This will be followed by a 3-ft layer of bentonite pellets placed immediately on top of the filter pack. A 3-ft layer of bentonite crumbles will follow the bentonite pellets. A cement grout seal will be placed immediately on top of the bentonite crumbles to ground surface. Accelerators may be used if excessive cement loss occurs.

Surface protection for each well will be a below-grade completion in accordance with WAC 173-160-420 (13) and GPR-EE-02-14.1, "Drilling, Remediating, and Decommissioning Resource Protection Wells and Geotechnical Soil Borings" with the following modifications:

- A metal flush-mount watertight monument shall be installed to enclose the top of each well below grade. This monument must include a removable cover equipped with a watertight gasket and securing bolts.
- The protective casing shall be a minimum of 2 in. larger in diameter than the permanent casing. This protective casing shall be made of Type 304 (or higher grade e.g., 304L, 316, or 316L) stainless steel. The protective casing shall rise to approximately 4 in. bgs in the groundwater monitoring wells. The protective casing on the groundwater monitoring wells will be capped with a watertight locking well cap.
- The permanent casing shall rise to approximately 8 in. bgs and shall be approximately 4 in. below the top of the protective casing in the groundwater monitoring wells. A concrete surface shall be installed to completely surround and secure the flush-mount monument of each well. The concrete surface must be sloped away from each well.
- A brass survey marker with the well identification number, well name, and completion date inscribed shall be installed on the north side of the sloped concrete surface that surrounds the flush-mount monument.

Final well development with a submersible pump will be performed on all wells after the wells are constructed. During final well development, water samples will be collected and analyzed for chemical parameters (pH, temperature, and specific conductivity) and turbidity using field instruments. A data logger will record pressure transducer water level measurements during drawdown and recovery phases of the final well development.
No sampling pumps will be installed in these wells.

3.0 Sampling and Analysis

Sampling and Analysis requirements for the high concentration apatite solution injections are organized into three periods with different analytes and frequencies. The three categories are: 1) initial pilot injection test(s), 2) barrier well injections, and 3) performance monitoring. The sampling and analysis for each of these periods is described below, and in Tables 3-1 and 3-2. Field test instructions will also be prepared prior to the injections that will include these sampling requirements along with a detailed set of operational parameters and procedures. Sampling will occur in a number of wells and aquifer tubes along the 100-N shoreline during all phases of treatment. The wells sampled during various phases are outlined in Table 3-3. Specifics on which wells will be sampled during pilot tests and barrier installation operations will be provided in activity specific field test instructions. All of the wells outlined in Table 3-3 will be sampled during pre-injection and performance monitoring.

3.1 Pilot Test Sampling and Analysis

Pre-Injection- 1 time the week before injection

- Analytes → major cations, anions, gross beta, Sr-90

Injection – Every 4 hours during injection in all monitoring wells, adjacent injection wells and nearby compliance wells. Sample the injection stream three times during injection (start/middle/end). Routinely measure injection stream field parameters (except DO, ~ once per hour). Sample aquifer tubes as necessary; to be determined in the field.

- Analytes → major cations, anions, citrate

Post-Injection – Daily sampling for 1 week, starting immediately after injection completion. Sample every other day during 2nd week. Then collect 1 sample per week for 4 weeks.

- Analytes → major cations, anions, citrate, gross beta

Other Monitoring – Pressures in injection well and all wells within 30 ft. Monitor all chemical flow rates at injection skid.

3.2 Barrier Installation Sampling and Analysis

Pre-Injection – 1 time the week before injection

- Analytes → major cations, anions, gross beta, Sr-90

Injection – Sample the injection stream three times during injection (start/middle/end). Routinely measure injection stream field parameters (except DO,~ once per hour). Collect sample near the end of injection from adjacent injection wells and available monitoring wells and compliance wells.

- Analytes → major cations, anions, citrate

Post-Injection – Daily sampling for 1 week, starting immediately after injection completion. Sample every other day during 2nd week. Then collect 1 sample per week for 4 weeks.

- Analytes → major cations, anions, citrate, gross beta

Other Monitoring – Pressures in injection well and all wells within 30 ft. Monitor all chemical flow rates at injection skid.

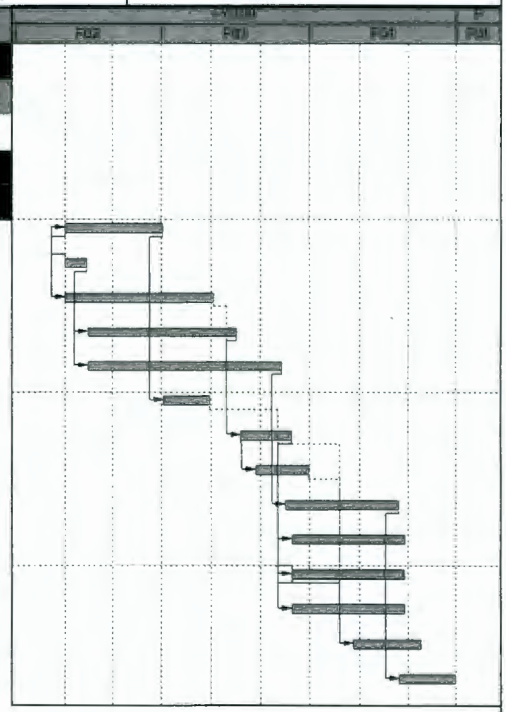
3.3 Performance Monitoring Sampling and Analysis

Bi-monthly monitoring of barrier wells, pilot-test monitoring wells, and compliance wells for 2 years following barrier emplacement. Analyze for all analytes. Continued monitoring needs determined after 2 years.

- Analytes → major cations, anions, gross beta, periodic sample splits for Sr-90 analyses

4.0 Schedule

RL-30 Groundwater Remediation Project BL -	100-NR-2			100-NR-2 BCR RL30-2008-019 Portrait
Activity ID	Activity Name	Start	Finish	
4.01.07.12.03.02		01-Feb-08	30-Sep-08	
100-NR-2 Barrier Maintenance		01-Feb-08	30-Sep-08	
V1BMNT	100-NR-2 Barrier Maintenance	01-Feb-08	30-Sep-08	
Barrier New Well Injections (no extractions)		[illegible]	[illegible]	
Barrier Emplacement		01-Feb-08	30-Sep-08	
G8M130	Pre-Injection Sampling for Test Well	01-Feb-08	01-Apr-08	
G8M110	Materials for 100-NR-2 Barrier Emplacement	01-Feb-08	14-Feb-08	
G8M140	System Modification/Batch Plant	01-Feb-08*	02-May-08	
G8M150	Pre-Plan for Test Well Injection	15-Feb-08*	16-May-08	
G8M160	Materials for 100-NR-2 Barrier Emplacement - Test Well Injection	15-Feb-08	13-Jun-08	
G8M170	Baseline Sampling for All Wells	02-Apr-08	30-Apr-08	
G8M180	Implement Test Well Injection	19-May-08*	19-Jun-08	
G8M190	Sampling Test Well Locations	29-May-08*	30-Jun-08	
G8M200	Materials for 100-NR-2 Barrier Emplacement - Injections	16-Jun-08	25-Aug-08	
G8M210	Chemicals for NR-2 Injections	20-Jun-08	29-Aug-08	
G8M220	Labor (Plant Forces) for NR-2 Injections	20-Jun-08	29-Aug-08	
G8M230	Subcontractor (Geoservices) Support for Injections	20-Jun-08	29-Aug-08	
G8M240	Continuous Sampling of Wells During Injections	28-Jul-08*	08-Sep-08	
G8M250	Materials for 100-NR-2 Barrier Emplacement - Post Injections	26-Aug-08	30-Sep-08	



Actual Work / Critical Remaining Work / Remaining Work ◆ / ◆ Milestone	Page 1 of 1	TASK filters: Ad Hoc 1, CIN = RL30-2008-019, X-Phase2 <> Old.

5.0 References

DOE-RL-2005-96 – Original TTP

Fluor/CH2M HILL. 2004. Evaluation of Strontium-90 Treatment Technologies for the 100-NR-2 Groundwater Operable Unit. Letter Report. (http://www.washingtonclosure.com/projects/endstate/risk_library.html#narea).

Szecsody JE, CA Burns, RC Moore, JS Fruchter, VR Vermeul, MD Williams, MJ Truex, DC Girvin, and JL Phillips. 2007. *Hanford 100N Area Apatite Emplacement: Laboratory Results of Ca-Citrate-PO4 Solution Injection and Sr-90 Immobilization in 100N Sediments*. PNNL-16891, Pacific Northwest National Laboratory, Richland, WA.

Table 2-1. Final Low Concentration Ca-citrate-phosphate Injection Formulation used in 2007

1.0 mM calcium chloride
2.5 mM trisodium citrate
10 mM phosphate (mixture of sodium phosphate, disodiumphosphate, and diammmonium phosphate, pH 7.8)
1.0 mM sodium bromide

Table 2-2. Nominal High Concentration Ca-citrate-phosphate Injection Formulation (4x low concentration injection solution) and chemical weights for 120,000 gal. injection volume.

Component	Nominal Concentration	Chemical Weights
calcium chloride	3.6 mM	399 lbs
trisodium citrate	9.0 mM	2645 lbs
phosphate (mixture of sodium phosphate, di-sodium phosphate, and di-ammonium phosphate for pH buffering)	40 mM	4596 lbs Na_2HPO_4 671 lbs NaH_2PO_4 264 lbs $(NH_4)_2HPO_4$
sodium bromide (tracer)	1.0 mM	103 lbs

Table 2-3. Baseline and Peak ^{90}Sr Concentrations at the Pilot #1 Test Site.

	Baseline		5/31/06 N-138 Inject Formula 1 (4,10,2.4) Post Inj Peak		6/8/2007 N-138 Inject Formula 3 (1,2.5,10) Post Inj Peak		Ratios			
Well	Sr pCi/L	Date	Sr pCi/L	Date	Sr pCi/L	Date	Formula 1 Peak / Mean Baseline	Formula 1 Peak / Baseline	Formula 3 Peak / Mean Baseline	Formula 3 Peak / Baseline
N-138	811	4/26/2006	801	6/2/2006	480	10/19/2007	1.10	0.99	0.66	0.59
N-123	1,040	4/12/2006	2,720	8/8/2006	1,480	9/7/2007[a]	3.75	2.62	2.04	1.42
APT-1	877	4/26/2006	3,400	10/9/2006	1,400	7/13/2007	4.68	3.88	1.93	1.60
P-1-R	570	4/26/2006	6,696	6/2/2006	2,500	7/8/2007	9.22	11.75	3.44	4.39
P-2-H	574	4/26/2006	3,735	6/2/2006	1,400	6/20/2007	5.14	6.51	1.93	2.44
P-3-R	314	4/26/2006	7,829	6/2/2006	1,600	10/19/2007	10.78	24.93	2.20	5.10
P-4-H	895	4/26/2006	7,365	6/2/2006	2,600	7/13/2007	10.14	8.23	3.58	2.91
P-5-R			11,000	6/28/2006	5,000	10/19/2007	15.15		6.88	
P-6-H	729	4/26/2006	9,482	6/16/2006	1,400	7/8/2007	13.06	13.01	1.93	1.92
P-7-R			12,000	7/17/2006	3,000	11/14/2007	16.52		4.13	
P-8-H			2,100	7/24/2006	1,100	7/8/2007	2.89		1.51	
Mean	726		6,103		1,996		8.40	8.99	2.75	2.54

Color Key

Sr-90

WSCF - Total beta radiostrontium

[a]Data flagged with Q qualifier

Table 2-4. Baseline and Peak ^{90}Sr Concentrations at the Pilot #2 Test Site.

	Baseline		9/27/06 N-137 Inject Formula 2 (2,5,2.4) Post Inj Peak		3/20/2007 N-137 Inject Formula 3 (1,2.5,10) Post Inj Peak		Ratios			
Well	Sr pCi/L	Date	Sr pCi/L	Date	Sr pCi/L	Date	Formula 2 Peak / Mean Baseline	Forumla 2 Peak / Baseline	Formula 3 Peak / Mean Baseline	Formula 3 Peak / Baseline
N-137	1,842	9/25/2006	4,002	10/27/2006	500	8/10/2007	3.25	2.17	0.41	0.27
N-147	1,220	9/18/2006	942	2/15/2007	3,000	3/23/2007	0.77	0.77	2.44	2.46
APT-5	932	9/25/2006	2,657	10/5/2006	1,100	10/19/2007	2.16	2.85	0.89	1.18
P2-1-R	1,857	9/27/2006	11,320	9/28/2006	6,800	4/6/2007[a]	9.20	6.10	5.53	3.66
P2-2-H	605	9/27/2006	1,804	9/28/2006			1.47	2.98		
P2-3-R	1,900	9/25/2006	8,800	10/19/2006	3,800	3/23/2007	7.16	4.63	3.09	2.00
P2-4-H	867	9/27/2006	1,768	9/28/2006			1.44	2.04		
P2-5-R	728	9/25/2006	4,574	10/13/2006	2,600	3/26/2007	3.72	6.28	2.11	3.57
P2-6-H			5,050	9/28/2006			4.11			
P2-7-R	1,295	9/25/2006	4,330	9/28/2006	2,200	8/23/2007	3.52	3.34	1.79	1.70
P2-8-H			3,535	9/28/2006			2.87			
P2-9-R	1,053	9/25/2006	6,721	10/13/2006	2,900	8/23/2007	5.46	6.38	2.36	2.75
Mean	1,230		4,625		2,863		3.76	3.76	2.33	2.20

Color Key
Sr-90
WSCF - Total beta radiostrontium
[a]Data Flagged with F Qualifier

Table 2-5. Well Identification Numbers and Well Names.

Well ID	Well Name
C6177	199-N-159
C6178	199-N-160
C6179	199-N-161
C6180	199-N-162
C6181	199-N-163
C6182	199-N-164

Table 1-6. Proposed Well Construction for NR-2 Operable Unit Wells.

Estimated Depth to Water (ft)[1]	Planned Total Depth (ft)[2]	Screen and Casing Diameter (in.)	Screen Slot Size	Screen Length[2] (ft)/ Interval (ft bgs)	Filter Pack Mesh/ Interval (ft bgs)	Bentonite Seal Interval (ft bgs)	Bentonite crumbles Interval (ft bgs)	Cement Seal Interval (ft bgs)
8-10	25	6	20	7/ 24'-17	10-20/ TD – 16	16-13	13-10	10- 0

Notes:

[1] Estimated depth to water taken from previously drilled wells and depends upon river stage.

[2] Information presented on table are estimates. Final position of well screen, filter pack interval, and bentonite seal intervals will be determined based upon actual borehole conditions

bgs = below ground surface

TD = total depth

Table 3-1. Apatite Pilot Test Sampling Requirements (Primary analytes shaded)

Parameter	Media/ Matrix	Sampling Frequency	Volume / Container	Preservation	Hold Time
Major Cations/metals: Al, As, B, Ba, Bi, Ca, Co, Fe, K, Mg, Mn, Ni, Zn, Zr, P, Sr, Na, Si, S, Sb	Water	See sections 3.1, 3.2, and 3.3 for pilot test, barrier installation, and performance monitoring requirements, respectively	20 ml plastic vial	Filtered (0.45 µm), HNO_3 to pH <2	60 DAYS
Anions: Cl^-, Br^-, SO_4^{2-}, PO_4^{3-}, NO_2^-, NO_3^-	Water	See sections 3.1, 3.2, and 3.3 for pilot test, barrier installation, and performance monitoring requirements, respectively	20 ml plastic vial	Cool 4⁰C	45 DAYS
Small Molecular Weight Organic Acids: Citrate, Formate	Water	See sections 3.1, 3.2, and 3.3 for pilot test, barrier installation, and performance monitoring requirements, respectively	20 ml plastic via	Filtered (0.22 µm), Sodium Azide, or freeze	20 Days
Sr-90 – PNNL Lab	Water	See sections 3.1, 3.2, and 3.3 for pilot test, barrier installation, and performance monitoring requirements, respectively	1 L plastic bottle	Filtered (0.45 µm), HNO_3 TO PH <2	60 Days
Gross Beta	Water	See sections 3.1, 3.2, and 3.3 for pilot test, barrier installation, and performance monitoring requirements, respectively	1 L plastic bottle	Filtered (0.45 µm), HNO_3 TO PH <2	60 Days
pH	Water	With every water sample, and as needed	Field Measurement	n/a	n/a
Specific Conductance	Water	With every water sample, and as needed	Field Measurement	n/a	n/a
Dissolved oxygen[(a)]	Water	With every water sample, and as needed	Field Measurement	n/a	n/a
Oxidation-Reduction Potential	Water	With every water sample, and as needed	Field Measurement	n/a	n/a
Temperature	Water	With every water sample, and as needed	Field Measurement	n/a	n/a
(a) Dissolved oxygen measured in monitoring well samples only. Not required for injection solution.					

Table 3-2. Analytical Requirements (Primary analytes shaded)

Parameter	Analysis Method	Detection Limit or (Range)	Typical Precision/Accuracy	QC Requirements
Major Cations / metals: Ca, Fe, K, Mg, P, Na, Si, S Al, B, Ba, Bi, Ni, Zn, Zr, Sr	ICP-OES, EPA Method 6010B or equivalent	1 mg/L 0.1 mg/L	±10%	Daily calibration; blanks and duplicates and matrix spikes at 10% level per batch of 20.
Anions: Cl^-, Br^-, SO_4^{2-}, PO_4^{3-}, NO_2^-, NO_3^-	Ion Chromatography, EPA Method 300.0A.or equivalent	1 mg/L	±15%	Daily Calibration; Blanks And Duplicates At 10% Level Per Batch Of 20.
Small molecular weight organic acids: Citrate and formate	Ion Chromatography, AGG-IC-001 (Based on EPA Method 300.0A.)	1 mg/L	±15%	Daily Calibration; Blanks And Duplicates At 10% Level Per Batch Of 20.
Sr-90 – PNNL Lab	separation followed by gross alpha/beta via liquid scintillation	75 pCi/L	±15%	Daily Calibration; Blanks And Duplicates At 10% Level Per Batch Of 20.
Gross Beta	Liquid Scintillation	5 pCi/L	±20%	Daily Calibration
pH	pH electrode	(2 to 12 units)	± 0.2 pH unit	User calibrate per manufacturer directions
Specific conductance	Electrode	(0 to 100 mS/cm)	± 1% of reading	User calibrate per manufacturer directions
Dissolved oxygen	Membrane electrode	(0 to 20 mg/L)	± 0.2 mg/L	User calibrate per manufacturer directions
Oxidation-Reduction Potential	Electrode	(-999 to 999 mV)	± 20 mV	User calibrate per manufacturer directions
Temperature	Thermocouple	(-5 to 50 °C)	± 0.2°C	Factory calibration

Table 3-3 Wells sampled during pre-injection, injection and performance monitoring. Field test instructions will specify monitoring requirements during injection operations.

