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Meeting Minutes Transmittal/Approval
Unit Managers' Meeting
Remedial Action and Waste Disposal Unit/Source Operable Unit
3350 George Washington Way, Richland, Washington
May 1999

0052963

APPROVAL: _____ Date 1/19/00
Glenn Goldberg/Chris Smith, 100 Area Unit Managers, RL (H0-12)

APPROVAL: _____ Date 1-27-00
Wayne Soper, 100 Aggregated Area Unit Manager, Ecology (B5-18)

APPROVAL: _____ Date 3-28-00
Dennis Faulk, 100 Aggregate Area Unit Manager, EPA (B5-01)

APPROVAL: N/A Date _____
Rick Bond, 100-N Area Unit Manager, Ecology (H0-18)

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Distribution
Unit Mangers' Meeting: Remedial Action Unit/Source Operable Units
100 Areas

Glenn Goldberg ..... DOE-RL, RP (H0-12)
Owen Robertson ..... DOE-RL, RP (H0-12)
Chris Smith ..... DOE-RL, RP (H0-12)

Lisa Treichel ..... DOE-HQ (EM-442)

Wayne Soper ..... WDOE (Kennewick) (B5-18)
Rick Bond ..... WDOE (Kennewick) (B5-18)

Lynn Albin ..... Washington Dept. of Health
Richard Jauish ..... Washington Dept. of Health

John April ..... BHI (H0-17)
Dave Blumenkranz ..... CHI (H9-02)
Ella Coenenburg ..... BHI (H9-03)
Frank Corpuz ..... BHI (X9-06)
Rick Donahoe ..... BHI (H0-17)
Jon Fancher ..... CHI (H9-02)
Dennis Falk ..... (B5-01)
Alvina Goforth ..... BHI (H0-09)
Chris Kemp ..... BHI (S3-20)
Tom Kisenwether ..... BHI (X9-10)
Alvin Langstaff ..... BHI (X3-40)
Tamen Rodriguez ..... BHI (H0-17)
Fred Roeck ..... BHI (H0-17)
Mark Sturges ..... CHI (X3-40)
Joan Woolard ..... BHI (H0-02)

Amy Jones ..... (H0-10)

Please inform Tamen Rodriguez (372-9562) – BHI
Of deletions or additions to the distribution list.

Meeting minutes are attached. Minutes are comprised of the following:

Attachment 1	--	Agenda
Attachment 2	--	Attendance Record
Attachment 3	--	100 Area UMM Minutes - May 1999
Attachment 4	--	Summary of NTRC Activities
Attachment 5	--	Test Plan for the Determination of Distribution Coefficient and Leachability of Hexavalent Chromium in 100 Area Hanford Formation Soils
Attachment 6	--	116-C-2 Site Map
Attachment 7	--	100 D Kd/Leachability Testing Schedule
Attachment 8	--	Backfill Concurrence Checklist
Attachment 9	--	Routine Use of HEPA-Filtered Vacuum at the N-Springs Pump and Treat Project
Attachment 10	--	Passively Vented Emissions Pump and Treat Projects

Prepared by: Tamen Rodriguez Date 3/28/00
Amy J. Jones (H0-10)/Tamen Rodriguez

Concurrence by: Richard Hoe Date 3/28/00
Vern Dronen, BHI Remedial Action and Waste Disposal Project Manager (H0-17)

UNIT MANAGERS' MEETING AGENDA

3350 George Washington Way, Room 2A01
May 20, 1999

1:00 – 3:00 p.m. 100 Area 2A01

100 Area Remedial Action

- 100-B/C Pipelines
- Inclusion of 100 Area Outfalls
- Status and Schedule of Cr^{+6} Kd-Leachability Testing (formal finalization and sign off of the test plan, and response comments
- Deep Vadose Characterization at 100-H (need and planning)
- 116-D-7 Waste Site 100·DR·1
- 116-H-4 Waste Site, Analagous Approach with 116-B-3 Waste Site BC·1 NR·1
- 116-F-5 Close out Report FR·1
- Site Closeout/Backfilling at 100-B/C Group 1 Sites
- Use of HEPA-Filtered Vacuum at N-Springs During Resin Changeout
- Potential for Radionuclide Air Emissions from Passively Vented Tanks at the Pump and Treat Projects (ZP-1, KR-4, HR-3, NR-2)
- Applicability of WAC 173-400 and WAC 173-460

100 Area Assessment

- 5 year ROD Review (B/C, DR, HR ROD)
- 100-N ROD Status
- Remaining Sites ROD Status
  - Address Comments
  - TSD Units Discussion
- Burial Ground FSS Status/Presentation to the National Remedy Board in September 1999
- 100 Area Remedial Design Schedule/Detailed Work Planning

Attachment 2

Remedial Action and Waste Disposal Unit Manager's Meeting
Official Attendance Record
June 1, 1999

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
JOAN WOOLARD	BHI		372-9649
Barry Vedder	BHI		372-9444
Rick Bond	Ecology		376-3037
Mark Sturges	CHI		373-5519
Jon Fanther	CHI		372-9610
Ella Coenenberg	CHI		372-9303

Attachment 2

Remedial Action and Waste Disposal Unit Manager's Meeting
Official Attendance Record
June 1, 1999

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
Frank M. Corpuz	BHI	Project Engineer	373-1661
Dennis Faulk	EPA	RPM	376-8631
JEFF ARMATROUT	BHI	TASK LEAD	5310676
Tom Ferns	DOE	Support	372-0649
Pamela Innis	EPA	RPM	376-4919
Alvin Langstaff	BHI	Task Lead	373-5876
Glenn Goldberg	DOE	PM	376-9552
Wayne Soper	Ecology	D Area	736-3049
FRED ROECK	BHI	Environ Lead	372-9086
Phil Mees	Benton Co.	Long Range Planner	736-3086
Rick Donaldson	BHI	Task Lead	372-5561

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 100 AREA
May 20, 1999

Attendees: See Attachment #2

Agenda: See Attachment #1

Topics of Discussion:

100 Area Remedial Action

1. Changes in Regulator Representation - Rick Bond, Washington Department of Ecology, will take over as the 100 N Area Ecology representative.

2. 100-B/C Pipeline Removal - EPA stated their expectation that DOE-RL will meet this Tri-Party Agreement milestone with no obstacles, including lack of funding or lack of a subcontractor. ERC explained that, in the FY99 DWP, the 100-B/C pipeline removal activity was originally scheduled for August 1999, but during the review process, this pipeline work was pushed out to FY 2001 to meet budget constraints. Further, for ERC to commence the pipeline removal work in 1999, ERC/DOE will either need to receive more funding or reprioritize work scope again. EPA restated their expectation regarding milestone completion, and requested of DOE that the pipeline work milestone be discussed further.

3. Inclusion of the 100 Area Outfalls - Attendees discussed current planned work to remove the concrete block structures and pipes leading up to each outfall. EPA stated that, ERC should evaluate work that would be needed to complete remediation of the outfall in the near term years. This evaluation would address specific issues, such as what to do with remaining structure and the capping/blocking of pipe left behind and be consistent with the previously performed engineering study for remediation of the outfalls. EPA suggested that this evaluation could be completed during the next fiscal year.