Barrier Wells	Compliance Wells	Other Monitoring Wells	Aquifer Tubes
N-136	N-122	N-126 (P1-1R)	APT1 (C5269)
N-137	N-123	N-127 (P1-2H)	APT5 (C5386)
N-138	N-146	N-128 (P1-3R)	Array 2A (C5256)
N-139	N-147	N-129 (P1-4H)	Array 3A (C5257)
N-140		N-130 (P1-5R)	Array 4A (C5258)
N-141		N-131 (P1-6H)	Array 6A (C5259)
N-142		N-132 (P1-7R)	Array 7A (C5260)
N-143		N-133 (P1-8H)	NVP2-116.0 (C5251)
N-144		N-148 (P2-1R)	
N-145		N-149 (P2-2H)	
		N-150 (P2-4H)	
		N-151 (P2-3R)	
		N-152 (P2-9R)	
		N-153 (P2-8H)	
		N-154 (P2-7R)	
		N-155 (P2-6H)	
		N-156 (P2-5R)	

Figure 1-1. 100-N Area Apatite Treatability Test Plan Site Map

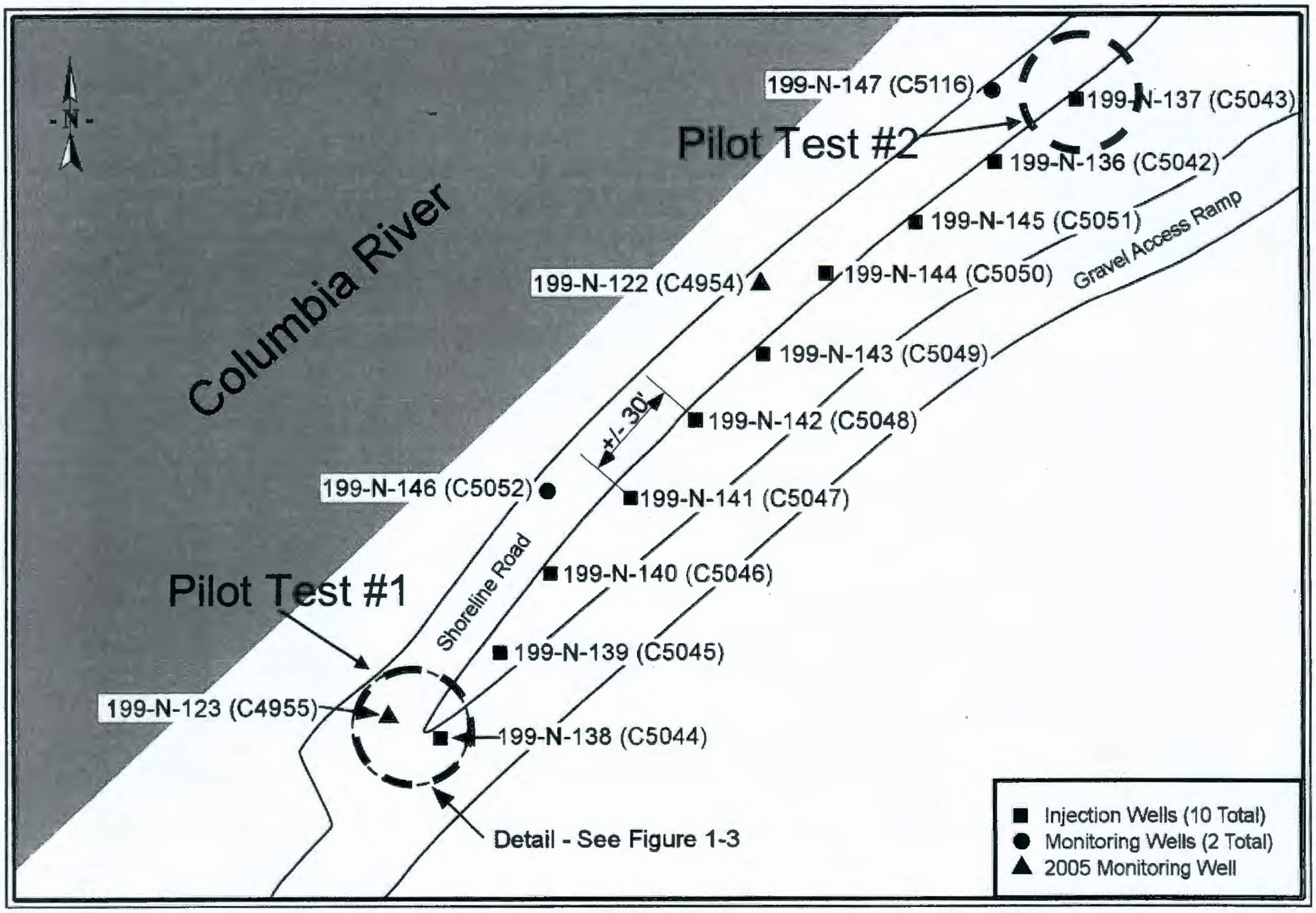
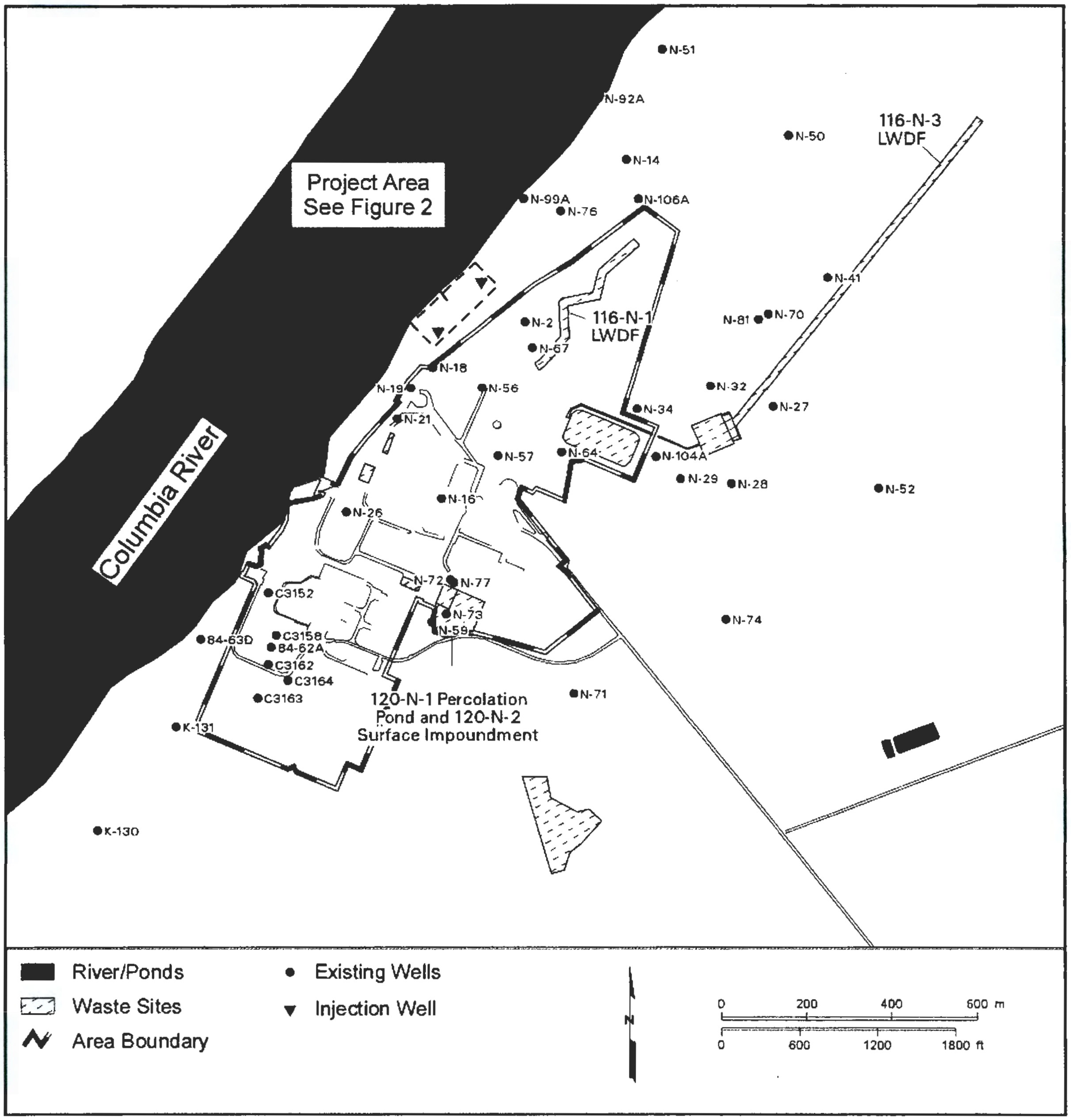


Figure 2-1. Location Map for the 100-NR-2 Operable Unit.



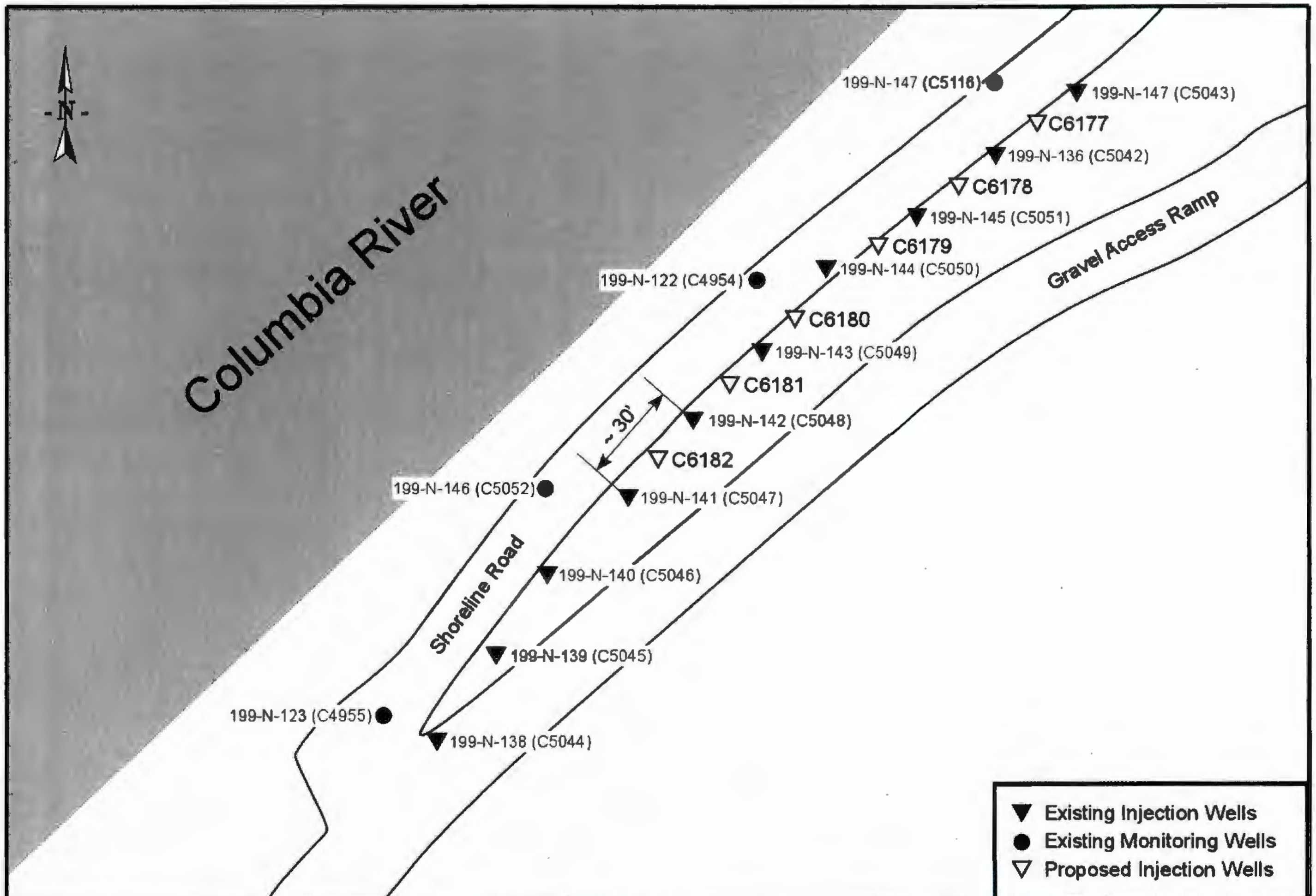
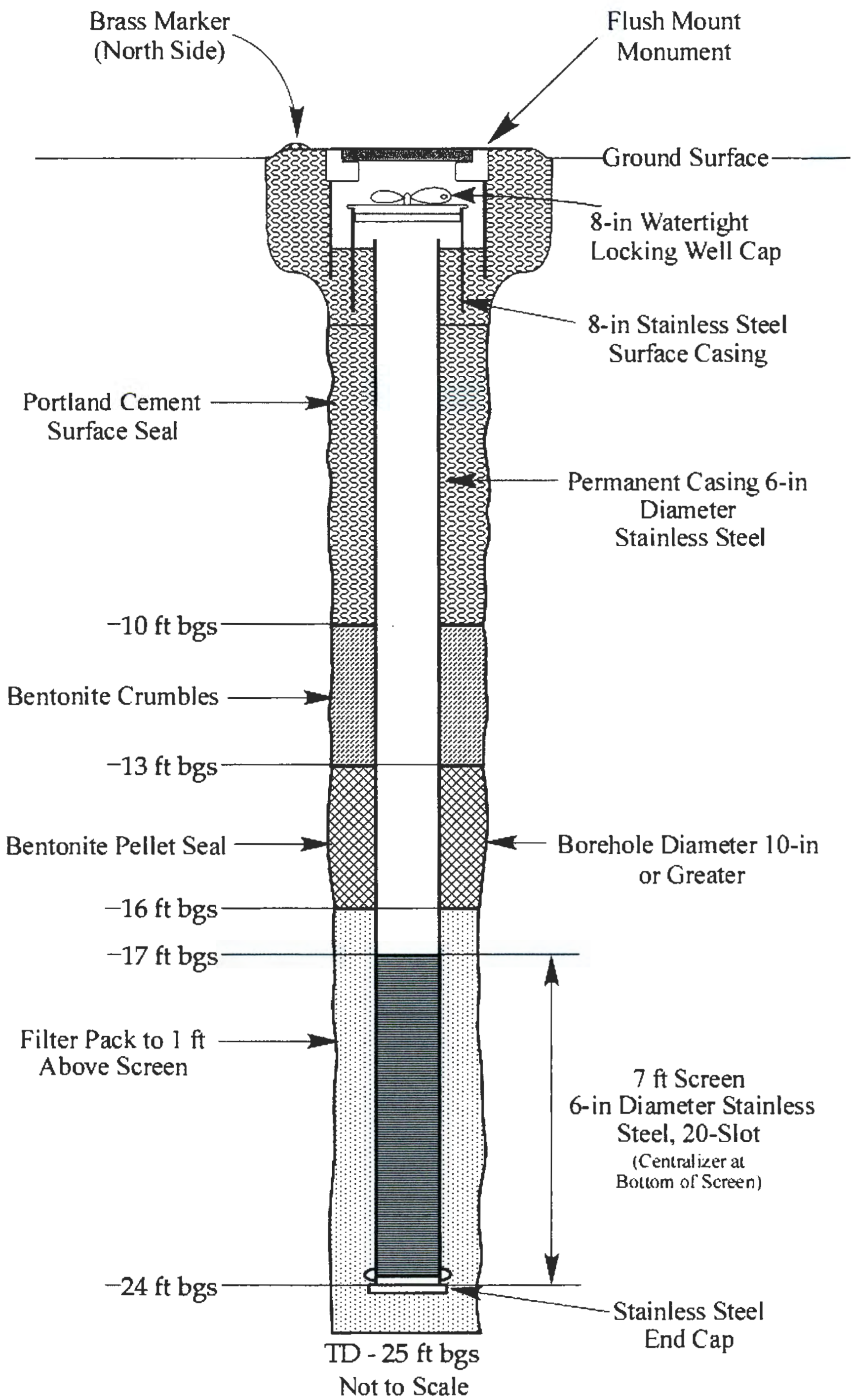


Figure 2-2. Well Locations.

Figure 2-3. Well Completion Design for 100-NR-2 Injection Wells.



(2)

Field Test Instruction

100-NR-2 Apatite PRB Treatability Test for Sequestration of Sr-90

High Concentration Pilot-scale Injection Testing

Purpose

The objective of this field test instruction is to provide technical guidance for conducting high concentration pilot-scale field tests in support of the 100-NR-2 Treatability Test Plan Addendum, DOE/RL-2005-96, Rev 0, hereafter referred to as the TTP. The TTP supports the Federal Facility Agreement Consent Order, Milestone M-16-06-01 ("Complete Construction of a Permeable Reactive Barrier at 100-N"). These injections will occur at both the upstream (199-N-138) and downstream pilot test site locations (199-N-137 and 199-N-159). Results from these injection testing activities will be used to develop an injection design for high concentration chemical treatment of the 300-ft apatite permeable reactive barrier.

Summary

Field testing at the 100-N Area Apatite Treatability Test Site showed that the barrier can be categorized by two general hydrologic conceptual models based on the overall well capacity and contrast between the Hanford and Ringold hydraulic conductivities. The upstream portion, between injection wells 199-N-138 and 199-N-141 (Figure 1), was characterized by relatively low overall well specific capacity estimated from well development data and a lower contrast in hydraulic conductivity between the Hanford and Ringold. The downstream portion, between injection wells 199-N-142 and 199-N-137, was characterized by generally higher well specific capacity and a larger hydraulic conductivity contrast between the Hanford and Ringold Formations (with the Hanford hydraulic conductivity values greater in the downstream portion than the upstream portion). The implication of this is that injections in the downstream portion of the barrier have to be done in two phases- one to treat the Ringold Formation, and one to treat the Hanford formation. On the upstream portion, adequate treatment can be achieved by injecting in a single well screened across both formations. For this reason, the pilot test outlined in this field test instruction will be conducted as three distinct injections. Treatment of the Hanford and Ringold formations will occur during a single injection operation at the upstream pilot test site (199-N-138). The Ringold Formation will be treated concurrently through a separate injection at a newly installed Ringold-only injection well at the downstream pilot test site location (199-N-159). At the conclusion of these two injections, treatment of the Hanford formation will occur at the downstream pilot test site location using well 199-N-137. The remainder of this test instruction provides details for conducting these injections.

Injection Design

The following description provides details on the injection design for conducting the pilot-scale apatite injection testing for the high concentration formulation. It should be emphasized that these pilot-scale tests are a scoping effort that will be used to establish the protocol for future barrier injections. Accordingly, conditions for the test may be changed or adjusted as the pilot tests proceeds, depending on input from on-going laboratory work and modeling, and the judgment of the PNNL and FH technical project leads. Thus detailed instructions for conducting the pilot scale injection tests will not be available beforehand, nor should they be expected.

The pilot test sites both consist of a central 6-in diameter injection well surrounded by small diameter monitoring wells as well as downgradient aquifer tubes to provide additional monitoring points (Figure 1). Water level transducers and sampling pumps for collection of groundwater samples will be placed in the monitoring wells to monitor water level during injection and to collect water samples (used to determine when the apatite solution arrives at the monitoring wells). Based on injection well hydraulic performance observed during previous barrier treatment operations, an injection rate of 40 gpm will be specified during treatment of the upstream portion of the barrier and during Hanford formation targeted treatment of the downstream portion of the barrier. However, injection rates may need to be reduced in the newly installed Ringold-only injection wells, depending on the hydraulic performance of these wells.

Based on chemical arrival responses observed during previous barrier treatment operations, an injection volume of 120,000 gallons of apatite forming chemical solution will be specified, which should provide sufficient volume to meet injection design criteria at the targeted radial extent of 20 ft. Over the upstream portion of the barrier, a single 120,000 gallon injection will be conducted to treat the Hanford and Ringold formations simultaneously. Over the downstream portion of the barrier, two separate injection operations of approximately 60,000 gallons each will be required for targeted treatment of the Hanford and Ringold formations. Both the upstream portion of the barrier and the Hanford interval over the downstream portion of the barrier needs to be treated during high Columbia River stage conditions to treat as high in the Hanford formation profile as possible. Treatment of the Ringold-only injection wells can be conducted during any river stage condition; however periods with steep increases or decreases in river stage should be avoided due to the large hydraulic gradients generated during these times directed inland or towards the river.

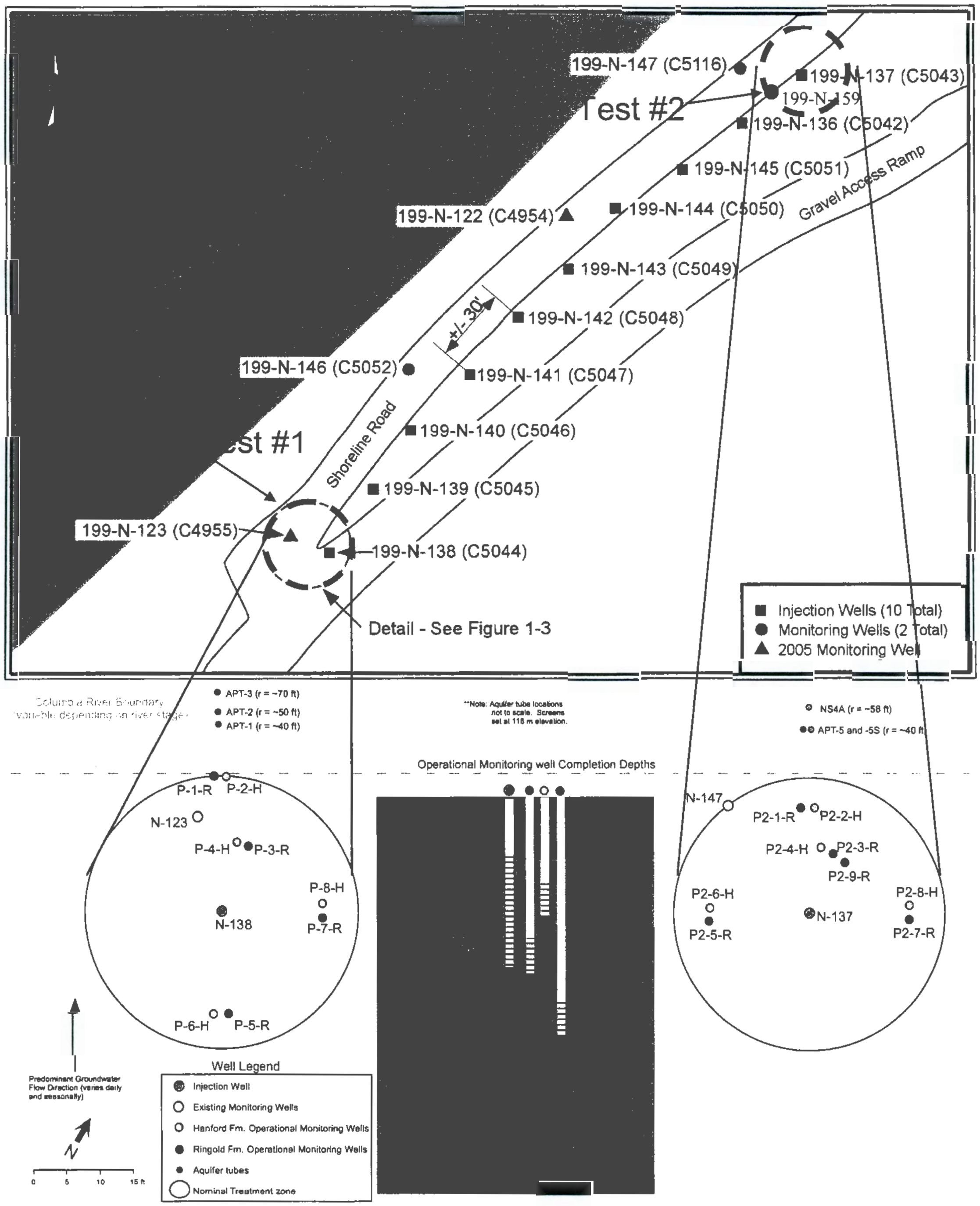


Figure 1. Apatite PRB Treatability Test Well Location Map.

Chemical Formulation

Solution Composition
Following is the recipe for the high concentration apatite injection solution:

9.0 mM trisodium citrate [HOC(COONa)(CH2COONa)2*2H2O] FW 294.1 g/mol
- also called sodium citrate dihydrate, ACS registry **6132-04-3**
- granular is more soluble than powdered
- reagent grade (quality) or equivalent for the citrate: USP/FCC
  (lower grades contain up to 5 ppm heavy metals)

3.6 mM calcium chloride, [$CaCl_2$], FW 110.98 g/mol
- reagent grade (quality) or equivalent: certified ACS, ACS registry **10043-52-4**
  (lower grades can contain 20 ppm lead)

32.4 mM disodium hydrogenphosphate [Na_2HPO_4], FW 141.96 g/mol
- also called disodium phosphate, anhydrous
- reagent grade (quality) or equivalent: certified ACS, ACS registry **7558-79-4**
  (lower grades can contain extra NaOH, which is only a small problem, changes pH and ionic strength)

5.6 mM sodium dihydrogenphosphate [NaH_2PO_4], FW 119.98 g/mol
- also called monosodium phosphate, anhydrous
- reagent grade or equivalent: certified ACS grade, ACS registry **7558-80-7**
  (lower grades can contain 8 ppm arsenic and 10 ppm heavy metals)

2.0 mM diammonium hydrogenphosphate [$(NH_4)_2HPO_4$], FW 132.1 g/mol
- also called diammonium phosphate
- granular is more soluble than powdered
- reagent grade (quality) or equivalent: certified ACS, ACS registry **7783-28-0**

1.0 mM sodium bromide [NaBr], FW 102.90 g/mol
- reagent grade (quality) or equivalent: certified ACS, ACS registry **7647-15-6**

At these molar concentrations, a 120,000 gal injection volume will consist of the following dry chemical weights:

Mix #1: (Ca/citrate in deionized water, minimum solution volume of 10,000 gallons)
2645 lbs of trisodium citrate
399 lbs of calcium chloride
Mix #2: (PO4/Br in deionized water, minimum solution volume of 10,000 gallons)
4596 lbs of Disodium hydrogenphosphate
671 lbs of Sodium dihydrogenphosphate
264 lbs of Diammonium hydrogenphosphate
103 lbs of Sodium bromide

Because we are relying on microbial degradation of the citrate for apatite formation to occur, make up water for these solutions should not contain residual chlorine or any other form of bactericide. Make up water will be from the Columbia River immediately upstream of the injection site.

Solution Stability Concerns

Solubility limits for each of the apatite solution components, based on laboratory evaluation and relevant solubility limits reported in the literature, are provided in Table 1. Minimum delivery volumes indicated above (10,000 gal) shall be maintained to avoid chemical precipitation during transport.

Mix #1 (trisodium citrate and calcium chloride) should be mixed up by completely dissolving the trisodium citrate first, then adding the calcium chloride. When making up Mix #2, disodium hydrogenphosphate, (FW 141.96) is soluble in 8 parts of water and hence should be added first in, at a minimum, 8 times the volume of water to mass of chemical used. Next diammonium hydrogenphosphate should be added (solubility 1g/1.7 mL water) followed by sodium bromide (1g/1.1 mL water) and finally sodium dihydrogenphosphate which is freely soluble. The criteria provided in Table 1 will result in a solution that is stable at both room temperature and 5°C for > 3 days (this solution is thermodynamically stable and should not form a precipitate).

Table 1. Solution Stability Criteria.

Apatite Solution Components	Max Conc. (mM)
trisodium citrate	120
calcium chloride	48
disodium hydrogenphosphate	526.5
sodium dihydrogenphosphate	91
diammonium hydrogenphosphate	32.5
sodium bromide	65

Another stability concern is the potential for biodegradation of the citrate solution during transport. Potential mitigation approaches include, but are not limited to, steam cleaning or some other sterilization approach of dissolving/mixing equipment, using distilled make-up water, filter sterilization (0.2 micron) of make-up water, UV sterilization of make-up water, and chilling the solution for transport. The approach should follow industry standards for citrate solution transport that assures the citrate solution will not be appreciably degraded during transport or during the 48 to 60 hrs it takes to inject the solution.

Order of Treatment

The first two phases of this pilot test will occur simultaneously. These phases will include treatment at the upstream pilot test site and treatment of the Ringold Formation at the downstream pilot test site. There should be no hydraulic interferences between the two injections as the injection wells are 300 foot apart. The third phase of the test will be treatment of the Hanford formation at pilot site 2.

Materials and Equipment.

The minimum requirements for equipment and materials as specified in the Engineering Design Criteria together with additional sampling related materials and equipment are listed as follows.

- Generator
- Pumps, fire hose, flow meters and shutoff/control valves
- Makeup water source (river water)
- Apatite solution delivered to site in tanker trucks. Exact weights and chemical formulation will be provided to the vendor in a supplemental SOW.
- 600-gallon purge water containment tank
- Coolers and/or refrigerator for sample storage
- Sample trailer and monitoring equipment (QED flow through cell with pH, ORP, DO, T, EC), HACH kit for field screening phosphate measurement.
- Submersible or peristaltic sample pumps and 1000 ft of ¼ or 1/8 inch poly tubing
- Pressure transducers
- Personnel safety equipment and materials (gloves, eye wear, eye wash, etc.)

Test Monitoring

- The chemical delivery system will be monitored on a regular basis to maintain appropriate flow rates. Measurements of system readings (flow, pressure) will be made on an hourly basis (nominally). Additionally, measurements of temperature, specific conductance (EC), pH and oxidation reduction potential (ORP) of the injection stream will be measured and recorded on an hourly basis.
- Pressure will be monitored in the injection well and as many surrounding monitoring wells as possible. Routine visual inspection of surface seal will be performed during the injection.
- An inflatable packer will be used to allow for an acceptable injection rate
- Primary monitoring of apatite solution arrival/distribution during the injection test will be through the collection of aqueous samples
    - Samples will be collected from the injection stream every four hours
        - Field parameters (EC, T, pH, ORP, DO) will be measured for each sample
        - Aqueous samples will be collected and submitted for IC (anions) and ICP-OES (major cations), and citrate (PNNL lab) analysis
        - At least 1 set of tanker samples will be submitted for IC, ICP-OES, and citrate analysis for each individual tanker truck.
    - Samples will be collected from monitoring wells and aquifer tubes on a routine basis, beginning with a baseline sampling event prior to chemical

injection. The sampling frequency will vary depending on solution arrival dynamics, and will be adjusted during the test. For example, the wells closer to the injection well will be monitored more frequently initially, then less frequently once the EC indicates complete arrival of the injection solution. Nominally, a sampling frequency of once every four hours will be used until sufficient evidence for a change is obtained.

- For each sample, field parameters will be recorded for each sample (EC, T, pH, ORP, DO).
- Aqueous samples will be collected and submitted for IC (anions) and ICP-OES (major cations), and citrate (PNNL lab) analysis

- Primary performance monitoring will be through the collection of aqueous samples (Fluor Hanford responsibility).
  - o Field parameters (EC, T, pH, ORP, DO) will be measured for each sample collected.
  - o Aqueous samples will be submitted for the following analysis:
    - IC – anions and small molecular weight organic acids
    - ICP-OES – major cations
    - Gross Beta

Sampling and Analysis

Water will be pumped from the wells at a nominal rate of 1 gpm. Based on an assumption that 50 ft of sample tubing running from each well to a sampling manifold located in a sample trailer, approximately 2 minutes of purge time will be sufficient time for parameter stabilization prior to each sample collection event. This is consistent with previous pilot tests.

Once field parameters (pH, EC, DO , ORP, and T) have stabilized, indicating that representative groundwater samples can be collected, parameter values will be recorded manually on data sheets which will be copied for distribution. The original data sheets will be pasted into a bound (FH controlled) field notebook at the earliest convenience following the test. Calibration of field probes will occur once (immediately prior to the test) and will follow the manufacturer's instructions using standard calibration solutions provided by the vendor or as prepared under standard laboratory practice in the GRP 200 Area Field lab or PNNL laboratories.

The sample stream will be discharged to a purgewater containment tank(s). Routine purgewater collection and disposal will be required throughout these planned field activities.

Sample collection and analysis for the planned apatite injections will be performed according to the guidelines set forth in Tables 1 through 3. It should be noted that the operational and performance monitoring approach and sampling requirements described in this section may be altered based on the results of ongoing bench-scale studies and observations made during other injection operations. This test instruction applies treatment and the sampling immediately following treatment. For long-term monitoring instructions, refer to the addendum to the Strontium-90 Treatability Test Plan for 100-NR-2 Groundwater Operable Unit (DOE-RL-2005-96).

Pumping Rates and Pressures

The Apatite solution will be injected until the total design volume (not to exceed 120,000 gallons) has been injected into the test well. Thus, it is anticipated that ~50 hours of continuous pumping will be needed to inject the entire volume. Actual volumes and test duration shall be at the discretion of the PNNL field task lead in accordance with roles and responsibilities specified in Reference 1.

Data Management

All operational, monitoring, and field parameter probe calibration data will be recorded manually on data sheets which will be copied for distribution to FH and PNNL personnel. The original data sheets will be pasted into a bound (FH controlled) field notebook at the earliest convenience following the test. All samples submitted to analytical laboratories will be accompanied by an appropriately filled out chain of custody form.

Health and Safety

All work performed on site will be conducted in accordance with the apatite treatability study Health and Safety plan and any applicable task specific JSA (FH developed documents). Gloves and eye protection are needed while handling chemicals and during sample collection. A portable eye wash station will be present during the sample collection and tracer mixing process. Spillage and drops of sample media will be absorbed on tissue and kept in a separate bag for RCT survey/release at the end of the test.

Table 1. Apatite Pilot Test Sampling Requirements (Primary analytes shaded)

Parameter	Media/ Matrix	Sampling Frequency	Volume/ Container	Preservation	Holding Time
Major Cations/metals: Al, As, B, Ba, Bi, Ca, Co, Fe, K, Mg, Mn, Ni, Zn, Zr, P, Sr, Na, Si, S, Sb	Water	See Table 2	20 ml plastic vial	Filtered (0.45 µm), HNO_3 to pH <2	60 DAYS
Anions: Cl^-, Br^-, SO_4^{2-}, PO_4^{3-}, NO_2^-, NO_3^-	Water	See Table 2	20 ml plastic vial	Cool 4°C	45 DAYS
Small Molecular Weight Organic Acids: Citrate, Formate	Water	See Table 2	20 ml plastic via	Filtered (0.22 µm), Sodium Azide, or freeze	20 Days
Sr-90 – PNNL Lab	Water	See Table 2	1 L plastic bottle	Filtered (0.45 µm), HNO_3 TO PH <2	60 Days
Gross Beta	Water	See Table 2	1 L plastic bottle	Filtered (0.45 µm), HNO_3 TO PH <2	60 Days
Field Parameters (pH, Specific Conductance, Dissolved Oxygen [(a)], Oxidation-Reduction Potential, Temperature)	Water	With every water sample, and as deemed necessary during injection. See Table 2	Field Measurement	None	n/a

(a) Dissolved oxygen measured in monitoring wells only. Not required for measurements of injection stream.

Table 2. Sampling Locations and Frequencies

Sample Purpose	Sampling Locations	Sampling Frequency	Analytes	Responsible Contractor
Baseline Monitoring	Injection Wells, monitoring wells, compliance wells	1 time prior to treatment	Cations, Anions, gross beta, Sr-90, field parameters	FH
Injection Monitoring	Injection stream, monitoring wells, adjacent injection wells, compliance wells, aquifer tubes	Nominally once every four hours. Aquifer tubes only near end of injection	Cations, Anions, organic acids, field parameters	PNNL
Performance Monitoring	Injection Wells, monitoring wells, compliance wells	Daily for 1st week, every other day for 2nd week, 1x per week for one month.	Cations, Anions, organic acids, gross beta, field parameters, Sr-90 splits immediately after and one month after treatment	FH

Injection Wells: N-137 and N-138
Injection Stream: sampled at injection skid
Monitoring Wells: P-1-R, P-2-H, P-3-R, P-4-H, P-5-R, P-6-H, P-7-R, P-8-H, P2-1-R, P2-2-H, P2-3-R, P2-4-H, P2-5-R, P2-6-H, P2-7-R, P2-8-H, P2-9-R
Adjacent Injection Wells: N-136 and N-139
Compliance Wells: N-123 and N-147
Aquifer Tubes: APT-1, APT-5

Table 3. Analytical Requirements (Primary analytes shaded)

Parameter	Analysis Method	Detection Limit or (Range)	Typical Precision/Accuracy	QC Requirements
Major Cations / metals: [redacted], Fe, K, Mg, P, [redacted], Si, S,Al, B, Ba, Bi, Ni, Zn, Zr, Sr	ICP-OES, EPA Method 6010B or equivalent	1 mg/L 0.1 mg/L	±10%	Daily calibration; blanks and duplicates and matrix spikes at 10% level per batch of 20.
Anions: Cl^-, Br^- , SO_4^{2-} , PO_4^{3-}, NO_2^-, NO_3^-	Ion Chromatography, EPA Method 300.0A.or equivalent	1 mg/L	±15%	Daily Calibration; Blanks And Duplicates At 10% Level Per Batch Of 20.
Small molecular weight organic acids: Citrate and formate	Ion Chromatography, AGG-IC-001 (Based on EPA Method 300.0A.)	1 mg/L	±15%	Daily Calibration; Blanks And Duplicates At 10% Level Per Batch Of 20.
Sr-90 – PNNL Lab	separation followed by gross alpha/beta via liquid scintillation	75 pCi/L	±15%	Daily Calibration; Blanks And Duplicates At 10% Level Per Batch Of 20.
Gross Beta	Liquid Scintillation	5 pCi/L	±20%	Daily Calibration
pH	pH electrode	(2 to 12 units)	± 0.2 pH unit	User calibrate, follow manufacturer recommendations
Specific conductance	Electrode	(0 to 100 mS/cm)	± 1% of reading	User calibrate, follow manufacturer recommendations
Dissolved oxygen	Membrane electrode	(0 to 20 mg/L)	± 0.2 mg/L	User calibrate, follow manufacturer recommendations
Oxidation-Reduction Potential	Electrode	(-999 to 999 mV)	±20 mV	User calibrate, follow manufacturer recommendations
Temperature	Thermocouple	(-5 to 50 °C)	± 0.2°C	Factory calibration