4. Hanford Natural Resource Council (NRTC) – Jamie Ziesloft/DOE-RL presented a summary of the NTRC's current activities (Attachment 4). The Hanford NTRC is currently holding public meetings and receiving public comment about the Hanford 100 Area related contaminant impacts on the Columbia River. The Hanford NTRC decided that there was already sufficient evidence of injury to groundwater, and have performed a damage assessment on the situation. This non-binding assessment was in response to concern over the statute of limitations expiring on responsibility for injurious releases. The assessment reviewed the potential impacts to Columbia River aquatic resources that have been damaged by 100 Area releases. EPA asked how this assessment would provide remediation of injuries for the public benefit. EPA also stated that they need to verify that the NTRC damage assessment work plans will be linked to Hanford site guidance documents. ERC discussed the assessment work plans, which specifically address remedies for the damage. ERC also verified that Hanford site guidance documents will be correlated to the work plans. ERC inquired, and RL verified that current actions and issues are only with respect to "current potential injury", hence only current groundwater sources, and not the vadose zone are subject to evaluation.

5. Status and Schedule of Cr^{+6} Kd-Leachability Testing - The formal finalization and sign off of the plan was completed (Attachment 5), and will be included in the Administrative Record as a template for any future Kd-Leachability testing needs.

6. Institutional Controls Plan –EPA stated that Region 10 requires this document, which shows that EPA-governed sites have appropriate guidance documents in place to complete the required work. EPA stated that, rather than maintain this document for Hanford, EPA Region 10 may tie to the Hanford Land Use Plan as a substitute document. Because the Hanford Record of Decision (ROD) documents specify that an Institutional Controls Plan is required, EPA will work with DOE to keep Hanford in compliance with this requirement.

7. Preliminary Cr^{+6} Analytical Data for 116-C-2 Waste Site - ERC presented preliminary data for the 116-C-2 a, b, and c sites (pump station, sand filter and crib respectively) (Attachment 6) taken from very near the bottom of the design excavation depth. This early data shows levels of concern for Cr^{+6} constituent above the soil clean up RAG of 2.2 ppm. EPA requested further information from upcoming verification samples in order to know whether the contamination extended vertically and is present at the bottom of the design excavation. This is the first course of action. EPA stated that if the final data confirms the presence of elevated Cr^{+6} soil concentrations, then EPA's preference for action would be, in order of preference:

   - Pothole exploration to evaluate distribution of Cr^{+6} concentrations with depth (before additional vertical excavation is pursued)
   - Analytical alternatives, to include assessment of contaminant bias to fines portion of soil, whereas fines constitute a small fraction of the soil mass.
   - Application of the Kd-leachability test results from the 100-D Area for the 116-D-7 waste site (see Items 5 and 8)
   - Evaluation/implementation of technologies for remediation (e.g., H_2S).

   The current excavation is to design depth, relatively deep (on the order of 7 to 8 meters), and the Subcontractor has demobilized excavation related equipment from the site as the Group 3 B/C Area excavation work is completed. Additional excavation with depth would require remobilization of equipment, as well as additional, substantive safe laybacks and ramps. Estimated, rough order of magnitude costs to excavate an additional 1 meter (for discussion purposes) would be on the order to $100K to $150K in subcontract costs, to include additional vertical excavation, layback, ramps, ERDF disposal and mobilization/demobilization.

8. Kd-Leachability Testing Schedule – ERC discussed the Kd/Leachability testing schedule (Attachment 7) for the soils taken from the 116-D-7 waste site located at 100-D. ERC indicated that assuming the testing would yield acceptable results, backfilling of the 100-D Group 2 sites, of which 116-D-7 is a substantive portion, could commence as scheduled for this fall. ERC asked if other alternatives pathways should be looked at in the event the Kd-leachability results are not favorable. Ecology stated that ERC should wait for the sample results before looking at alternative methods. However, if balancing factors are needed, Ecology requested immediate notification so the lengthy public approval process can be initiated. This immediate notification would minimize potential delays to the site backfill activity.

9. Deep Vadose Characterization at 100-H – ERC noted that the 100-D Remedial Action Project would soon be performing the planned vadose borehole sampling at 116-DR-1/2. ERC asked if Ecology would consider the 100-D borehole samples to be used as analogous data for deep vadose characterization at 100-H (analogous site being 116-H-1, to be verified as needed). Ecology stated that they would prefer to have vadose characterization performed at each operable unit. ERC stated that an exploratory trench would likely be ERC's preferred method of exploration at H area since groundwater is relatively shallow at the 100-H Area. Ecology indicated that exploration via trenching would be adequate.

10. 116-D-7 Waste Site – See Item 8 above, regarding Kd-Leachability Testing Schedule.

11. 116-H-4 Waste Site, Analogous Approach With the 116-B-3 Waste Site - Sample data results are not available on this site yet. ERC will provide the data results and will meet with Ecology as soon as it becomes available.

12. 116-F-5 Site Closeout Report– This is one of ERC's first site closeout verification report documents for clean site verification. Before approving/commenting further or action taken on the current issued draft of this report, EPA will wait for completion, review and approval of the Clean Site Verification Sampling and Analysis Plan by ERC. Once approved, this closeout verification report can be used as the example (template) document for similar future reports.

    116-F-4 Site Closeout – This site is associated with a previous excavation treatability test. EPA indicated that the Treatability test data could be used on its own to close out this waste site.

13. Site Closeout/Backfilling at 100-B/C Group 1 sites – ERC presented the Backfill Concurrence Checklist (Attachment 8) for EPA and Ecology to review and sign. Both parties signed the checklist, which provides their official concurrence that the sites specified on the form can be closed out and backfilled.

14. Use of HEPA-Filtered Vacuum at N-Springs During Resin Changeout - ERC discussed a proposed agreement (Attachment 9) with DOE, Ecology, and DOH for the use of a HEPA-filtered vacuum at N-Springs to cleanup radionuclide-contaminated resins during resin changeout. Ecology agreed that ERC could set up a meeting with DOE, Ecology, and DOH to discuss this agreement further. ERC provided the supporting potential emissions calculation brief, and took the action to set up the meeting. -

15. Potential for Radionuclide Air Emissions from Passively Vented Tanks at the Pump and Treat Projects - ERC provided EPA and Ecology with a summary handout (Attachment 10) outlining the potential impact of the Hanford Site Air Operating Permit (AOP, to be issued in the summer of 1999) on passively ventilated tanks used by the pump and treat projects. While CERCLA projects are exempt from permitting, this issue could still be relevant to the pump and treat projects. ERC, upon review, found that the currently approved RODs did not identify WAC-246-247 as an ARAR (Radiation Protection – Air Emissions). The N Area ROD in preparation identifies WAC 246-247 as an ARAR. ERC calculated the total 1998 release inventory for the projects based on sample data, and found potential releases of radionuclides to be very low. EPA and Ecology requested that ERC include this item on the agenda of the meeting decided in item 14.