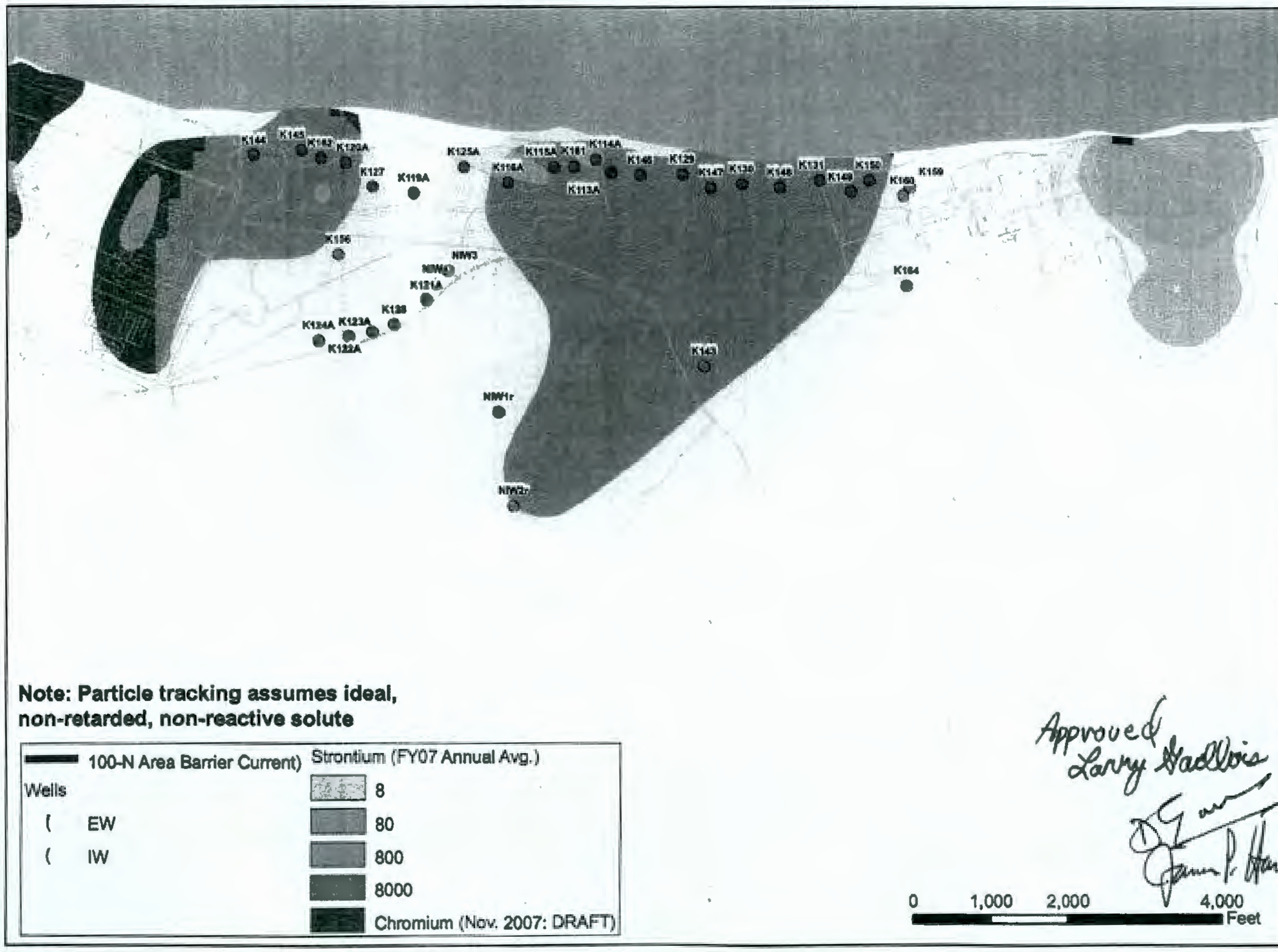
Summary of Test Instructions

- Collect baseline samples prior to chemical injection
    - Field parameters and performance monitoring samples
- Begin chemical injection
    - 1 gal/min each chemical
    - 38 gal/min water
    - 40 gal/min total solution injection rate
- Measure field parameters in available site monitoring wells
- Measure field parameters on skid every hour
- Collect aqueous samples for analysis with each field parameter measurement
- Conduct performance monitoring post injection (FH samplers)

Attachment 3

DRAFT for Preliminary Comparative Purposes Only
April 15th, 2008

Capture Extent: Scenario-3



Approved [signature] 4-15-08

[signatures] 4-15-08

Attachment 4

(4)

Environmental Protection Mission Completion Project
May 8, 2008

Orphan Sites Evaluations

- 100-IU-2 and 100-IU-6 summary report being drafted for RL/regulator review scheduled for late May.
- Continuing N-Area historical review and walkdown.
- Reviewed H-Area OSE results with Ecology on May 5th. A field trip to visit a select group of sites will be scheduled for later this month.
- Collection of orthophotography and LiDAR data in support of inter-areas evaluation was completed on April 28th. The data is currently being processed and anticipated to be available in late-Summer.

Long-Term Stewardship

- Continue preparing the draft 100-BC Area Remedial Action Report.

River Corridor Baseline Risk Assessment

- Continuing preparation of Draft B ecological risk and human health risk volumes.

Columbia River Component Investigation

- Continuing development of work plan/sampling and analysis plan to support beginning sample collection in Fall 2008. Draft A review by Tri-Parties and stakeholders anticipated to begin June 10.
- Working on facility availability and logistics for offsite comment resolution working sessions the week of August 11.

Source/GW Systematic Planning

- Developing D/H Area source data gaps and proposed needs to support input to draft work plan sections in June.
- Gathering background information to support systematic planning process for K, B/C, F, and 300 Areas.

Document Review Look-Ahead

Document	Regulator Review Start	Duration
100-IU-2 and 100-IU-6 Areas Orphan Sites Evaluation Report	May 27, 2008	45 days
Columbia River Component Work Plan	June 10, 2008	60 days
RCBRA Draft B	September 16, 2008	45 days
Integrated RI/FS Work Plan – D/H Area Addendum	December 2008	60 days

Attachment 5

MAY 08

Updated at ~~November~~ River Corridor Unit Managers Meeting

Issues and Actions	Action Due Date	Status May 2008
100/300 Crosscutting		
Issue 1. Additional risk assessment information is needed to evaluate the interim actions prescribed within the records of decisions and to develop final cleanup decisions.		
Action 1-1. Submit Draft A of the River Corridor Baseline Risk Assessment Report.	Jun-07	**Complete**
Action 1-2. Submit draft sampling and analysis plan for Inter-Areas Shoreline Assessment.	Aug-06	**Complete**
New Action 1-3 *. Reassess and resubmit to EPA the protectiveness determinations for operable units 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1. 100-FR-2. 100-HR-1. 100-HR-2, 100-HR-3, 100-IU-2, 100-IU-6, 100-KR-1, 100-KR-2, 100-KR-4, 100-NR-1, 300-FF-1, and 300-FF-2 using new information from the River Corridor Baseline Risk Assessment and submit to EPA an Addendum with, as appropriate, updated Protectiveness Determinations, Issues, and Follow-up Actions.*	Feb-08	This was to be coordinated with the finalization of the River Corridor Baseline Risk Assessment. The RCBRA should be complete April, 2009. RL anticipates completing this action within 90 days of Ecology and EPA acceptance of the report.
Issue 2. A strategy to obtain the final records of decisions and integrate the waste sites, deep vadose zone and groundwater has not been developed and agreed upon with the regulator agencies.		
Action 2-1. Submit Draft A of the River Corridor Strategy for Achieving Final Cleanup Decision in the River Corridor. Document will identify issues for integration and provide alternatives for future discussions between the Tri-Parties on milestones for final records of decision in the River Corridor.	Nov-06	**Complete**
New Action 2-2 *. Reach agreement between the Tri-Party Agencies on a strategy and schedule to obtain final records of decisions in the River Corridor.*	Nov-07	The Tri-Parties agreed on ROD groupings as documented in the June, 2007 IAMIT minutes. A TPA change request will be submitted by 05/01/08 or within the scope of the overall milestone negotiations underway by the Parties.
New Action 2-3 *. Submit a TPA change package with new milestones for submitting RI/FS work plans and proposed plans for all operable units in the river corridor. New milestones shall require submission of RI/FS work plans and proposed plans for final actions at all of the following operable units that do not already have these documents approved: 100-BC-1, 100-BC-2, 100-DR-1; 100-DR-2, 100-FR-1. 100-FR-2. 100-HR-1. 100-HR-2, 100-HR-3, 100-IU-2, 100-IU-6, 100-KR-1, 100-KR-2, 100-KR-4, 100-NR-1, 300-FF-1, and 300-FF-2.*	Feb-08	In TPA negotiations, dependent on Action 2-2

Issues and Actions	Action Due Date	Status May 2008
100-K Area		
Issue 3. The southeastern (inland) extent of the chromium groundwater plume from the 116□K-2 trench, northeast of the current injection wells, has not been delineated.		
Action 3-1. Install three additional wells to further delineate the southeastern (inland) extent of the chromium groundwater plume from the 116-K-2 trench, northeast of the current injection wells. Wells installed as part of the pump-and-treat system expansion or injection well relocation may count towards this effort if appropriately located.	Aug-08	Completed-1/2008. Drilling began on 18 KR-4 pump-and-treat wells on 10/4/07. Wells K153, 154 & 163 were drilled to address this action. See Figure 3-1.
Issue 4. The small chromium plume at KW Reactor site has reached the river, as evidenced by near-shore aquifer tubes. There is currently no active remediation system in place for the small chromium plume at the KE-KW Reactor site. Therefore, construction of a new pump-and-treat system has been initiated in response to this condition.		
Action 4-1. Construct a new pump-and-treat facility to the address the chromium groundwater plume in the KW Reactor area.	Aug-08	Completed-1/2007. KW system is operating at design capacity of 100 gpm using 4 extraction/2 injection wells. See Figure 3-1.
Issue 5. Groundwater monitoring indicates that the expansion of the 100-K Area pump-and-treat extraction system has not yet achieved the remedial action objective.		
Action 5-1. Expand the 100-K Area pump-and-treat system by 378.5 liters (100 gallons) per minute to enhance remediation of the chromium plume between the 116-K-2 and the N Reactor perimeter fence.	Aug-08	The existing KR-4 pump-and-treat system operates at design capacity of 300 gpm. Construction of the expanded KR-4 process building and 2 transfer bldgs was completed in early 2007. Plant design for the 300 gpm expansion was completed 10/07. Construction began in 03/08. See Figure 3-1.
Action 5-2. Add additional wells between the 166-K-2 trench and the N Reactor perimeter fence for groundwater extraction, and connect the additional wells to the pump-and-treat system.	Mar-07	Drilling began on 18 KR-4 pump-and-treat wells on 10/4/07, and completed 3/19/08. Wells K147, 148, and 149, along with existing wells K130 & 131 fulfill this action. The wells will be connected to the expanded KR-4 system and completed with Action 5-1. See Figure 3-1.

Issues and Actions		Action Due Date	Status May 2008
100-N Area			
Issue 6. The pump-and-treat system is ineffective and inefficient in reducing the flux of strontium-90 to the Columbia River, providing only a fraction (1:10) of the protection provided by natural radioactive decay. The degree of protection provided by hydraulic control from the pump-and-treat is unproven.			
	Action 6-1. Implement the treatability test plan for permeable reactive barrier utilizing apatite sequestration as described in the *Strontium-90 Treatability Test Plan for 100-NR-02 Groundwater Operable Unit* (DOE 2005c). Issue Treatability Test Report.	Sep-08	Two pilot injections were conducted June and September 2006. DOE used these results and bench scale testing to modify the injected solution. DOE conducted two injection campaigns in FY07, one in the Ringold formation during low water (02/28 - 03/22), and the second in the Hanford formation during high water (06/06 - 07/10). The draft test report will be completed in June 2008.
Issue 7. Additional ecological data is needed to assess the interim actions prescribed within the record of decisions and to develop final cleanup standard. The extent of shoreline water quality impacts related to the diesel spill that occurred circa 1963 are not well known.			
	Action 7-1. Perform additional data collection to support risk assessment, provide to Ecology previously collected data, and coordinate with River Corridor sampling efforts to collect additional pore water data from new and existing aquifer tubes along the 100-NR-2 shoreline in order to assess water quality impacts.	Sep-08	Samples were collected from aquifer tubes in FY07and will continue through FY08. Section 2.4.1 of the Groundwater Annual report discusses significant results. PNNL placed additional tubes to identify the dimensions of SR-90 and TPH contaminants at 100-NR-2 in 2007. The results are detailed in PNNL-16714. Additional tubes will be installed in 2008. Previous sample results have been provided to Ecology.

Issues and Actions	Action Due Date	Status May 2008
100-D Area		
Issue 8. Groundwater monitoring data indicates there is an unidentified chromium vadose source in the 100-D Area near the demolished 190-DR clear wells.		
Action 8-1. Complete a field investigation to investigate additional sources of chromium groundwater contamination within the 100-D Area. Additional geologic and geochemical investigations of the vadose zone in the 100-D Area.	Mar-09	Initial field work completed March 2007 with the drilling of 7 wells (DOE/RL-2006-74). These and selected existing wells are currently being monitored to refine the source area. Four additional boreholes will be drilled in 2008 to further refine the source area. See Figure 8-1. An investigation of the northeastern chromium plume, including vadose boreholes and wells, will take place in FY2008. PNNL is completing geochemical investigations to determine how chromium is refined on sediments. An interpretive report will be submitted to RL 9/30/08.
Issue 9. There is less than adequate data to characterize potential chromium groundwater contamination between the 100-D and 100-H Area, in the area known as the "horn."		
Action 9-1. Perform additional characterization of the aquifer for chromium contamination between the 100-D and 100-H Area, in the area known as the "horn," and evaluate the need to perform remedial action to meet the remedial action objectives of the 100-D record of decision for interim action. This issue will also be addressed in the final record of decision.	Sep-09	Drilling of 21 wells began August 2007 and was complete January 2008 (SGW-33844). Nine sets of aquifer tubes have been installed and sampled in October and November 2007. Post sampling and well monitoring continues. See Figure 9-1. A "horn" investigation report will be submitted to RL by 9/30/08.

Updated at November River Corridor Unit Managers Meeting

Issues and Actions	Action Due Date	Status May 2008
Action 9-2. Incorporate the "horn" area into the 100-HR-3 interim ROD treatment zone if Action 9-1 indicates "horn" contains a groundwater chromium plume that needs immediate remediation.	Sep-09	This action is dependent on results of Action 9-1 above and will be incorporated into the Systematic Planning Process for HR-3 OU.
Issue 10. Some of the groundwater wells near the 182-D reservoir show conductivity values similar to values expected for raw water indicating some leakage from the reservoir.		
Action 10-1. Issue direction to the operating contractor to change operations to further minimize leakage from the 182-D reservoir.	Completed	**An Order was issued to prevent the use of 182-D except in the event of an emergency situation, such as fire control or loss of other safety system water supplies (Reference: JLD-02-02-2007-01 Rev02)**
Issue 11. A few wells within the in situ redox manipulation barrier have shown break through much sooner than expected.		
Action 11-1. Initiate limited iron amendments to the in situ redox manipulation barrier to evaluate whether this enhances the performance.	Sep-07	Initial laboratory tests of preferred iron compounds were found to be un-reactive. Laboratory testing to identify suitable iron compounds is planned to be completed in May, 2008. Field testing will occur in summer 2008.
Action 11-2 (unintentionally omitted from Five-Year Review Report Executive Summary). Expand groundwater pump-and-treat extraction within the 100-D Area by 378.5 liters (100 gallons) per minute to enhance remediation of the chromium plume.		DOE and Ecology have agreed that this action will be resolved through continuing improvements to the pump-and-treat system. Currently, optimization of the pump-and-treat system and new technologies (electrocoagulation) for the treatment of extracted water are being evaluated.

MAY 08

Updated at November River Corridor Unit Managers Meeting

Issues and Actions		Action Due Date	Status May 2008
	100-H Area		
Issue 12. Groundwater samples from one deep well extending below the aquitard exceed the drinking water standard (100 mg/L) for chromium. The extent of chromium contamination in this zone is not well understood.			
	Action 12-1. Perform additional characterization of the aquifer below the initial aquitard.	Sep-09	A Work Plan (Draft A) will be issued in December 2008. Field work will be conducted in 2009 and 2010 and will be incorporated into the Systematic Planning Process for HR-3 OU in 2008.
	300 Area		
Issue 19. Predicted attenuation of uranium contaminant concentrations in the groundwater under the 300 Area has not occurred. DOE is currently performing additional characterization and treatability testing in the evaluation of more aggressive remedial alternatives.			
	Action 19-1. Complete focused feasibility study for 300-FF-5 Operable Unit to provide better characterization of the uranium contamination, develop a conceptual model, validate ecological consequences and evaluate treatment alternatives. Concurrently test injection of polyphosphate into the aquifer to immobilize the uranium and reduce the concentration of dissolved uranium. These activities support a CERCLA proposed plan.	Sep-08	Alternatives for remediation of the the uranium contamination in the 300 Area will be addressed in a Remediation Strategy Report due to EPA on 9/30/08. Complete information on implementation and costs needed to complete a Feasibility Study is not available this fiscal year.

Attachment 6

May 2008 UMM
100F Field Remediation

Status

- Completed Backfill of 120-F-1 and 100-F-26:9.
- Demobilized all rented trailers.
- Completed demobilization of all subcontractor equipment.
- A small quantity of waste remains, hopefully be gone by late this month.
    - ERDF destined should be gone by next week
    - 1 drum for off-site treatment by PHMC, will ship 5/29.
    - 7 drums to other off-site treatment, hopefully late this month.

- Partial sample results back from of 600-111, look favorable.
- Characterization report for 600-149, draft back, waiting for final, hope to collect waste characterization/treatment sample next week, but we have to align the people and processes.

Attachment 7

0588911

(7)

Waste Site: 118-F-6 Burial Ground	**BACKFILL CONCURRENCE CHECKLIST** (Concurrence to Proceed with Waste Site Backfill Operations)	**WIDS No:** 118-F-6

This checklist is a summary of cleanup verification results for the 118-F-6 Burial Ground. The checklist is intended as an agreement allowing the RCCC subcontractor to backfill the burial ground excavation prior to the issuance of the final cleanup verification package. Portions of this waste site may be backfilled based on an attainment of Remedial Action Objectives (RAOs). The small area where groundwater contamination has been encountered may remain open, or may be backfilled, as appropriate to support further characterization efforts. The lead regulatory agency has been provided copies of detailed calculations. The results are summarized below.

Regulatory Requirement	Remedial Action Goals (RAG)	Results	RAG Attained	Ref.
Direct Exposure – Radionuclides	1. Attain 15 mrem/yr dose rate above background over 1000 years.	1. Maximum dose rate estimated using generic dose equivalence lookup values is 11.4 mrem/yr.	Yes	A, C
Direct Exposure – Nonradionuclides	1. Attain individual COPC RAGs.	1. Non-radionuclide COPCs were not detected in cleanup verification samples.	Yes	A
Meet Nonradionuclide Risk Requirements	1. Hazard quotient of less than 1 for noncarcinogens.	1. Non-radionuclide COPCs were not detected in cleanup verification samples.	Yes ~~NA~~	NA
	2. Cumulative hazard quotient of less than 1 for noncarcinogens.	2. Non-radionuclide COPCs were not detected in cleanup verification samples.		NA
	3. Excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	3. Non-radionuclide COPCs were not detected in cleanup verification samples.		NA
	4. Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	4. Non-radionuclide COPCs were not detected in cleanup verification samples.		NA
Groundwater/River Protection – Radionuclides	1. Attain single COC groundwater & river RAGS. 2. Attain National Primary Drinking Water Regulations 4-mrem/yr (beta/gamma) dose standard to target receptor/organ.	1, 2. No radionuclide COCs were quantified in the soil verification samples above groundwater/river protection lookup values. The vadose zone was removed in trenches 3 and 4 during remediation and groundwater intrusion occurred in trench 4. Groundwater samples were taken in trench 4 for information purposes. These samples contained Sr-90 above the maximum contaminant level (MCL) (DOE-RL 2005). An area extending 3 m from the groundwater sampling site within trench 4 will be available for further characterization. Backfill may be performed in this area to support further characterization. Backfill in all other areas of 118-F-6 will be performed based on attainment of RAOs.	Yes	A, E, F, G, H, I
	3. Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5.	3. No alpha-emitting radionuclide COCs were quantified above groundwater/river protection lookup values.		
	4. Meet total uranium standard of 21.2 pCi/L.	4. Uranium was not identified as a site COC.		

Waste Site: 118-F-6 Burial Ground	BACKFILL CONCURRENCE CHECKLIST (Concurrence to Proceed with Waste Site Backfill Operations)		WIDS No: 118-F-6	
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater and river cleanup requirements.	1. Non-radionuclide COPCs were not detected in cleanup verification samples.	Yes	A
Other Supporting Information	1. Sample location design calculation brief figures. 2. Focus sample locations. 3. GPERS Survey Maps.			B, D, E

All citations above and references on attached sheet are on record with Washington Closure Hanford, Inc., Document Control. Above noted regulatory requirements have been attained.

J.A. Capron For J.D. Fancher, per e-mail 2/21/08		2/21/08		2/25/08
WCH Project Manager	Date	WCH Project Engineer	Date	DOE Project Manager	Date

Given the attached information, DOE can proceed with backfill of the site with minimal risk. Final approval that the site has met RAOs and RAGs will occur with the submittal, review, and approval of the Cleanup Verification Package by the lead regulatory agency.

	2-25-08	N/A	N/A
EPA Project Manager	Date	Ecology Project Manager	Date

0591931

Waste Site: 118-F-6 Burial Ground	BACKFILL CONCURRENCE CHECKLIST (Concurrence to Proceed with Waste Site Backfill Operations)	WIDS No: 118-F-6

This checklist provides supplemental information regarding the backfill of Trench 4 in the 118-F-6 Burial Ground. An agreement to leave this portion of the waste site accessible for further characterization had been reached with the lead regulatory agency (WCH 2008). This checklist is intended as an agreement allowing the RCCC subcontractor to backfill the remaining portion of the trench 4 excavation within the 118-F-6 Burial Ground prior to the issuance of the final cleanup verification package. The backfill of this area is based on attainment of Remedial Action Objectives (RAOs). The lead regulatory agency has been provided copies of detailed calculations. The results are summarized below.

Regulatory Requirement	Remedial Action Goals (RAG)	Results	RAG Attained	Ref.
Direct Exposure – Radionuclides	1. Attain 15 mrem/yr dose rate above background over 1000 years.	1. Maximum dose rate for the entire 118-F-6 Burial Ground footprint estimated using generic dose equivalence lookup values is 11.4 mrem/yr.	Yes	WCH, 2008
Direct Exposure – Nonradionuclides	1. Attain individual COPC RAGs.	1. Non-radionuclide COPCs were not detected in cleanup verification samples.	Yes	WCH, 2008
Meet Nonradionuclide Risk Requirements	1. Hazard quotient of less than 1 for noncarcinogens.	1. Non-radionuclide COPCs were not detected in cleanup verification samples.	Yes	WCH, 2008
	2. Cumulative hazard quotient of less than 1 for noncarcinogens.	2. Non-radionuclide COPCs were not detected in cleanup verification samples.		WCH, 2008
	3. Excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	3. Non-radionuclide COPCs were not detected in cleanup verification samples.		WCH, 2008
	4. Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	4. Non-radionuclide COPCs were not detected in cleanup verification samples.		WCH, 2008
Groundwater/River Protection – Radionuclides	1. Attain single COC groundwater & river RAGS. 2. Attain National Primary Drinking Water Regulations 4-mrem/yr (beta/gamma) dose standard to target receptor/organ.	1&2. No radionuclide COCs were quantified in the soil samples above groundwater/river protection lookup values. The vadose zone was removed in trenches 3 and 4. Three samples of water accumulated in the base of trench 4 were taken for information purposes. These samples contained Sr-90 above the maximum contaminant level (MCL) (DOE-RL 2005), but are believed to not be representative of groundwater. Groundwater is within the scope of the 100-FR-3 Groundwater Operable Unit. Information regarding this site has been shared with groundwater and source integration activities. The groundwater program will install an additional monitoring well near the burial ground in July 2008; perform quarterly sampling for strontium-90, TCE, uranium, nitrate, hexavalent chromium, and field parameters; and perform water level monitoring at representative well locations to collect additional data for seasonal variations. Any appropriate additional follow-on investigations will be described in the 100-FR-3 Remedial Investigation/Feasibility Study Work Plan.	Yes	WCH, 2008

Waste Site: 118-F-6 Burial Ground	BACKFILL CONCURRENCE CHECKLIST (Concurrence to Proceed with Waste Site Backfill Operations)		WIDS No: 118-F-6	
	3. Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25[th] of the derived concentration guide for DOE Order 5400.5.	3. No alpha-emitting radionuclide COCs were quantified above groundwater/river protection lookup values.	Yes	WCH, 2008
	4. Meet total uranium standard of 21.2 pCi/L.	4. Uranium was not identified as a site COC.	Yes	WCH, 2008
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater and river cleanup requirements.	1. Non-radionuclide COPCs were not detected in cleanup verification samples.	Yes	WCH, 2008
Other Supporting Information	DOE-RL, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 5, Draft B, U.S. Department of Energy, Richland Operations Office, Richland, Washington. WCH, 2008, *Backfill Concurrence Checklist – Waste Site: 118-F-6 Burial Ground*, CCN 0588911, Washington Closure Hanford Inc., Richland, Washington.			

All citations above and references on attached sheet are on record with Washington Closure Hanford, Inc., Document Control. Above noted regulatory requirements have been attained.

[signature]	4/9/08	[signature]	4/09/08	[signature]	4/10/08
WCH Project Manager	Date	WCH Project Engineer	Date	DOE Project Manager	Date

Given the attached information, DOE can proceed with backfill of the site with minimal risk. Final approval that the site has met RAOs and RAGs will occur with the submittal, review, and approval of the Cleanup Verification Package by the lead regulatory agency.

[signature]	4-15-08	N/A	N/A
EPA Project Manager	Date	Ecology Project Manager	Date

Attachment 8

 (8)

Strom, Dean N

From: Golden, James W
Sent: Thursday, May 08, 2008 12:58 PM
To: Strom, Dean N
Subject: FW: 300 Area FR Project UMM Input
Attachments: 618-7 Progress Photo5.2.08.xls

From: Darby, John W
Sent: Thursday, May 08, 2008 12:39 PM
To: Golden, James W; Donnelly, Jack W
Cc: Faulk, Darrin E
Subject: 300 Area FR Project UMM Input

Activities at the 618-7 Burial Ground this week included:

- Have completed excavation and sorting of the west half of the main trench down to 15 feet. Began excavation from east half of middle trench (see attached file for progress). Have excavated 31,500 bcm to date. bank cubic meters
- Have recently encountered a cache of drums in the excavation and have processed 140+ drums to date. No Zr or Uranium drums have been found.
- Have initiated load-out and have shipped 4200 ust to ERDF. US standard ton
- Completed placement of surface rock for west side queue and plan on using the west side queue starting Friday May 9.

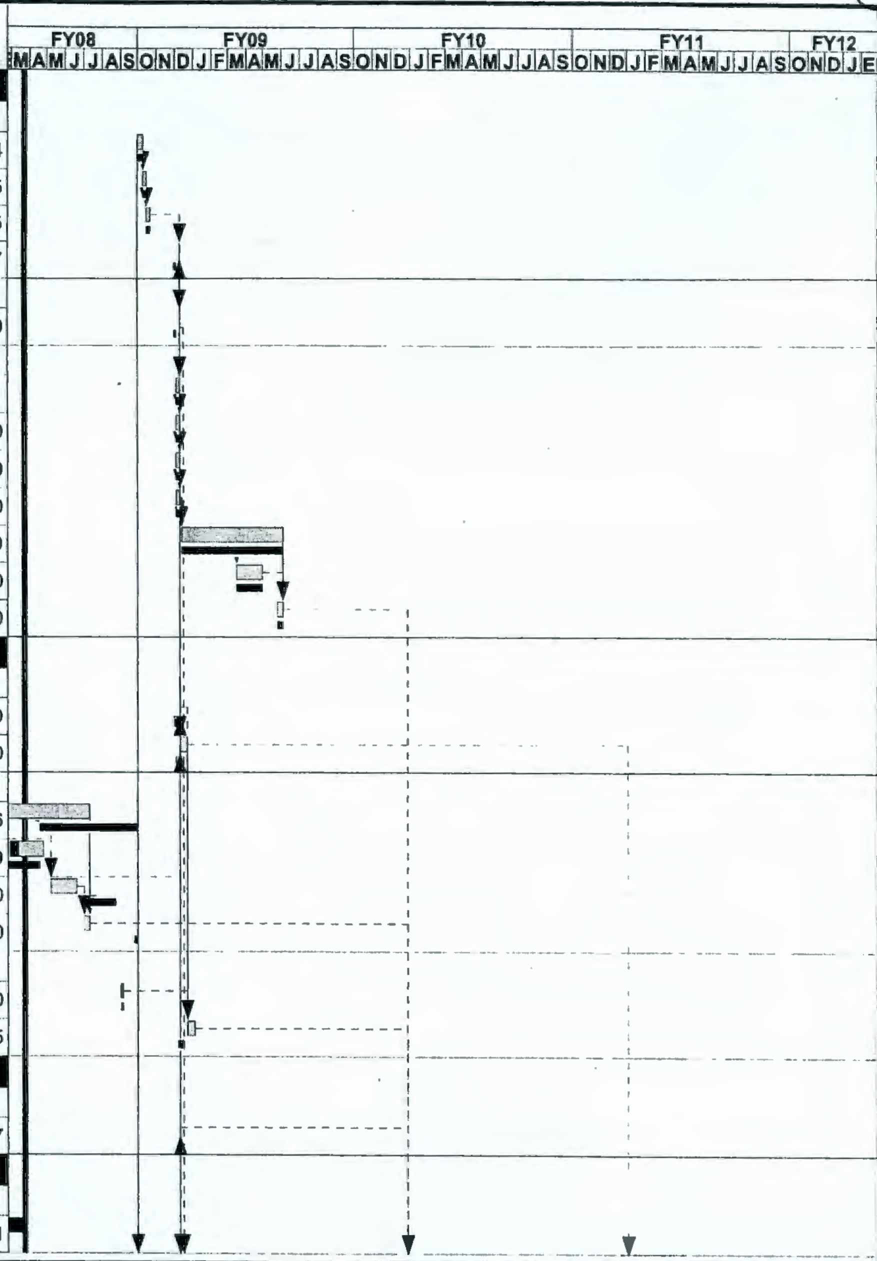
618-1

- Mobilization activities continue. The EPHA was submitted to the client for review on April 15. Have received comments on the EALs and the EALs write-up was revised and resubmitted.

EAL = Emergency Action Levels
EPHA = Emergency Preparedness Hazard Analysis

Attachment 9

Activity ID	Activity Description	OD	RD	% Cmp	Early Start	Early Finish	Cost to Complete
100-B-17 Waste Site							
Excavation Process							
EXC100B7B	100-B-17 Prepare Waste Designation	4	4	0	01OCT08*	07OCT08	816.34
EXC100B7C	100-B-17 Prepare Waste Profile	4	4	0	08OCT08	14OCT08	8,328.25
EXC100B17D	100-B-17 ERDF Review / Approve Waste Profile	4	4	0	15OCT08	21OCT08	223.55
EXC100B7A	Excavation 100-B-17 (0 BCM)	2	2	0	10DEC08	11DEC08	8,925.37
Loadout							
LO100B17A	Loadout 100-B-17 (0 UST)	2	2	0	10DEC08	11DEC08	0.00
Closeout Sampling							
CLOSB17A	Prepare Verification Sample WI for 100-B-17	5	5	0	04DEC08	11DEC08	13,419.41
CLOSB17B	RL/Regulator Review Draft A WI for 100-B-17	5	5	0	04DEC08	11DEC08	0.00
CLOSB17C	RL/Regulator Sign Rev. 0 WI for 100-B-17	5	5	0	04DEC08	11DEC08	0.00
CO10B17D	Closure Sampling & Analysis for 100-B-17	5	5	0	04DEC08	11DEC08	0.00
CO10B17E	Prepare Closure Document for 100-B-17	93	93	0	15DEC08	02JUN09	19,726.19
CO10B17F	RL/Reg Review Draft A Closure Doc for 100-B-17	26	26	0	18MAR09	30APR09	0.00
CO10B17G	RL/Reg Sign Rev. 0 Closure Doc for 100-B-17	5	5	0	26MAY09	02JUN09	0.00
100-B-19 Waste Site							
Backfill							
BKFL100B47	Backfill 100-B-19 (105 BCMs)	1	1	0	10DEC08	10DEC08	699.30
BF10B19B	Backfill 100-B-19 (4,575 BCMs)	6	6	0	11DEC08	22DEC08	30,469.50
Closeout Sampling and Documentation							
CO519E	Prepare Closure Document for 100-B-19	90	60	2	17JAN08A	08JUL08	19,331.66
CO519D	Closure Sampling & Analysis for 100-B-19	30	17	25	28FEB08A	21APR08	6,057.30
CO519F	RL/Reg Review Draft A Closure Doc for 100-B-19	26	26	0	05MAY08*	18JUN08	0.00
CO519G	RL/Reg Sign Rev. 0 Closure Doc for 100-B-19	5	5	0	30JUN08	08JUL08	0.00
Revegetation							
C210B19400	100-B-19 Order Revegetation Plants/Sagebrush	3	3	0	02SEP08*	04SEP08	0.00
C210B19410	100-B-19 Plant Plants/Sagebrush (0.17 acre	5	5	0	23DEC08	05JAN09	222.85
100-B-20 Waste Site							
Loadout							
BB520B	100-B-20 Loadout (20 tons)	1	1	0	10DEC08	10DEC08	13,758.27
100-B-21 Waste Site							
Excavation Process							
EXB21E	Excavation 100-B-21 (408 BCM) CDD (:3)	17	1	99	02JAN08A	24MAR08	135.91