An air emissions related discrepancy between the 100-N Area ROD and the Remaining Sites ROD was discussed. The 100-N Area ROD states that Washington Administrative Code (WAC) 173-400 and 460 are ARARS. In the Remaining Sites ROD, WAC 173-400 and 460 are not listed as ARARs. EPA and Ecology agreed that the WAC 173-400 and 460do not apply to the CERCLA activities described in these RODs. Ecology noted that this discrepancy needs to be corrected in the 100 N Area ROD and has the action to discuss it within Ecology.

16. 100-N ROD Status - EPA stated that EPA legal is currently reviewing these RODS. EPA's target date to obtain approval signatures on these RODs are 6/30/99, but the goal could possibly be pushed out one additional month.

17. Remaining Sites ROD Status - EPA is currently revising this ROD and sees no potential obstacles from the comments received during its review. In this ROD, the language will be such that EPA and Ecology have the control of the use of balancing factors. Under 100 Assessment

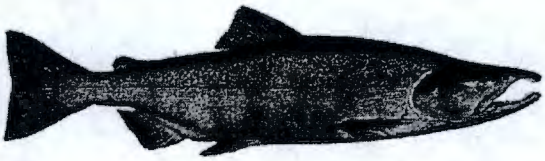
18. Burial Ground FSS Status/Presentation to the National Remedy Review Board in September 1999 - The FSS is currently out for review by EPA and the Native American tribal representatives. EPA stated that they do not agree with DOE's preferred treatment alternative and will be taking the full TPA review period for their review. EPA also stated that they are considering postponing the presentation to the National Remedy Review Board until the January 2000, EPA also strongly recommended that DOE make every effort to meet the review cycles in Tri-Party Agreement before sending any notice to EPA that the associated TPA Milestone may not be met. ERC committed to provide DOE and EPA with information regarding the certainty of the 100 Area Burial Ground Contents.

19. 100 Area Remedial Design Schedule/Detailed Work Planning – ERC's design for Calendar Year 2000 activities include the remediation of one large and three to five small burial grounds. EPA asked ERC to verify that the appropriate ROD is in place prior to remediation of the burial grounds, as some waste may have high radiological readings and require disposal in a canyon. ERC replied that out year planning integrates the different activities of other groups, such as Decontamination and Decommissioning. Therefore, out year work planning will include the disposition on any highly radiologically contaminated waste.

20. 5 Year ROD Review (B/C, DR, HR ROD) - ERC discussed the requirement of a 5 Year ROD review, on the B/C, DR, HR ROD which is scheduled to be performed next fiscal year. ERC asked EPA to identify the level of detail and involvement needed for this review. EPA commented that they were uncertain to the level, but anticipated it to be minimal. ERC will provide funding for this task. The 5 Year ROD review will include the ROD amendment as well as well.

HANFORD NATURAL RESOURCE TRUSTEE COUNCIL (NRTC)

INVITES YOU TO LEARN ABOUT HANFORD 100 AREA RELATED CONTAMINANT IMPACTS ON THE COLUMBIA RIVER



Your Comments Are Requested

- ***30-Day Public Comment Period June 1 through June 30, 1999***
- ***Open House and Public Meeting June 17, 1999***

The Hanford Natural Resource Trustee Council (NRTC) has released its *Hanford Site 100 Area Assessment Plan, Volume I: Columbia River Aquatic Resources* for public comment from June 1 to June 30, 1999.

You are invited to an Open House and Public Meeting at the Department of Ecology office at 1315 West 4th Avenue, Kennewick, WA 99336 on June 17, 1999 starting at 6:00 p.m. Representatives of the NRTC will briefly discuss the Assessment Plan starting at 7 p.m. and answer questions. Public comments will be heard following the discussion.

The goal of this assessment is to determine injury to natural resources caused by the release of Hanford-related hazardous substances along the Columbia River, and ultimately to restore and protect those resources from future exposure. The NRTC is comprised of representatives from state, federal and Tribal natural resource trustee organizations working on Hanford restoration.

For more information, contact Jay McConnaughey, Chair, NRTC, phone (509) 736-3095, e-mail jmcc461@ecy.wa.gov or send written comments to 1315 W. 4th Ave, Kennewick, WA 99336

The Draft Assessment Plan is available for public review at Hanford Public Information Repositories in Richland, Seattle, and Spokane, Washington, and in Portland, Oregon.
The Draft Assessment Plan is also available on the NRTC World Wide Web site at: http://www.hanford.gov/boards/nrtc/index.html

If you have special accommodation needs, please Mary Anne Wuennecke, Department of Ecology, Nuclear Waste Program, at (509) 736-3036 (voice) or (360) 407-6006 (TDD).

Test Plan Concurrence

Determination of Distribution Coefficient and Leachability of
Hexavalent Chromium in
100 Area Hanford Formation Sediments

Concurrence: _____ Date 6/1/99
Glenn I. Goldberg, RL Project Manager

Concurrence: _____ Date 6-1-99
Dennis A. Faulk, EPA

Concurrence: _____ Date 6-1-99
Wayne W. Soper, Ecology

Concurrence: _____ Date 6/1/99
Alvin L. Langstaff, BHI Task Lead

Comment/Response

For The

March 17, 1999 DRAFT

Test Plan for the Determination of Distribution Coefficient and Leachability of Hexavalent Chromium in 100 Area Hanford Formation Soils

Reviewers:

U.S. Environmental Protection Agency (EPA)
Washington State Department of Ecology (Ecology)
United States Geological Service (USGS)

General Comments:

1. Given attention to specific comments raised as part of the review of this document, the laboratory procedures, as described herein, should accommodate the needs of the study and provide the data needed to design worthwhile pilot/field-scale experimentation. However, better attention should be paid toward understanding the intrinsic properties of soils and, therefore, devising the means to sample and undertake bench-scale experimentation that will produce results that most likely will be transferable to a field setting.

Response: **Noted**: Working with limited budget and schedule considerations, there will be no change to expand the scope of this test. The values resulting from this bench scale work will be directly applicable to RESRAD calculations as presented. RL, EPA and Ecology concur that pilot/field–scale experimentation is not necessary. No change in text or test plan will be made.

Specific comments:

1. **Page 1, Section 1.1, paragraph 1, sentence 2**: The statement is true regarding soil solution, but does not account for primary and secondary mineral forms, let alone insoluble/immobile complexes.

Response: **Partial Accept:** The test plan shall be revised to read, "Hexavalent chromium is typically present in soil pore water as chromate ion $HCrO_4^-$ (soil pH <6.5) or CrO_4^{2-} (soil pH ≥6.5), or as dichromate ion $Cr_2O_7^{2-}$ (soil pH ≥6.5) at higher concentrations (EPA 1992)." It is difficult, and perhaps impossible, to measure the speciation of Cr on the sediments directly. We have attempted to distinguish Cr(VI) from Cr(III), or more correctly total Cr by using SW-846

extraction procedures. Results suggest that there is measurable Cr(VI) in the sediments as shown in the following table.

Sample Sub unit	HEIS Number	Cr+6 (mg/Kg)	Total Cr (mg/Kg)
A1	B0PK25	1.3	117
A2	B0PK19	2.9	153
A3	B0PK24	0.80U	144
B4	B0PK17	0.80U	226
B5	B0PK23	8.5	339
B6	B0PK21	0.80U	131
C7	B0PK26	1.4	117
C7 Dup	B0PK27	3.0	142
C7 Split	B0PK16	5.89	209
C8	B0PK20	18.0	152
C9	B0PK18	3.8	90.9

It is the fate of this Cr(VI) that is the focus of our investigation. Change to text will be made as noted above.

2. **p. 1, 1.1, para. 1, sentence 3:** Again, there is a distinction between bulk soil-chemistry and soil-solution chemistry.

Response: **Noted:** The text in the test plan does not consider the Cr speciation on the solids but does address current understanding of how solution borne Cr(VI) would interact with sediment surfaces from an adsorption perspective. We did not include solubility processes in the discussion because we felt that the current pore waters would not contain enough Cr(VI) to initiate precipitation of a pure Cr(VI) compound. The science of co-precipitation is often conceptualized and modeled as adsorption so even if the Cr(VI) is involved in co-precipitation with other analytes it can be discussed and modeled as a sorption process. No change in text or test plan will be made.

3. **p. 1, 1.1, para. 1, sentence 7:** If clay is a significant component of soil (especially compared to organic matter), then clay (depending on type) may effectively control chromium mobility.

Response: **Noted:** We do not disagree with this statement. However some of the soils used by Korte et al. (1976) had clay contents higher than the Hanford formation sediments, especially the coarse grained sediments near the Columbia River. The test plan was only reviewing information of others findings and as written Korte did not find clay content to be a significant variable in his studies. We did not infer anything from Korte's data explicitly but do feel it does apply to the coarse-grained Hanford sediments also. No change in text or test plan will be made.

4. **p. 1, 1.1, para. 1, sentence 8:** Reducing conditions are needed for this to be a factor -- which is unlikely in unsaturated soils with low organic-matter content.

Response: **Noted:** We agree, and did not mean to infer in the literature review section that we expected organic matter to play a reducing role in the contaminated Hanford sediments at the 100-Areas. No change in text or test plan will be made.

5. **p. 1, 1.1, para. 2, sentence 1:** The definition for Kd is unclear.

Response: **Accept:** The following wording will be added: "The ratio is calculated using the concentration of contaminant bound to the solid (per gram of solid) divided by the concentration of contaminant in solution (per milliliter of liquid)."

6. **p. 2, 1.1, para. 2, sentence 4:** "Vadose soil" is not correct terminology.

Response: **Noted:** Comment needs clarification. Are you saying that we should call the unsaturated solids at Hanford sediments as opposed to soils, which have a distinction from sediments in the eyes of agricultural scientists and engineers? We agree but the interchangeability of the term soil and sediment is very common in waste management terminology. We trust that this comment is editorial in nature, and does not preclude viability and commencement of the test plan. No change in text or test plan will be made.

7. **p. 2, 1.1, para. 6, sentence 1:** The text indicates that data only exist for Kd values from 1.2 to 1800, however a Kd value of zero was selected in the RD/RA Work Plan. It is understood that the value of zero was selected based on previous Hanford data or other published data. Please provide clarification to this statement.

Response: **Accept:** Yes the text is confusing and was the observation of one author's literature review. It should not be construed as meaning that the use of a Kd of zero was "wrong". At the time the RD/RA was produced there was no Hanford site specific Kd data for Cr(VI) but the expert judgement of several geochemists at Hanford, with concurrence from EPA and Ecology, was that the value could quite possibly be zero and the traditional risk approach is to use conservative values when adequate site and scenario values are not available. No published Hanford data exists demonstrating directly and definitively that the Kd value for Cr(VI) in Hanford soils is zero. The text will be revised reflecting this clarification.

8. **p. 3, 1.1, para. 6, sentence 5:** This sentence and the last sentence in Section 1.0 imply variation in 100 area soils that necessitate that Kd values must be determined site-by-site. Clarify these statements.

Response: **Accept:** The key point we are trying to make is that the quantification of the mobility of Cr(VI) or Cr total at the Hanford Reservation is problematical. That is, predictions of its fate and known groundwater plumes suggest that it is potentially mobile and potentially a risk driver. The use of non-specific or generic Kd values to perform the fate/transport calculations is unsatisfactory when there is a clear indication that there may be real risk. In such instances, the best technical approach is to gather site-specific and scenario relevant data. That is exactly what we are proposing to do. Actual data on the sorption (Kd) and leachability of Cr from the 100-Area sediments will bolster the technical credibility of any future predictions of long-term fate and allow more technically sound decisions to be made.

The currently proposed test is to be performed on soils from the 116-D7 site at the 100 D Area. Applicability of the results outside of the 116-D7 site and 100 D Area would be determined on a case by case basis by the lead regulatory agency. EPA and Ecology have stated that generally there is a potential for analogous soils approach at three groupings of areas: 100 BC and K Areas; 100 D and H Areas; and 100 F Area.

The text will be revised reflecting clarification in the above paragraph.

9. **p. 2, 1.1, para. 3, sentence 1:** Soils exist to a depth of 4-6 feet, below which the material should be referred to as underlying sediments.

Response: **Accept:** The depth at which soils exist is dependent on weathering environments, parent material, climate and other factors. At Hanford 100-Area one can argue that there is no "soil" developed at the surface because of the past catastrophic floods. We will change the wording throughout the test plan to use the more technically accurate term sediment.

10. **p. 2, 1.1, para. 3, sentence 2:** What is the textural composition of the soils that formed on Hanford Formation sediments?

Response: **Noted:** If there was a true soil layer at 100-Areas it has been disturbed and mixed with the sediments. The Hanford sediment along the Columbia River in the 100-Areas are quite coarse; predominately gravels with as little as 20%-40% sand, silt, and clay. No change in text or test plan will be made.

11. **p. 3, 1.2, point 1:** There most likely will be some variance, as both the soils and concentrations of chromium and species of chromium vary. Therefore, a mean Kd could be determined with associated standard deviation.

Response: **Noted:** p. 3, last paragraph, third sentence states the average (mean) value will be reported. The test plan calls for selecting a representative clean sediment and sieving it through #4 mesh [4.76 mm] for use in some preliminary batch

adsorption experiments using Hanford groundwater spiked with three different starting concentrations of Cr(VI) as chromate. If the preliminary results suggest that there is very little sorption [Kd < 0.5 ml/g], then no further sorption testing will be performed. The rest of the testing will be leach testing of a representative contaminated sediment.

While it is true that the total and Cr(VI) extractable concentrations vary with location and depth in the contaminated 100-Area sediments, we believe at present that the Cr sources and reactions with the sediments are similar enough that testing on one representative sediment will be adequate to gain valuable and useful data for making decisions. No change in text or test plan will be made.

12. **p. 3, 1.2, point 2, para. 1:** The conversion of hexavalent chromium to the trivalent form is unlikely, unless it's because the soils are saturated for a period of time -- therefore, this effort may be unproductive.