Start Date	29AUG05
Finish Date	04AUG11
Data Date	24MAR08
Run Date	02APR08 06:47

Early Bar
Target 1 Early Bar
Progress Bar
Critical Activity

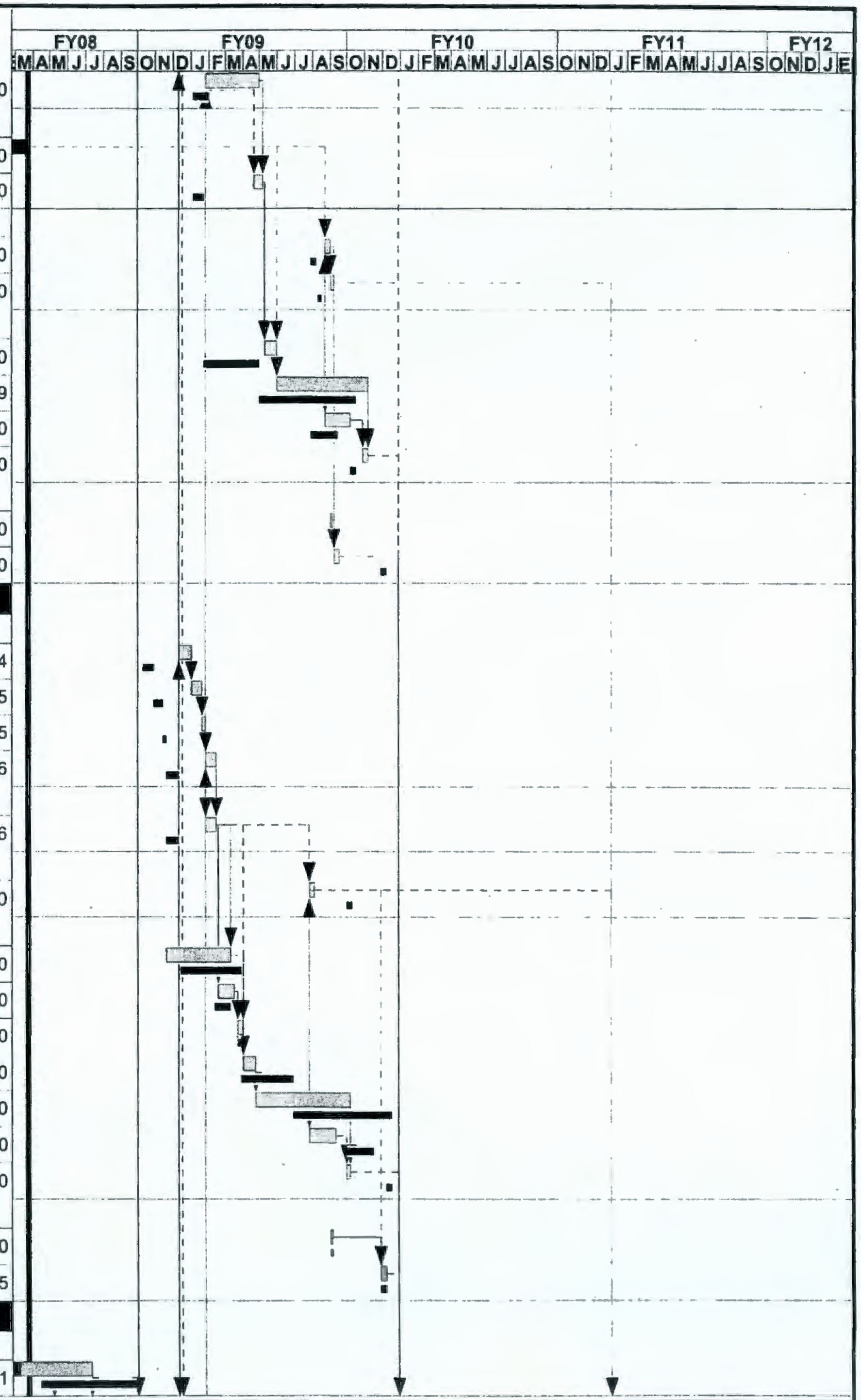
FBC8

Sheet 1 of 6

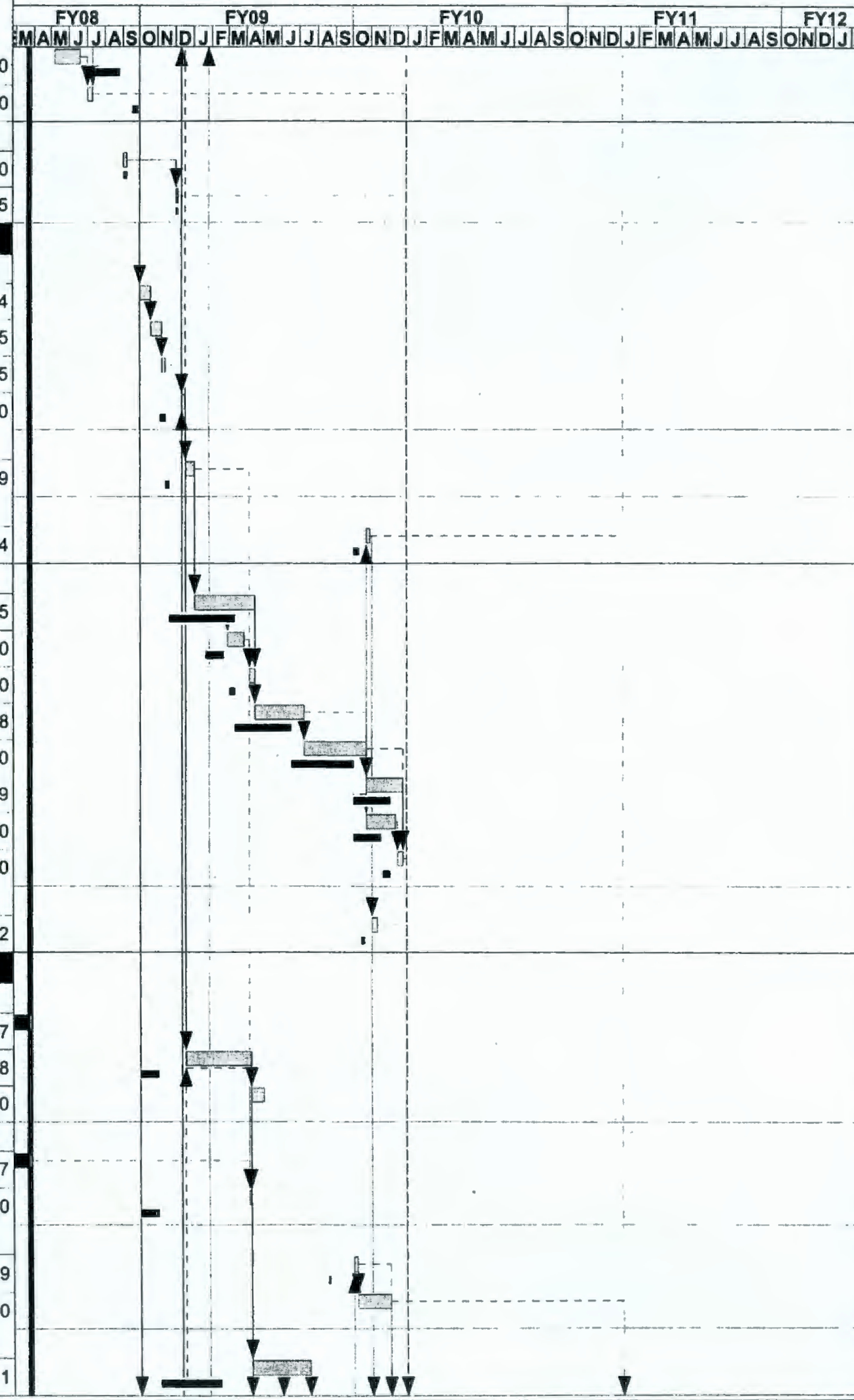
Washington Closure Hanford, LLC

BC Recovery Schedule
M-16-94

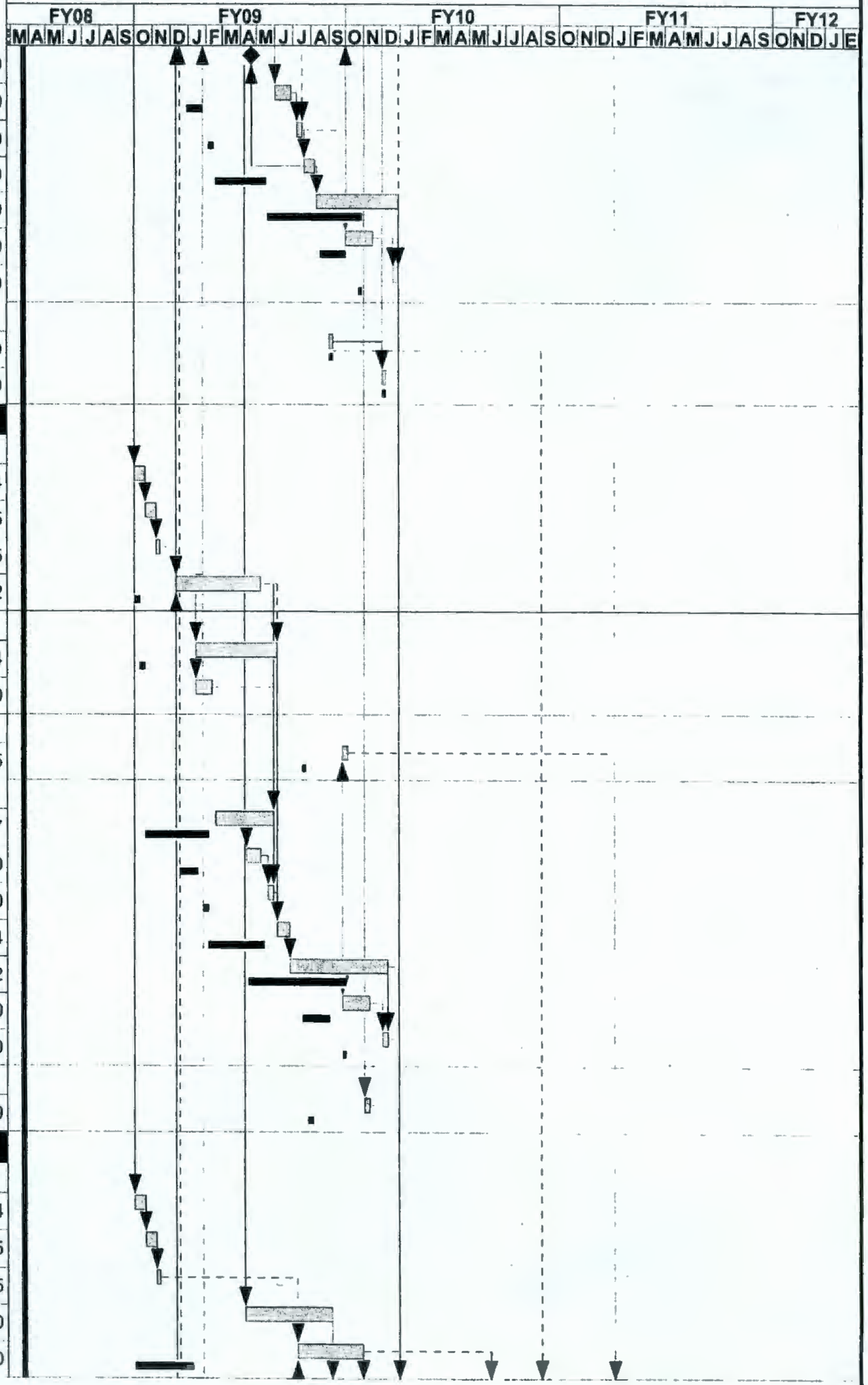
Activity ID	Activity Description	OD	RD	% Cmp	Early Start	Early Finish	Cost to Complete
EXB21F	Excavation 100-B-21 (xxx BCM) CDD (:44)	54	54	0	27JAN09*	30APR09	0.00
Loadout							
LOB21B	Loadout 100-B-21 (230 UST) CDD (:3)	11	1	99	04DEC07A	24MAR08	52.90
LOB21C	Loadout 100-B-21 (xxx UST) CDD (:44)	11	11	0	21APR09	07MAY09	0.00
Backfill							
BF10B21B	Backfill 100-B-21 (2,295 BCM) (:3)	5	5	0	24AUG09	31AUG09	15,284.70
BFB21C	Backfill 100-B-21 (xxx BCM) (:44) CDD	5	5	0	01SEP09	09SEP09	0.00
Closeout Sampling and Documentation							
CO521D	Closure Sampling & Analysis for 100-B-21	12	12	0	11MAY09	01JUN09	27,076.40
CO521E	Prepare Closure Document for 100-B-21	89	89	0	02JUN09	05NOV09	19,726.19
CO521F	RL/Reg Review Draft A Closure Doc for 100-B-21	26	26	0	24AUG09	07OCT09	0.00
CO521G	RL/Reg Sign Rev. 0 Closure Doc for 100-B-21	5	5	0	29OCT09	05NOV09	0.00
Revegetation							
C210B21400	100-B-21 Order Revegetation Plants/Sagebrush	3	3	0	01SEP09*	03SEP09	42.50
C210B21410	100-B-21 Plant Seeds/Sagebrush (0.17 acres)	5	5	0	10SEP09	17SEP09	382.50
100-B-22 Waste Site							
Excavation Process							
EXB22A	Prepare Waste Designation	10	10	0	10DEC08	30DEC08	816.34
EXB22B	Prepare Waste Profile	10	10	0	31DEC08	19JAN09	8,328.25
EXB22C	ERDF Review / Approve Waste Profile	4	4	0	20JAN09	26JAN09	223.55
EXB22D	Excavation 100-B-22 (102 BCM)	11	11	0	27JAN09	12FEB09	11,561.16
Loadout							
LOB22A	Loadout 100-B-22 (230 UST)	11	11	0	27JAN09	12FEB09	4,114.66
Backfill							
BKFL100B67	Backfill 100-B-22 (105 BCM)	5	5	0	28JUL09	04AUG09	2,443.60
Closeout Sampling and Documentation							
COB22A1	Prepare Verification Sample WI for 100-B-22	57	57	0	19NOV08	09MAR09	2,055.60
COB22B	RL/Regulator Review Draft A WI for 100-B-22	16	16	0	17FEB09	16MAR09	0.00
COB22C	RL/Regulator Sign Rev. 0 WI for 100-B-22	5	5	0	25MAR09	01APR09	0.00
COB22D	Closure Sampling & Analysis for 100-B-22	12	12	0	02APR09	22APR09	27,076.40
COB22E	Prepare Closure Document for 100-B-22	93	93	0	23APR09	07OCT09	13,353.50
COB22F	RL/Reg Review Draft A Closure Doc for 100-B-22	26	26	0	28JUL09	10SEP09	0.00
COB22G	RL/Reg Sign Rev. 0 Closure Doc for 100-B-22	5	5	0	30SEP09	07OCT09	0.00
Revegetation							
C210B22400	100-B-22 Order Revegetation Plants/Sagebrush	3	3	0	01SEP09*	03SEP09	0.00
C210B22470	100-B-22 Plant Plants/Sagebrush (0.17 acre	5	5	0	30NOV09	07DEC09	222.85
100-B-23 Waste Site							
Closeout Sampling and Documentation							
COB23E	Prepare Closure Document for 100-B-23	93	60	10	20FEB08A	08JUL08	8,520.71



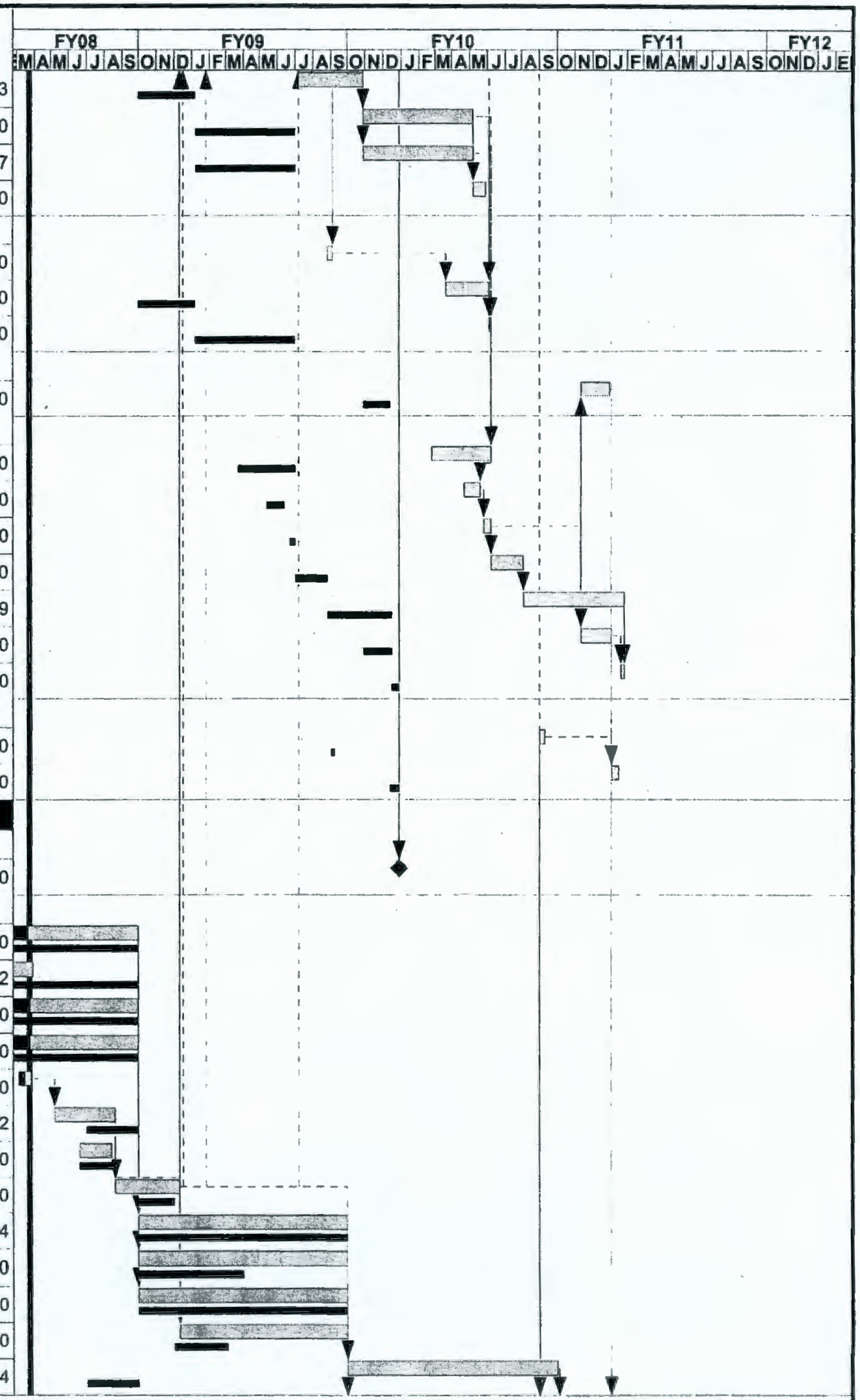
Activity ID	Activity Description	OD	RD	% Cmp	Early Start	Early Finish	Cost to Complete
COB23F	RL/Reg Review Draft A Closure Doc for 100-B-23	26	26	0	05MAY08	18JUN08	0.00
COB23G	RL/Reg Sign Rev. 0 Closure Doc for 100-B-23	5	5	0	30JUN08	08JUL08	0.00
Revegetation							
C210B23400	100-B-23 Order Revegetation Plants/Sagebrush	4	4	0	02SEP08*	08SEP08	0.00
C210B23410	100-B-23 Plant Reveg/Sagebrush (0.17 acres	4	4	0	01DEC08	04DEC08	222.85
100-B-25 Waste Site							
Excavation							
BB521A1	100-B-25 Prepare Waste Designation	9	10	0	01OCT08	16OCT08	816.34
BB521A2	100-B-25 Prepare Waste Profile	10	10	0	20OCT08	04NOV08	8,328.25
BB521A3	100-B-25 ERDF Review / Approve Waste Profile	4	4	0	05NOV08	11NOV08	223.55
BB521A	100-B-25 Excavation (1,781 BCMs)	5	5	0	10DEC08*	17DEC08	100,540.70
Loadout							
BB521B	100-B-25 Loadout (1,510 UST)	5	5	0	18DEC08	30DEC08	39,397.59
Backfill							
BB521C	100-B-25 Backfill (1,781 BCMs)	5	5	0	22OCT09	29OCT09	11,400.64
Closeout Sampling and Documentation							
BB521D1	Prepare Verif Sample Closeout Doc for 100-B-25	57	57	0	31DEC08	13APR09	6,595.85
BB521D2	RL/Reg Rview Draft A Closeout Doc for 100-B-25	16	16	0	26FEB09	25MAR09	0.00
BB521D3	RL/Reg Sign Rev. 0 Closeout Doc for 100-B-25	5	5	0	06APR09	13APR09	0.00
BB521D4	Closure Sampling & Analysis for 100-B-25	47	47	0	14APR09	07JUL09	14,197.18
BB521D5	Prepare Closure Document for 100-B-25 Part A	60	60	0	08JUL09	21OCT09	2,562.00
BB521D5A	Prepare Closure Document for 100-B-25 Part B	33	33	0	22OCT09	22DEC09	1,409.39
BB521D6	RL/Reg Review Draft A Closure Doc for 100-B-25	26	26	0	22OCT09	09DEC09	0.00
BB521D7	RL/Reg Sign Rev. 0 Closure Doc for 100-B-25	5	5	0	15DEC09	22DEC09	0.00
Revegetation							
BB521E	100-B-25 Revegetation (0.5 acre)	5	5	0	02NOV09	09NOV09	3,393.52
100-B-27 Waste Site							
Excavation Process							
EXB27D	Excavation 100-B-27 (297 BCM)	11	1	99	18JUN07A	24MAR08	75,128.97
EXB27D10	Excavation 100-B-27 (87,413 BCMs)	59	59	0	18DEC08	07APR09	879,429.08
EXB27D15	100-B-27 Final sampling to determine path fwd	12	12	0	08APR09	28APR09	7,012.00
Loadout							
LOB27A	Loadout 100-B-27 (671 UST)	11	1	99	18JUN07A	24MAR08	253.37
LOB27A10	Loadout 100-B-27 (892 UST)	2	2	0	06APR09	07APR09	24,045.00
Backfill							
BKFL100B27	Backfill 100-B-27 (297 BCM)	4	4	0	01OCT09	07OCT09	3,953.59
BB512C1	Backfill 100-B-27 (125,766 BCM)	28	28	0	08OCT09	30NOV09	666,361.00
Closeout Sampling and Documentation							
COB27A	Prepare Verification Sample WI for 100-B-27	55	55	0	08APR09	15JUL09	13,419.41