Response: **Noted:** Although the comment has merit, stating that conversion does or does not take place without some form of evidence, either way, is inconclusive. In addition to the mass balance, this analysis will also add value by giving an idea of the variability of the soils being tested. The total and hexavalent analyses on the water samples may also help address any anomalies encountered in the data. No change in text or test plan will be made.

13. **p. 4, 1.2, point 2, para. 3, sentence 6:** Column tests are generally run under saturated conditions, which do not represent the soils as they naturally occur. Such conditions will have a large impact on the solubility and mobility of a variety of constituents, including chromium.

Response: **Noted:** We elected to perform a saturated column study to reduce the time necessary to gather data and the costs of performing the test. The fact that we will be using saturated conditions should leach more Cr from the contaminated sediment than might occur under vadose zone conditions and thus our leach rate data may be conservative (i. e., overestimate Cr leaching). No change in text or test plan will be made.

14. **p. 5, 2.1.1, sentence 3:** One would be hard pressed to conclude any reliable Kd value during such a screening process.

Response: **Noted:** We disagree. Although we did omit the details, the screening batch adsorption test will use techniques that have been performed at Hanford and passed peer review for over 20 years. The method Relyea, J. F., R. J. Serne and D. Rai. 1980. Methods for Determining Radionuclide Retardation Factors: Status Report. PNL-3349, Richland, Washington was the template used by ASTM to form their standard D 4319 "Standard Test Method for Distribution

Ratios by the Short-term Batch Method" promulgated in 1983 and re-approved in 1990. No change in text or test plan will be made.

15. **p. 5, 2.1.2, first bullet:** Generally, this analysis would be performed on oven-dried material.

Response: **Noted:** We disagree. With Hanford sediments we have found that oven drying and then wet sieving can lead to an underestimation of the silt and clay fraction probably because some of the fine get baked onto the sands. The difference is less than that found by dry sieving, however. We prefer to use field moisture content material that has been well mixed by cone and quartering and then taking an aliquot (for this testing three for moisture content) and then proceeding directly to wet sieving. All data is reported on an oven dry basis. No change in text or test plan will be made.

16. **p. 5, 2.1.2, second bullet:** This is typically done on whole soil or soil sieved in the field.

Response: **Accept:** An as received moisture content will be taken on the coarse material before sieving and then after sieving and differences will be reported. We have found in the past that if the sieving is performed rapidly that there is very little change in the moisture content that is not accounted for by removing "dry" boulders from the mix. A change in text and test plan will be made accordingly.

17. **p. 5, 2.1.2, third, fourth, fifth, sixth bullets:** The times should be considerably longer. A good reference for this type of work is "Soil Characterization Laboratory Procedures Manual," by Falen and Fosberg, available through the University of Idaho Agricultural Experiment Station.

Response: **Partial Accept:** We will use the recommendations from **"Methods of Soil Analysis Part 3—Chemical Methods "**. It is published by the Soil Science Society of America and American Society of Agronomy, Inc. Madison, Wisconsin. They recommend one-hour contact times. Appropriate changes to the text will be made (contact times revised from ½ to one hour).

18. **p. 5, 2.1.2, seventh, eighth bullets:** What methods will be used?

Response: **Noted:** The methods are shown in Table 4 later in the test plan. They are EPA SW-846 procedures. No change in text or test plan will be made.

19. **p. 6, 2.1.2, para. 3, sentence 3**: Why use groundwater on soils? They are unlikely to ever have interaction.

Response: **Noted:** Groundwater was chosen because it has a similar composition to vadose zone pore water as determined by saturation extracts and 1:1 water

extracts. See Serne, R. J. et al, 1993. Solid-Waste Leach Characteristics and Contaminant-Sediment Interactions. Vol. 1: Batch Leach and Adsorption Tests and Sediment Characterization, PNL-8889, Pacific Northwest Laboratory, Richland, Washington, and Serne, R. J. and M. I. Wood. 1990. Hanford Waste-Form Release and Sediment Interaction: A Status Report with Rationale and Recommendations for Additional Studies, PNL-7297, Pacific Northwest Laboratory, Richland, Washington . for details. We do not want the bulk composition of the water phase to change when contacting the sediments because then reaching equilibrium takes a long time. The whole purpose of determining the Kd values desires that the system be at equilibrium. All we want to measure is the change in the Cr(VI) that is added to the solution when contacting Hanford sediment. We are trying to isolate the adsorption reaction from other extraneous reactions. No change in text or test plan will be made.

20. **p. 6, 2.1.2, para. 3, fourth bullet:** ORP is commonly referred to as Eh

Response: **Noted:** We will continue to use ORP (oxidation reduction potential). No change in text or test plan will be made.

21. **p. 6, 2.1.2, para. 4, sentence 3:** Are you referring to solids or bulk chemistry, and which analytical methods?

Response: **Noted:** As a clarification, the test plan states that the Cr(VI) and total Cr would be measured at the end of the test on the final solution only. A mass balance will be used to determine the final soil concentration. Methods are in table 4 for water. No change in text or test plan will be made.

22. **p. 6, 2.1.1, para. 1, sentence 1:** Remember--this is a dynamic "equilibrium".

Response: **Noted:** No change in text or test plan will be made.

23. **p. 8, table 1:** See previous comments about these.

Response: **Noted:** See response to comment 17. No change in text or test plan will be made.

24. **p. 8, 2.1.4, para. 1, sentence 2:** Why 30%?

Response: **Noted:** Past history on working with Hanford sediments show that 30% is an achievable yet adequately challenging goal. Setting the criteria more stringently only leads to the expenditure of more money with no better end results on the value of the data. In other words the natural variability of many of these parameters in sediments is very close to 30% and the analytical labs can not be held to produce data more precise than natural heterogeneity. No change in text or test plan will be made.

25. **p. 10, 2.2.1, para. 2, sentence 2:** Is the site irrigated?

Response: **Noted:** No the site is not currently irrigated. The irrigation scenario is one scenario that must be assessed for the future land use in fate and risk calculations. Thus to be protective in future risk calculations the amount of water expected during irrigation was chosen as the test condition to be used. No change in text or test plan will be made.

26. **p. 10, 2.2.1, para. 2, sentence 3:** This test may take awhile.

Response: **Noted:** The column will be contacted with the volume of water expected to be present in one year [914 mm (36 in.) of water that represents rainfall (6 in.) plus irrigation (30 in.)]. To get results in a more timely fashion the flow rate will be selected to be 10 times this rate such that 914 mm of water can be collected in 40 days instead of one year. Given the dimensions of the proposed column the residence time for a pore volume of water will be 4 days, which is long enough to expect minimal kinetic effects for the leaching of slightly soluble Cr (VI) salts. The column test will continue until leaching is no longer occurring or a years worth of solution has exited the column [based on the column dimensions 9.75 pore volumes will be collected in 40 days]. No change in text or test plan will be made.

27. **p. 11, bullets:** See previous comments about these.

Response: **Noted:** See response to comment 17. No change in text or test plan will be made.