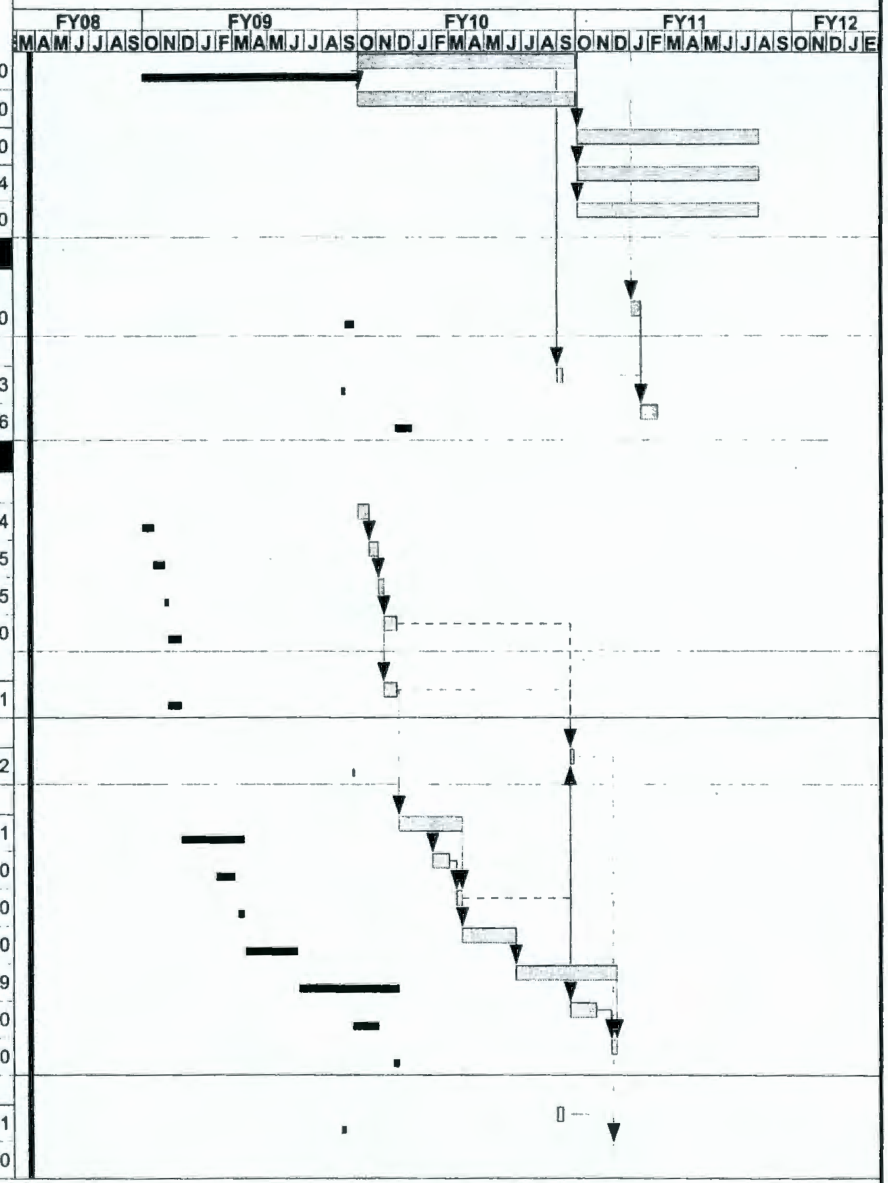
Activity ID	Activity Description	OD	RD	% Cmp	Early Start	Early Finish	Cost to Complete
COB27M	Notify EPA of upcoming closeout samples	0	0	0	20APR09		0.00
COB27B	RL/Regulator Review Draft A WI for 100-B-27	16	16	0	02JUN09	29JUN09	0.00
COB27C	RL/Regulator Sign Rev. 0 WI for 100-B-27	5	5	0	09JUL09	16JUL09	0.00
COB27D	Closure Sampling & Analysis for 100-B-27	12	12	0	20JUL09	06AUG09	14,515.40
COB27E	Prepare Closure Document for 100-B-27	78	78	0	10AUG09	30DEC09	19,726.19
COB27F	RL/Reg Review Draft A Closure Doc for 100-B-27	26	26	0	01OCT09	16NOV09	0.00
COB27G	RL/Reg Sign Rev. 0 Closure Doc for 100-B-27	5	5	0	21DEC09	30DEC09	0.00
Revegetation							
C210B27400	100-B-27 Order Revegetation Plants/Sagebrush	4	4	0	01SEP09*	08SEP09	624.00
C210B27410	100-B-27 Plant Plants/Sagebrush (0.87 acres)	5	5	0	01DEC09	08DEC09	1,544.00
100-B-28 Waste Site							
Excavation							
BB522A1	100-B-28 Prepare Waste Designation	9	10	0	01OCT08	16OCT08	816.34
BB522A2	100-B-28 Prepare Waste Profile	10	10	0	20OCT08	04NOV08	8,328.25
BB522A3	100-B-28 ERDF Review / Approve Waste Profile	4	4	0	05NOV08	11NOV08	223.55
BB522A	100-B-28 Excavation (1,464 BCMs)	80	80	0	10DEC08*	05MAY09	404,642.52
Loadout							
BB522B	100-B-28 Loadout (1,675 UST)	80	80	0	13JAN09	03JUN09	36,479.74
BB522B1	100-B-28 Liquid Disposal	16	16	0	13JAN09	09FEB09	0.00
Backfill							
BB522C	100-B-28 Backfill (1,464 BCMs)	5	5	0	24SEP09	01OCT09	18,295.35
Closeout Sampling and Documentation							
BB522D1	Prepare Verif Sample Closeout Doc for 100-B-28	57	57	0	17FEB09	27MAY09	11,666.77
BB522D2	RL/Reg Rview Draft A Closeout Doc for 100-B-28	16	16	0	13APR09	07MAY09	0.00
BB522D3	RL/Reg Sign Rev. 0 Closeout Doc for 100-B-28	5	5	0	19MAY09	27MAY09	0.00
BB522D4	Closure Sampling & Analysis for 100-B-28	12	12	0	04JUN09	24JUN09	25,112.04
BB522D5	Prepare Closure Document for 100-B-28	93	93	0	25JUN09	10DEC09	7,024.62
BB522D6	RL/Reg Review Draft A Closure Doc for 100-B-28	26	26	0	24SEP09	09NOV09	0.00
BB522D7	RL/Reg Sign Rev. 0 Closure Doc for 100-B-28	5	5	0	03DEC09	10DEC09	0.00
Revegetation							
BB522E	100-B-28 Revegetation (3 acres)	5	5	0	02NOV09	09NOV09	6,372.09
100-C-7 Waste Site							
Excavation Process							
BC502A1	100-C-7 Prepare Waste Designation	9	10	0	01OCT08	16OCT08	816.34
BC502A2	100-C-7 Prepare Waste Profile	10	10	0	20OCT08	04NOV08	8,328.25
BC502A3	100-C-7 ERDF Review / Approve Waste Profile	4	4	0	05NOV08	11NOV08	223.55
BC502A4	100-C-7 Concrete Removal	84	84	0	08APR09	03SEP09	293,300.00
RRRPAS1921	100-C-7 Soil Excavation (53,851 BCMs) OB	64	64	0	07JUL09*	27OCT09	437,367.00

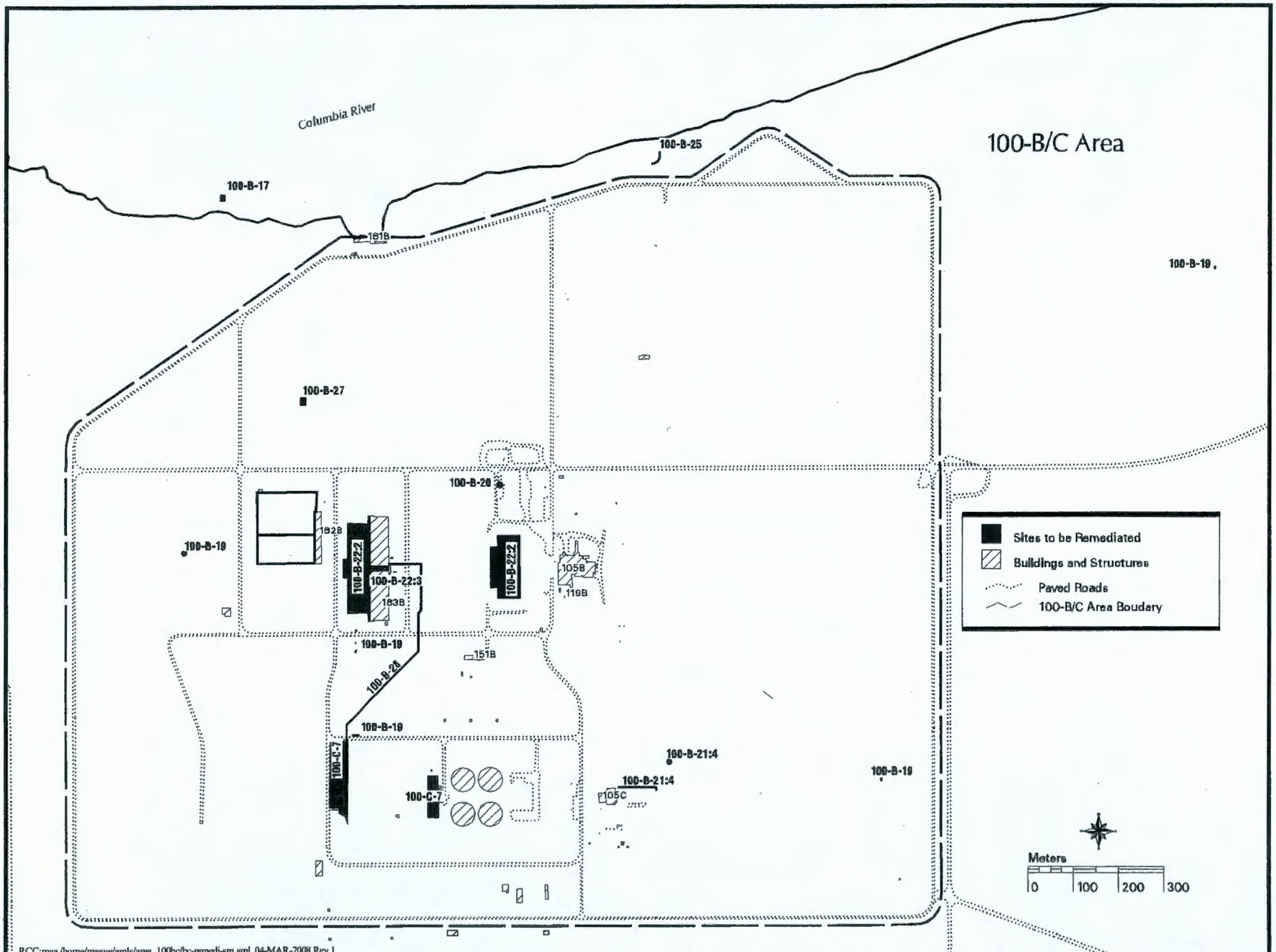


Activity ID	Activity Description	OD	RD	% Cmp	Early Start	Early Finish	Cost to Complete
RRRPAS3121	100-C-7 In-Process Sampling	64	64	0	07JUL09	27OCT09	328,669.33
RRRPAS1911	100-C-7 Soil Excavation (71,969 BCMs) ACL	103	103	0	28OCT09	05MAY10	729,712.00
RRRPAS3111	100-C-7 & 7:1 In-Process Sampling	103	103	0	28OCT09	05MAY10	560,699.07
BC502B2	100-C-7 Final sampling to determine path fwd	13	13	0	06MAY10	27MAY10	7,512.00
Loadout							
BC502B1	100-C-7 Concrete Loadout	5	5	0	27AUG09	03SEP09	43,510.00
RB1000RM10	100-C-7 Loadout (123,768 USTs)	42	42	0	22MAR10	02JUN10	946,610.00
RB1000RM	100-C-7 Loadout (2,018 USTs) over IPB	2	2	0	03JUN10	07JUN10	423,974.00
Backfill							
SHELLWI13	100-C-7 Backfill (122,270 BCMs)	25	25	0	10NOV10	29DEC10	1,592,166.00
Closeout Sampling and Documentation							
SHELLWI1	Prepare Verification Sample WI for 100-C-7	57	57	0	25FEB10	07JUN10	18,471.60
SHELLWI2	RL/Regulator Review Draft A WI for 100-C-7	16	16	0	21APR10	18MAY10	0.00
SHELLWI3	RL/Regulator Sign Rev. 0 WI for 100-C-7	5	5	0	27MAY10	07JUN10	0.00
COC7D	Closure Sampling & Analysis for 100-C-7	32	32	0	08JUN10	03AUG10	114,286.00
COC7E	Prepare Closure Document for 100-C-7	93	93	0	04AUG10	24JAN11	19,726.19
COC7F	RL/Reg Review Draft A Closure Doc for 100-C-7	26	26	0	10NOV10	03JAN11	0.00
COC7G	RL/Reg Sign Rev. 0 Closure Doc for 100-C-7	5	5	0	17JAN11	24JAN11	0.00
Revegetation							
C8100C7127	100-C-7 Order Revegetation Plants/Sagebrush	4	4	0	01SEP10*	08SEP10	3,472.00
C8100C7128	100-C-7 Perform Revegetation (4.86 acres)	8	8	0	03JAN11	13JAN11	7,023.00
100BC Project Support							
Fld. Rem.-100 B/C Non Site Specific Support							
C8100C7138	TPA M-16-94 Comp IRA 100 B/C	0	0	0		30DEC09	0.00
Fld. Rem.-100 B/C Non Site Specific Support							
FY08PS10	Project Support FY08	201	107	47	01OCT07A	30SEP08	96,173.60
FY08PS30	Air Monitoring	201	4	80	01OCT07A	27MAR08	26,548.82
B25FR108B	FR-108 Added NSS for additional quantities	155	107	31	26DEC07A	30SEP08	0.00
B25FR112B	FR-112 Sub OH & Fee on IPB	155	107	31	26DEC07A	30SEP08	0.00
FY08PS70	Subcontractor Demob	18	2	50	03MAR08A	25MAR08	25,000.00
6512136542	RFP for remaining BC sites	60	60	0	06MAY08*	20AUG08	49,774.32
FY08PS40	CPP Planning 09	33	33	0	18JUN08*	14AUG08	5,018.80
FY08PS80	Subcontractor Award and Mob	60	60	0	21AUG08	09DEC08	200,000.00
FY08PS50	Project Support FY09	200	200	0	01OCT08	30SEP09	1,582,764.44
FY09AIR100	Air Monitoring	200	200	0	01OCT08	30SEP09	67,500.00
FY09WCH100	Project Support FY08	200	200	0	01OCT08	30SEP09	0.00
FY08PS90	Subcontractor O&O FY09	162	162	0	10DEC08	30SEP09	972,000.00
FY08PS60	Project Support FY10	200	200	0	01OCT09	30SEP10	1,582,764.44



Activity ID	Activity Description	OD	RD	% Cmp	Early Start	Early Finish	Cost to Complete
FY09SUB100	Subcontractor O&O FY10	200	200	0	01OCT09	30SEP10	1,200,000.00
FY10AIR	Air Monitoring FY10	200	200	0	01OCT09	30SEP10	67,500.00
FY11AIR	Air Monitoring FY11	168	168	0	04OCT10	04AUG11	67,500.00
FY11PS	Project Support FY11	168	168	0	04OCT10	04AUG11	1,328,638.94
FY11SUB	Subcontractor O&O FY11	168	168	0	04OCT10	04AUG11	972,000.00
600-253 Waste Site (Pit 24)							
Backfill							
C4RPAS5462	Pit #24 Recontouring	10	10	0	03JAN11	18JAN11	103,130.00
Revegetation							
C4RPAS5461	Pit #24 Order Revegetation Plants/Sagebrush	4	4	0	01SEP10	08SEP10	25,394.73
C4RPAS5471	Pit #24 Plant Reveg/Sagebrush (40 acres)	16	16	0	19JAN11	15FEB11	86,968.26
1607-B5 Waste Site							
Excavation Process							
CMB05282	Prepare Waste Designation 1607-B5	10	10	0	01OCT09*	19OCT09	816.34
CMB05284	Prepare Waste Profile 1607-B5	10	10	0	20OCT09	04NOV09	8,328.25
CMB05285	ERDF Review / Approve Waste Profile 1607-B5	4	4	0	05NOV09	11NOV09	223.55
BKFL100B87	Excavation 1607-B5 (861 BCM)	11	11	0	12NOV09	03DEC09	12,915.00
Loadout							
BKFL100B97	Loadout 1607-B5 (453 UST)	11	11	0	12NOV09	03DEC09	9,471.81
Backfill							
BKFL100B77	Backfill 1607-B5 (861 BCM)	4	4	0	21SEP10	27SEP10	4,163.92
Closeout Sampling and Documentation							
AA1607B5	Prepare Verification Sample WI for 1607-B5	57	57	0	07DEC09	22MAR10	13,419.41
AB1607B5	RL/Regulator Review Draft A WI for 1607-B5	16	16	0	02FEB10	02MAR10	0.00
AC1607B5	RL/Regulator Sign Rev. 0 WI for 1607-B5	5	5	0	15MAR10	22MAR10	0.00
CO607B5D	Closure Sampling & Analysis for 1607-B5	51	51	0	23MAR10	21JUN10	0.00
CO607B5E	Prepare Closure Document for 1607-B5	93	93	0	22JUN10*	07DEC10	19,726.19
CO607B5F	RL/Reg Review Draft A Closure Doc for 1607-B5	26	26	0	21SEP10	03NOV10	0.00
CO607B5G	RL/Reg Sign Rev. 0 Closure Doc for 1607-B5	5	5	0	30NOV10	07DEC10	0.00
Revegetation							
RB1020RM	Reveg 1607-B5 Procure	4	4	0	01SEP10*	08SEP10	355.01
RB1030RM	Reveg 1607-B5 Plant (0.79 acre)	1	1	0	01DEC10	01DEC10	1,975.00





100-B/C Area
Columbia River
100-B-17
100-B-25
181B
100-B-19
100-B-27
100-B-20
182B
100-B-22:2
100-B-22:3
183B
105B
119B
151B
100-B-28
100-C-7
100-B-21:4
105C
Sites to be Remediated
Buildings and Structures
Paved Roads
100-B/C Area Boudary
Meters
0
100
200
300
RCC:maa /home/maaye/amls/area_100bc/bc-remedi-sm.aml 04-MAR-2008 Rev 1