28. **p. 13, 3.0, para. 1, sentence 2:** These are too deep to be considered a "soil".

Response: **Accept:** See response #9.

29. **p. 13, 3.0, para. 2:** But it is not the chemistry of the water that may leach contaminants of concern from the soil.

Response: **Noted:** See comment # 19. Further rainwater quickly equilibrates with the arid Hanford sediments and takes on the chemical nature of the pore water and thus the groundwater. No change in text or test plan will be made.

30. **p. 13, 3.1, para. 1, sentence 1:** How is this done when little, if any, knowledge exists on soils at Hanford? Perhaps a random design could be used. However, if enough information exists to be able to distinguish different soil series within the study area then, perhaps, a stratified sampling design should be used to incorporate the variability into the sampling.

Response: **Noted:** The intent of this statement is to let the sampler know we are after "typical" material found at the site being sampled as opposed to the occasional sandy lens or boulder field that have been encountered in the past. There is much knowledge and data available on the Hanford formation sediments. There have also been field investigations in the 100-Areas to ascertain the distribution of total and Cr(VI). It is the Cr issue that drives this plan. While it is true that the total and Cr(VI) extractable concentrations may vary with location and depth in the contaminated 100-Area sediments, we believe at present that the Cr sources and reactions with the sediments are similar enough that testing on one representative sediment will be adequate to gain valuable and useful data for making decisions. No change in text or test plan will be made.

Test Plan for Determination of Distribution Coefficient and Leachability of Hexavalent Chromium in 100 Area Hanford Formation Sediments

CONTENTS

1.0 INTRODUCTION 1
1.1 BACKGROUND 1
1.2 TEST OBJECTIVES 3

2.0 SCOPE AND DESIGN 4
2.1 BATCH EQUILIBRIUM TESTING 4
2.1.1 Preliminary Screening 5
2.1.2 Batch Test Setup 5
2.1.3 Batch Test Sampling and Analysis Requirements 7
2.1.4 Batch Test Quality Control Requirements 8
2.2 COLUMN TESTING 9
2.2.1 Column Test Setup 9
2.2.2 Column Test Sampling Requirements 11
2.2.3 Column Test Quality Control Requirements 12

3.0 FIELD SAMPLE COLLECTION 12
3.1 SEDIMENT SAMPLE REQUIREMENTS 13
3.2 WATER SAMPLE REQUIREMENTS 13

4.0 QUALITY CONTROL REQUIREMENTS 14

5.0 REFERENCES 16

APPENDICES

A 116-D-7 RETENTION BASIN ANALYTICAL DATA ..... A-i
B BATCH TEST DATA FORMS ..... B-i

Figures

A-1. CHROMIUM LEVELS AT 116-D-7. ..... A-1
A-2. TOTAL CHROMIUM/CR^{+6} COMPARISON A-1

Tables

1. BATCH TEST SAMPLING REQUIREMENTS. 8
2. COLUMN TEST SAMPLING REQUIREMENTS 11
3. SEDIMENT SAMPLE REQUIREMENTS[A] 13
4. SAMPLE ANALYSIS REQUIREMENTS 15

A-1. 116-D-7 HEXAVALENT CHROMIUM AND TOTAL CHROMIUM ANALYTICAL RESULTS A-1

B-1. BATCH TEST MATRIX. B-1

B-2. SEDIMENT RATIO BATCH TEST MATRIX B-4
B-3. QUALITY ASSURANCE/QUALITY CONTROL SAMPLES B-4

ACRONYMS

ASTM	American Society for Testing and Materials
EIP	Environmental Investigation Procedure
ERC	Environmental Restoration Contractor
K_d	distribution coefficient
ORP	oxidation reduction potential
RARA	Radiation Area Remedial Action
RESRAD	RESidual RADioactivity dose model

1.0 INTRODUCTION

This document describes the process, procedures and testing that will be conducted during bench-scale testing designed to determine a hexavalent chromium sediment/water distribution coefficient (K_d) and leachability of hexavalent chromium in the Hanford Site's 100 Areas sediments where site-specific information does not currently exist. Samples used for testing will be obtained from the 100-D Area, and applicability of the test results to individual sites in the 100 Areas will be determined on a case-by-case basis. This document is organized as follows:

- Introduction, including background project information and test objectives
- Scope and design of the testing
- Field sample collection
- Existing total and hexavalent chromium data for the 116-D-7 retention basin
- Data management.

1.1 BACKGROUND

The available literature provides broad and varied descriptions of mechanisms and conditions that affect the mobility of metals in sediments, and as a result, a complex relationship emerges for each metal at each location. Metals exist within sediments as either free metal ions, in soluble complexes with inorganic or organic ligands, or associated with mobile inorganic and organic colloidal material. Hexavalent chromium is typically present in sediment porewaters as chromate ion $HCrO_4^-$ (porewater pH <6.5) or CrO_4^{2-} (porewater H ≥6.5), or as dichromate ion $Cr_2O_7^{2-}$ (porewater pH ≥6.5) at higher dissolved chromium concentrations (EPA 1992). It is difficult, and perhaps impossible, to measure the speciation of Cr on the sediments directly. We have attempted to distinguish Cr^{+6} from CR^{+3}, or more correctly, total Cr, by using SW-946 extraction procedures. Results suggest that there is measurable Cr^{+6} in the sediments as shown in appendix A.

Because of the anionic nature of hexavalent chromium, its association with sediment surfaces is limited to positively charged exchange sites, the number of which decreases with increasing sediment pH. Stollenwerk and Grove (1985) found that hexavalent chromium adsorption was due in part to the presence of iron oxides and hydroxides within alluvial particles, but that hexavalent chromium was readily desorbed with the input of uncontaminated water. Korte et al. (1976) found that hexavalent chromium was mobile in alkaline sediments. Parameters that correlated with hexavalent chromium immobility were free iron oxides, total manganese, and sediment pH, whereas sediment properties, surface area, and percent clay had no significant effect on hexavalent chromium mobility. It has been shown that organic matter can act as an electron donor in the redox reaction of hexavalent/trivalent chromium (Bartlett and Kimble 1976; Bloomfield and Pruden 1980) and that the reaction rate for the reduction in Cr^{+3} increases with decreasing sediment pH (Cary et al. 1977; Bloomfield and Pruden 1980). It is also

possible that the hexavalent chromium found in sediment is present as an insoluble precipitate as opposed to being adsorbed on surface exchange sites.

The K_d is defined as the ratio of sediment bound contaminant concentration to the concentration of contaminant in the water concentration at equilibrium. The ratio is calculated using the concentration of contaminant bound to the solid (per gram of solid) divided by the concentration of contaminant in solution (per milliliter of liquid). The K_d represents a number of different mechanisms affecting the distribution of the contaminant, of which only sorption (i.e., adsorption and ion exchange) is typically addressed through short-term testing (ASTM 1993; ASTM 1987). To date, only K_d (and not leachability) has been used to evaluate groundwater impact using the RESidual RADioactivity dose model (RESRAD). RESRAD also has a computation feature to evaluate groundwater impact from residual vadose sediment contaminant concentrations, utilizing *leachability* parameters, which represent combined dissolution and desorption of contaminated sediments with the introduction of water. Given the multiple mechanisms available for hexavalent chromium adsorption/desorption and/or solubility/precipitation in sediment, as well as the wide range of K_d values currently published in literature, specific testing of hexavalent chromium mobility in sediment underlying former 100 Areas waste sites is warranted.

A proposed source of contaminated material to be used for testing is the 116-D-7 retention basin site, located north of the 100-DR-1 Operable Unit at the Hanford Site. The basin was an open concrete structure with a vertical concrete wall lengthwise down the middle of the basin and wood and concrete baffles to control water flow through the basin. Between 1944 to 1967, the site received large quantities (the exact amount is unknown) of process effluent water contaminated with radionuclides, process and water treatment chemicals to allow for thermal cooling and decay prior to discharge to the Columbia River. The basin is known to have had extensive leaks throughout its period of usage. Sodium dichromate was used for corrosion control by addition to the cooling water and also used for cleaning as chromic acid. After operations ceased in 1967, the site was decommissioned as part of the Radiation Area Remedial Action (RARA) Program. The upper portion of the basin's side walls, center structure, and baffles were knocked down into the basin and the entire site was stabilized with 0.6 to 1.2 m (1 to 2 ft) of overburden sediment.

The 116-D-7 site and underlying vadose zone (i.e., unsaturated sediments above the groundwater table) consist of material from the Hanford Formation. The Hanford Formation consists predominantly of medium-dense to dense sand and gravel, with various degrees of silt and cobble-sized material. The long-term groundwater depth beneath the site is estimated at 13.4 m (44 ft) below the bottom of the remedial action excavation. The site is located approximately 190 m (626 ft) from the 100-year flood level of the Columbia River.

The basin is currently being remediated as part of the Group 2 Remedial Action Project. The excavation of previously placed overburden backfill and the removal and disposal of the 116-D-7 engineered structure were completed in 1998. The remaining sediment

beneath the removed structure was sampled to determine if remedial action goals had been achieved. Hexavalent chromium was found at concentrations ranging from 0.8 mg/kg to 18 mg/kg (see Appendix A). RESRAD modeling indicates a potential impact to groundwater from these sediments, assuming a hexavalent chromium K_d value of zero. Additional excavation-at-depth is in progress to remediate these sediments. Similar conditions of elevated hexavalent chromium concentrations (relative to a K_d of 0) are anticipated at other 100-D Area sites.

The *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 1998) conservatively specifies a K_d value of 0 (zero) for hexavalent chromium, but a K_d range from 1.2 to 1800 is indicated based on the results of a literature search. The available K_d data for hexavalent chromium in this reported range is neither specific for the 100-D Area, nor the 100 Areas, in general. Leach rates, in general, are not as readily available in the literature and have not been pursued to date. At the time the document was produced there was no Hanford site specific Kd data for Cr^{+6} but the expert judgement of several geochemists at Hanford, with concurrence from EPA and Ecology, was that the value could quite possibly be zero and the traditional risk approach is to use conservative values when adequate site and scenario values are not available.

Important decisions affecting the cost and extent of remedial action are currently based on a very conservative value. The determination of area-specific K_d and leach rates will provide a more accurate picture of actual potential impacts to ground water and support future remedial action cleanup goals and planning. The currently proposed test is to be performed on sediments from the 116-D-7 site at the 100 D Area. Applicability of the results outside of the 116-D-7 site and 100 D Area would be determined on a case by case basis by the lead regulatory agency. EPA and Ecology have stated that generally there is a potential for analogous sediments approach at three groupings of areas: 100 BC and K Areas; 100 D and H Areas; and 100 F Area.

1.2 TEST OBJECTIVES

The primary objectives of this test are to:

1. Determine a K_d for hexavalent chromium specific to Hanford Formation sediments found throughout the 100 Areas.

The use of K_d to represent partitioning between sediment and water is considered valid if the isotherm is linear over the range of concentrations present in the field (both sediment and water). This test is designed to acquire at least three data points to evaluate whether a constant K_d with changing hexavalent chromium concentrations is found. Literature indicates that over six different chemical reactions can effect contaminant distribution and curvilinear isotherms with empirical solutions commonly used for K_d modeling (EPA 1992).

2. Determine a leach rate for hexavalent chromium specific to contaminated sediments found in the Hanford Formation throughout the 100 Areas.

To achieve these objectives, the testing will utilize a combination of batch equilibrium tests (with clean sediments exposed to water spiked with hexavalent chromium) and column testing (with pre-existing hexavalent chromium contaminated sediments) to generate the necessary data.

The data collected from the batch testing with clean sediments exposed to water spiked with hexavalent chromium will be used to plot an isotherm of the hexavalent chromium concentrations in sediment and water. A linear plot will confirm the appropriateness of using a single partition coefficient (K_d) over the range of interest. The averaged sediment/water concentration ratios will be reported as the K_d for these sediments. Due to the difficulty and highly variable results of sediment analyses, the sediment concentrations will be determined by mass balance using "before" and "after" water analyses. Analysis for total chromium and hexavalent chromium will be performed to determine the mass balance of the process.

Column testing will be run to determine the leach rate of sediment contaminated with hexavalent chromium using a flow rate equivalent to ten times faster than rainfall plus irrigation. This flow rate is within the range of most leach and adsorption tests performed in laboratory studies and will give a residence time of each packet of water of 4 days in the column. This reaction time is long enough for most simple surface adsorption and slightly soluble salt dissolution reactions to reach equilibrium. Samples will be taken over designated time intervals to establish the concentration of chromium in the effluent with time and sediment pore volumes eluted. A mass balance analysis will be performed using initial concentrations of sediment and water and continuing analyses of column effluent for total chromium and hexavalent chromium. A final leach rate will be determined based on the data collected.

2.0 SCOPE AND DESIGN

The scope of the testing will be limited to determining a 100 Areas Hanford Formation hexavalent chromium K_d and leach rate. The design of the test takes into consideration the range of contamination typically encountered in the field. The processing of sediment samples prior to testing is intended to result in material similar to the material that is used for closeout samples.

2.1 BATCH EQUILIBRIUM TESTING

The batch equilibrium testing method applies to situations in which only sorptive processes (i.e., adsorption and ion exchange) are operable for the species of interest and are considered to be the main mechanisms of concern. Batch testing will be used to acquire a minimum of three data points for each concentration to develop a plot of the

data (i.e., isotherm). The isotherm will demonstrate the relationship between the sediment and aqueous concentrations. The data will be evaluated to verify that the relationship of the partition coefficient over the range of concentration is independent of concentrations. The resulting K_d factor (assuming a linear relationship) will be reported as a 100 Areas Hanford Formation value. In the event of a non-linear relationship, the data will be evaluated for consideration of using concentration specific values.