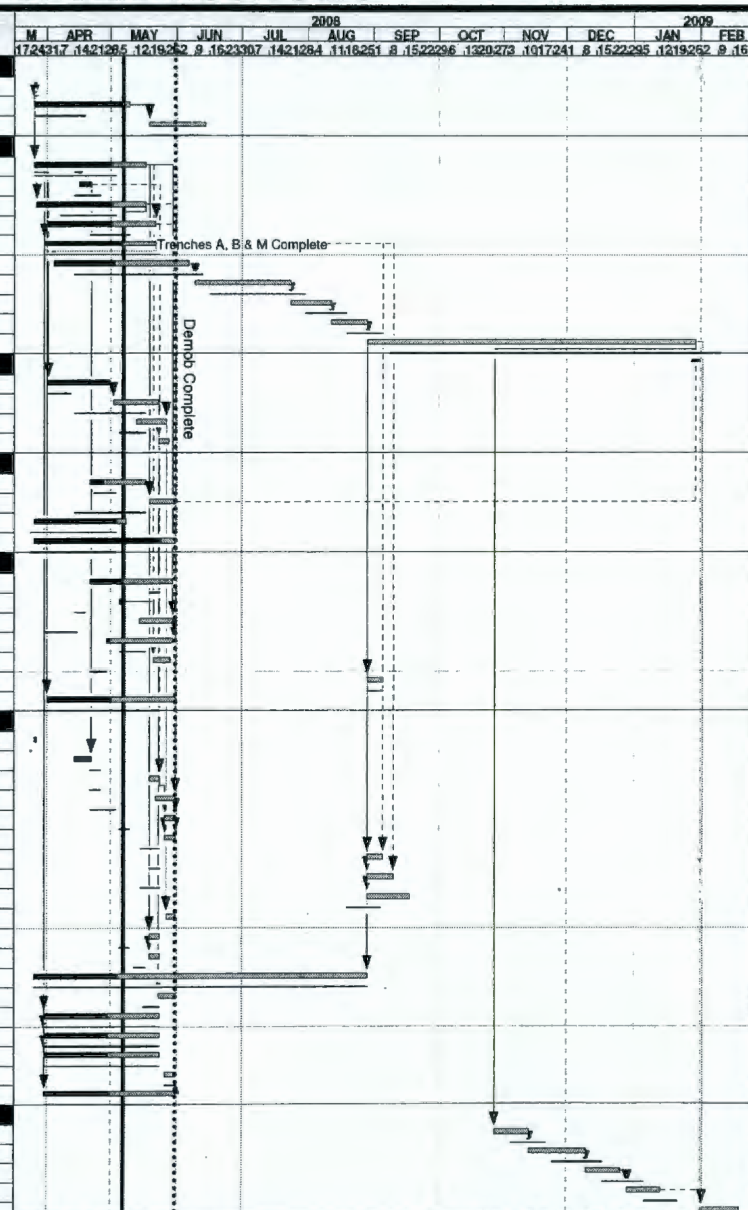
Attachment 10

10

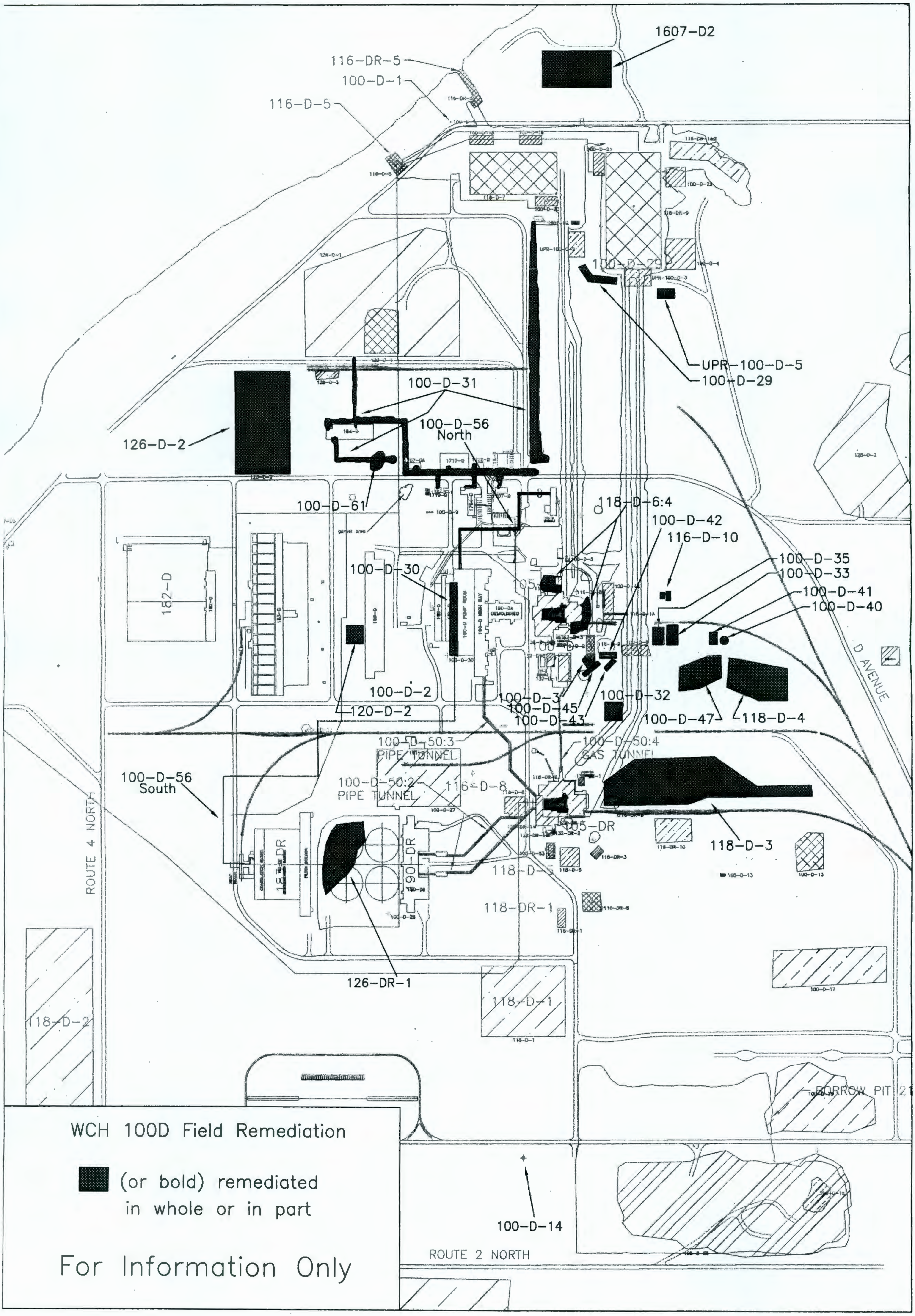
Washington Closure Hanford

Field Remediation
118-K-1 Shutdown/Closure

Activity ID	Activity Description	Early Start	Early Finish
Contracts			
01000	Issue Notice of Termination to DelHur	26MAR08A	26MAR08A
01050	Close Out Open Change Notices	26MAR08A	09MAY08
01200	Finalize Contract Costs (Post-Demob)	19MAY08	13JUN08
Close Out Sorting Cells & Clean Trenches (A,B&M)			
01600	Load Out Material (Includes Hot Part. & Debris)	26MAR08A	16MAY08
01620	Size Reduce Debris	16APR08A	21APR08A
01625	Cleanout / Establish Sorting Cell Sloping	27MAR08A	16MAY08
01630	On Site Survey & Down Post	01APR08A	21MAY08
01640	Survey (LARADS)	31MAR08A	21MAY08
01650	Develop Verification Sampling Instructions	04APR08A	05JUN08
01665	Regulator Review/Approval	09JUN08	23JUL08
01668	Finalize Sampling Plan	24JUL08	11AUG08
01750	Sample (Including Lab Time)	12AUG08	28AUG08
01800	CVP Development & Approval	29AUG08	29JAN09
Stabilize Open Trenches			
02390	Mobilize Excavator, Dozer & Trucks	02APR08A	29APR08A
02400	Cover with Clean Soil (minimum 6 in.)	02MAY08A	22MAY08
02415	Conduct Rad Survey & Repost	13MAY08	26MAY08
02450	Burm Trenches for Drainage Controls	23MAY08	27MAY08
Containerized Waste Disposal			
02690	Anomaly Work Package Preparation	21APR08A	16MAY08
02700	Process Anomalies (Independent of Demob)	19MAY08*	30MAY08
02750	Process Ready-to-Ship Waste	26MAR08A	07MAY08
02800	Sample/Profile Waste	26MAR08A	30MAY08
Decon and/or Demob Equipment			
04100	Intl Pay Hauler (Decon Included)	21APR08A	29MAY08
06100	CAT 312 (Decon Included)	05MAY08A	06MAY08A
06150	CAT 330 (Decon Included)	14MAY08	29MAY08
06200	Hitachi 400 (Decon Included)	29APR08A	29MAY08
06250	Hitachi 310 (Decon Included)	21MAY08	28MAY08
06260	CAT 245 (Decon Included)	29AUG08	04SEP08
06300	Remove "Clean" Equipment	01APR08A	30MAY08
Demob Trailers & Facilities (Including Electric)			
04150	Remove MO-795 (CTA)	26MAR08A	26MAR08A
04600	Remove MO-775 (Sampler)	14APR08A	21APR08A
04650	Remove MO-753 (RCT)	19MAY08*	23MAY08
04700	Remove MO-750 (POD)	22MAY08*	30MAY08
04750	Remove MO-754 (RCT)	26MAY08	30MAY08
04800	Remove MO-774 (DHI)	26MAY08	30MAY08
04850	Remove MO-751 (Restroom)	29AUG08	04SEP08
04900	Remove MO-755 (WCH)	29AUG08	09SEP08
04950	Remove Sample Trailer (Needed for Closeout)	29AUG08	17SEP08
04960	Remove PPE Trailer	27MAY08	30MAY08
14200	Survey Tent	19MAY08*	23MAY08
14250	Scales	19MAY08	23MAY08
14300	Environmental Air Monitors	26MAR08A	28AUG08
14320	Remove Water Tank & Isolate Pump	23MAY08	30MAY08
14450	Remove & Dispose All Chemicals	31MAR08A	23MAY08
14500	Remove Fuel Tanks	31MAR08A	23MAY08
14580	Transfer Safety Equip	31MAR08A	23MAY08
14590	Final Walkdown	26MAY08	30MAY08
14600	Complete Punchlist Items	31MAR08A	30MAY08
Backfill			
03750	Prepare Scope of Work	28OCT08	12NOV08
03800	Establish Contract	13NOV08	09DEC08
03850	Develop Work Package	10DEC08	25DEC08
03860	Review/Approval Contract Submittals (HASP, etc)	29DEC08	13JAN09
03900	Conduct Backfill (Trench A,B,M & Sort Cells)	02FEB09	18FEB09



Attachment 11


1607-D2
116-DR-5
100-D-1
116-D-5
UPR-100-D-5
100-D-29
100-D-31
100-D-56
North
126-D-2
100-D-61
118-D-6:4
100-D-42
116-D-10
100-D-35
100-D-33
100-D-41
100-D-40
100-D-30
182-D
D AVENUE
100-D-2
120-D-2
100-D-3
100-D-45
100-D-43
100-D-32
100-D-47
118-D-4
100-D-50:3
PIPE TUNNEL
100-D-50:4
GAS TUNNEL
100-D-56
South
100-D-50:2
PIPE TUNNEL
116-D-8
105-DR
118-D-3
ROUTE 4 NORTH
190-DR
118-D-5
118-DR-1
126-DR-1
118-D-1
118-D-2
BORROW PIT 21
100-D-14
ROUTE 2 NORTH
WCH 100D Field Remediation
(or bold) remediated in whole or in part
For Information Only

Attachment 12

Mission Completion
Sample Design and Cleanup Verification
for the May 2008 UMM

AREA	DOE-RL/REGULATOR DELIVERABLE	START	FINISH
100-BC			
	RL/Regulator Review Draft A WI for 100-B-21:2	5/8/2008	6/21/2008
	RL/Regulator Review Draft A Closure Doc for 100-B-23	5/13/2008	6/26/2008
	RL/Regulator Sign Rev. 0 WI for 100-B-21:2	7/16/2008	7/17/2008
	RL Approve 100-BC AMP (100B/FY07)	7/22/2008	8/25/2008
	RL/Regulator Sign Rev. 0 Closure Doc for 100-B-23	7/28/2008	7/29/2008
100-D			
	RL/Regulator Sign Rev. 0 WI for 100-D-61	3/18/2008 (A)	5/15/2008
	RL/Regulator Review Draft A Closure Doc for 100-D-3	4/17/2008 (A)	5/31/2008
	RL/Regulator Review Draft A WI for 120-D-2	5/7/2008 (A)	6/20/2008
	RL/Regulator Review Draft A WI for 100-D-32	5/22/2008	7/5/2008
	RL Approve 100-D AMP (100-D_MD_FS)	6/16/2008	7/21/2008
	RL/Regulator Review Draft A WI for 100-D-47	6/19/2008	8/2/2008
	RL/Regulator Review Draft A WI for 100-D-56 South	6/19/2008	8/2/2008
	RL/Regulator Sign Rev. 0 Closure Doc for 100-D-3	6/23/2008	6/24/2008
	RL/Regulator Sign Rev. 0 WI for 120-D-2	7/8/2008	7/14/2008
	RL/Regulator Review Draft A WI for 118-D-4	7/9/2008	8/22/2008
100-F			
	RL/Regulator Review Draft A Closure Doc for 100-F-44:2	5/8/2008 (A)	6/21/2008
	RL/Regulator Review Draft A Closure Doc 100-F-26:4 Pipeline Segment	5/8/2008 (A)	6/21/2008
	RL/Regulator Review Draft A Closure Doc for 100-F-46	5/14/2008	6/27/2008
	RL/Regulator Review Draft A Closure Doc for 100-F-44:5	5/15/2008	6/28/2008
	RL/Regulator Review of Draft A Closeout Doc 118-F-6	5/20/2008	7/3/2008
	RL/Regulator Review Draft A Closure Doc for 120-F-1	5/22/2008	7/5/2008
	RL/Regulator Review Draft A Closure Doc for 100-F-52	5/28/2008	7/11/2008
	RL/Regulator Review Draft A Closure Doc for 100-F-53	5/28/2008	7/11/2008
	RL/Regulator Review Draft A Closure Doc for 100-F-44:4	6/17/2008	7/31/2008
	RL/Regulator Review Draft A Closure Doc 100-F-26:9 Pipeline Segment	6/25/2008	8/7/2008
	RL/Regulator Review of Draft A Closeout Doc 128-F-2	6/25/2008	8/7/2008
	RL/Regulator Sign Rev. 0 Closure Doc for 100-F-46	7/21/2008	7/22/2008
	RL/Regulator Sign Rev. 0 Closure Doc for 100-F-44:2	7/21/2008	7/22/2008
	RL/Regulator Sign Rev. 0 Closure Doc 100-F-26:4 Pipeline Segment	7/21/2008	7/22/2008
	RL/Regulator Sign Rev. 0 Closure Doc for 100-F-44:5	7/28/2008	7/29/2008
100-H			
	RL/Regulator Signature Rev. 0 WI for 100-H-36	6/2/2008	6/3/2008
100-N			
	RL Review of Draft 100-A ESD	1/3/2008 (A)	7/14/2008
	RL/Regulator Review Draft A WI for 100-N-28	4/7/2008 (A)	5/21/2008
	RL/Regulator Sign Rev. 0 WI for 100-N-28	6/5/2008	6/12/2008
	RL/Regulator Review of 100-A SAP	6/17/2008	8/5/2008
	RL Review of 100-A RDR	7/7/2008	8/21/2008
	RL Issue 100-A Draft B ESD for Public Review	7/15/2008	8/13/2008
100-IU-2/-6			
	RL Review Draft A 618-10/11 SAP	5/7/2008	6/4/2008
	618-10/11 Comment Res/Transmit to EPA Drft A SAP	6/5/2008	6/18/2008
	Obtain EPA Approval of 600-111 Backfill Concurrence	6/18/2008	
	RL Approve 100-IU AMP (100-IU_2_6)	6/19/2008	7/24/2008

All Data is based on FY08/09 CPP with April 2008 Month End Status

Mission Completion
Sample Design and Cleanup Verification
for the May 2008 UMM

AREA	DOE-RL/REGULATOR DELIVERABLE	START	FINISH
300 Area			
	RL/Regulator Review of Draft A Closure Document 600-243	5/8/2008	6/21/2008
	RL/Regulator Sign Rev. 0 WI for 300-275	5/15/2008	5/19/2008
	RL Review Draft B 300 Area ESD	6/5/2008	6/30/2008
	RL Review 300-Area Cultural Review	6/23/2008	7/28/2008
	RL/Regulator Review Draft A WI for 300-32	6/30/2008	8/13/2008
	RL Review 300 Area RDR	7/1/2008	8/19/2008
	RL Review Misc Rest Cultural Review(MR_FY08)	7/9/2008	8/12/2008
	RL/Regulator Sign Rev. 0 Closure Document 600-243	7/22/2008	7/23/2008
	RL Approve 300 Area AMP (300_25s)	7/28/2008	8/28/2008

All Data is based on FY08/09 CPP with April 2008 Month End Status

Attachment 13

(13)

100 Area D4/ISS Status
May 8, 2008
100/300 Area Combined Unit Manager Meeting

Ongoing Activities

- **109-N –** Asbestos abatement complete in Area 5, all scaffolding removed. Asbestos abatement in corridor 19 complete, final clean-up in progress. Cable trays (flame mastic) will be removed the week of 5/12/08. Asbestos abatement in room 33 ongoing. Hazardous material removal in 109-N ongoing. Preparation/planning for mobilization in 105-N ongoing.
- **116-N –** Preparation for explosive demolition ongoing.
- **117-N –** Hazardous material removal ongoing.
- **182-N** – Hazardous material removal ongoing.
- **184-N** – Preparation for explosive demolition ongoing.
- **184-NA** – Demolition of 184-NA ongoing.
- **1802-N** - Below grade demolition and load-out of above and below grade debris ongoing.
- **1310-N** – Berm wall removal ongoing.
- **105-N –** Class 1 asbestos abatement ongoing.
- **1705-N/1706-N** - Belowgrade demolition ongoing.

60-Day Project Look Ahead

- 105-N Subcontractor mobilization beginning the week of 5/12/08.
- 184-N demolition.
- 108-N demolition phase 1.
- WCH bid review of 105-N/109-N demolition and Safe Storage Enclosure construction proposals complete. Bid review by DOE HQ required, transmittal in preparation. Contract award scheduled for June 2008.
- 1310-N/1322-N characterization.
- 116-N stack demolition.

Agreements/Other

ISS RAWP Scope Clarification.
Ammonia cylinder status/offsite determination approval.
B Reactor Roof air monitoring clarification.

Attachment 14

14

Change Agreement Between Ecology and DOE-RL Pending Revision of DOE/RL-2005-43 *Removal Action Work Plan for 105-N/109-N Building Interim Safe Storage and Related Facilities*

The following section is approved for addition to the above RAWP pending a full revision of the document (planned for this summer) that will include the means and methods for N Basin demolition and a revised Air Monitoring Plan that includes the N Basin demolition.

1.3.2 Materials and Equipment within the Safe Storage Enclosure

As noted earlier, the demolition / removal of structures and equipment within the SSE footprint shown in Figure 1-4 is excluded from this RAWP.

However, in order to provide assurances that hazardous and radiological contamination and equipment remaining within the SSE are stable (i.e., not available for migration or release to the environment during the surveillance period), and to protect the future surveillance and maintenance workers, the following general deactivation actions are anticipated.

a. Liquids will be removed to the extent practicable
b. Electrical and instrumentation systems (except those installed for SSE surveillance and maintenance) will be de-energized
c. Remaining friable asbestos or radiological contamination within the expected surveillance areas outside Zone 1 will be encapsulated or fixed
d. Loose lead (not installed or used for shielding) will be removed to the extent practicable
e. Loose hazardous and housekeeping items will be removed as practicable
f. Sludge, debris, equipment and areas that could be a source of airborne contamination during the safe storage period will be stabilized or encapsulated

In addition, below is a list of anticipated steps to control known hazards and facilitate surveillance and maintenance are as follows:

a. Provide a filtered, passive ventilation path for Zone 1, to allow the structure to "breath" during changing weather conditions similar to filters installed at the other reactor blocks in ISS
b. Install a monitoring system for use during the safe storage period
c. Tack welds installed in place of "high radiation area" padlocks on various Zone 1 entry points to eliminate periodic checks on the padlocks

Attachment 15

Saueressig, Daniel G

From: Faulk.Dennis@epamail.epa.gov
Sent: Tuesday, May 06, 2008 7:38 AM
To: Saueressig, Daniel G
Cc: Smith, Chris; Woolard, Joan G; Martell, P John (DOH); Allen, Mark E; Proctor, Megan L
Subject: Re: B REACTOR ROOF REPLACEMENT

Attachments: winmail.dat

winmail.dat (3 KB)

Dan,

Your message below captures our discussion accurately.

Dennis

"Saueressig, Daniel G" <dgsauere@wch-rcc.com>

05/05/2008 08:12 AM

To: Dennis Faulk/R10/USEPA/US@EPA, "Martell, P John (DOH)" <John.Martell@DOH.WA.GOV>

cc: "Smith, Chris" <Douglas_C_Chris_Smith@rl.gov>, "Woolard, Joan G" <jgwoolar@wch-rcc.com>, "Proctor, Megan L" <mlprocto@wch-rcc.com>, "Allen, Mark E" <meallen@wch-rcc.com>

Subject: B REACTOR ROOF REPLACEMENT

> Dennis, per our phone conversation on April 29, 2008 regarding removal
> and replacement of the B Reactor roof, I wanted to document our
> discussion and agreements so that it can be included as an "agreement"
> at the next Unit Managers Meeting (UMM).
>
> I discussed that WCH feels that the near field air monitors and
> environmental TLDs utilized by the Field Remediation organization at B
> Area aren't necessary for this work because very minor, if any,
> amounts of contamination is expected. I also discussed that we would
> utilize the Radiological Control Organizations controls to ensure this
> work is performed safely. You were in agreement and stated that if
> contamination was encountered, WCH would provide both EPA and the
> Department of Health a courtesy call.
>
> I also discussed that we'd like to use a guzzler type vacuum, or

> similar, to remove the roof. I stated that this unit would be an
> efficiency tested HEPA unit and the Radiological Control Organization
> would monitor the exhaust during use and would smear the exhaust port
> before and after use. You were in agreement with this plan.
>
> Let me know if this accurately reflects our discussion. I'll include
> this email in the next UMM documenting our agreement.
>
> Thanks and give me a call if you have any questions.
>
> Dan Saueressig
> 100 Area D4 Environmental
> 373-5473 (office)
> 727-7014 (cell)
>

(See attached file: winmail.dat)

Attachment 16

(16)

300 Area D4 Status
May 8, 2008
100/300 Area Combined Unit Manager Meeting

Ongoing Hazardous Material Removal

- **324**
- **327**
- **337B**
- **308**

Ready for Demolition:

- **337**
- **321**
- **323**
- **3718**
- **3718A, B, C, E and N**

Demolition Activities:

- **384** – Hot demolition underway

60-Day Project Look Ahead

- Continue hazardous material removal at 337B, 3718G
- Begin hazardous waste removal at 3721, 3727 and 3728
- Start demolition at 321 and 323