Batch testing will consist of combining a measured weight of uncontaminated sediment with a measured quantity of spiked groundwater to a standard laboratory container, fully immersing the sediment at a ratio of 1:4 (sediment/water). The sediment or groundwater may contain trace levels of chromium and will need to be evaluated for background levels for corrections to the final calculations. The batch test container is typically agitated/mixed to ensure full and continuous contact between the sediment particles and groundwater. Samples are taken at discrete time intervals for analysis of the contaminant of interest. The analytical results are monitored, and the test is concluded when sample results are relatively unchanged from one time to the next. At this point, the concentration of the contaminant in the sediment is at equilibrium with the contaminant in the water. The sample data can be plotted to show the time required to reach equilibrium conditions. Once the time of equilibrium is established, the remainder of the data for each concentration will be evaluated for linearity. Due to the difficulty and highly variable results of sediment analyses, the sediment concentrations will be calculated by difference based on changes in concentrations of the water samples.

The water used will typify uncontaminated groundwater of the 100-HR-3 Operable Unit (uncontaminated portion of the groundwater unit underlying the 100-DR-1 Operable Unit) or natural precipitation. It is assumed that the pH and mineral content of this water will be consistent with previously collected samples.

2.1.1 Preliminary Screening

Preliminary screening will consist of 50 g samples and 200 mL of spiked groundwater. Three different spike levels of 0.1, 1.0 and 10 mg/L hexavalent chromium will be set up in triplicate for contact times of 4 and 14 days with groundwater/sediment blanks. There will also be container blanks (spiked groundwater without sediment) to account for Cr^{+6} stability and wall adsorption.

The preliminary screening will evaluate the adsorption process, provide information on the 5 concentrations that should be evaluated and the time intervals for testing. If this screening process shows the K_d to be 0.5 or less, the formal batch testing procedure will not be performed.

2.1.2 Batch Test Setup

An initial weight of 10 kg of uncontaminated sediments will homogenized by cone and quartering to acquire more representative and consistent subsamples. The material used for batch testing (passing a # 4 sieve) will be acquired through additional sieving of

enough of the split material. General chemistry (pH, conductivity, etc.) will be measured using an aqueous extract (Sparks, 1996). Initial testing of the uncontaminated sediment will include the following:

- Moisture content (initial)
- Wet sieve analysis after initial splitting (percentage of material retained/passing a series of sieves: 4, 10, 20, 40, 60, 100,140, and 200 mesh)
- Moisture content (after passing # 4 sieve)
- Sediment pH (50/50 mix with deionized water after 1 hour of contact)
- Conductivity (50/50 mix with deionized water after 1 hour of contact)
- Alkalinity (50/50 mix with deionized water after 1 hour of contact)
- Oxidation reduction potential (ORP) (50/50 mix with deionized water after 1 hour of contact)
- Major anions (50/50 mix with deionized water after 1 hour of contact)
- Major cations – acid digestion
- Total chromium – acid digestion
- Hexavalent chromium – alkaline extraction.

Prior to batch testing, the sieved sediments will be equilibrated in uncontaminated groundwater twice for a period of 24 hours. The samples will be centrifuged after each equilibration, to remove as much of the groundwater as possible. The amount of residual unspiked groundwater will be measured gravimetrically so that the small dilution, after spike addition, can be quantified.

Batch test will consist of subsamples of approximately 50 g to wide-mouth ,250-mL plastic containers known to not adsorb metals (high-density polyethylene, or equivalent) for each testing period in the batch test matrix (see Appendix B). All samples will be set up in triplicate. Accurate weights (nearest 0.1 g) and volumes (closest 0.1 mL) will be recorded on data sheets or in logbooks. After the pre-equilibration with unspiked groundwater, each container will then receive 200 mL of groundwater spiked with different levels of hexavalent chromium and the cap will be securely attached. Five different concentrations, as determined from initial screening, will be used in the batch testing. Groundwater will be spiked at a minimum volume of 2 L at a time from a stock solution of 1,000 mg/L hexavalent chromium. The stock solution will be made up from reagent-grade sodium dichromate and will be checked against accepted analytical

standards. Spiked solutions will be checked for pH and adjusted back to original groundwater levels if not within 0.1 units of the original measurements.

Initial testing of the unspiked groundwater will consist of the following:

- pH
- Conductivity
- Alkalinity
- ORP
- Total chromium
- Hexavalent chromium
- Major cations
- Major anions.

Sample containers will be well marked to represent each time period and sample shown in the batch test matrix. Due to the difficulty and highly variable results of sediment analyses, only the water phase of the batch testing will be analyzed. Final sediment concentrations will be calculated using mass balance rather than being determined analytically, directly on the sediments.

Each container will be mixed for 2 hours each day in a laboratory shaker/rotator. At the end of the assigned time periods, the samples will be allowed to settle, and an aliquot sufficient for the metals analyses will be decanted off and centrifuged at 1,400 g for 20 minutes. The resulting liquid will then be filtered using a 0.45-micron membrane filter and analyzed for total and hexavalent chromium. The remaining liquid will be tested for parameters other than metals (pH, conductivity, ORP).

2.1.3 Batch Test Sampling and Analysis Requirements

As a minimum level of analysis, the first data set will be compared with the next two data sets to determine if the various concentrations have reached equilibrium. If equilibrium has not been reached, the next data set will be processed at the assigned time and will be analyzed and compared to the previous data. This process will continue until at least three data points representing equilibrium conditions for each concentration have been established, or until the last set has been processed. Table 1 summarizes the sampling requirements and analytical parameters for batch test sampling.

Table 1. Batch Test Sampling Requirements.

Analyte	Frequency of Sample	Laboratory
Sediment Analyses Required		
Wet sieve analysis	Split sediments	PNNL
Moisture	Initial sediments (in triplicate) Split sediments (in triplicate)	PNNL
pH (aqueous extract)	Split sediments	PNNL
ORP (aqueous extract)	Split sediments	PNNL
Conductivity (aqueous extract)	Split sediments	PNNL
Alkalinity (aqueous extract)	Split sediments	PNNL
Cr^{+6} (alkaline extraction)	Split sediments (in triplicate)	Quanterra
Total chromium (acid digestion)	Split sediments (in triplicate)	Quanterra
Major cations (acid digestion)	Split sediments	Quanterra
Major anions (aqueous extraction)	Split sediments	PNNL
Water Analyses Required		
pH (water)	Initial characterization All batch tests Sediment blanks Equilibrium samples	PNNL
Conductivity (water)	Initial characterization All batch tests Sediment blanks Equilibrium samples	PNNL
ORP (water)	Initial characterization All batch tests Sediment blanks Equilibrium samples	PNNL
Cr^{+6} (water)	Initial characterization All batch tests Sediment blanks Equilibrium samples Container blanks	PNNL
Total chromium (water)	Initial characterization All batch tests Sediment blanks Equilibrium samples Container blanks	PNNL
Major cations (water)	Initial characterization Sediment blanks	PNNL
Major anions (water)	Initial characterization Sediment blanks	PNNL

2.1.4 Batch Test Quality Control Requirements

All sediment metals testing (total and hexavalent chromium) will be performed on samples collected in triplicate. Each sample will be analyzed in duplicate for a total of 6 analyses

Sediment blanks will consist of three 50 g aliquots in the same size bottles, with 200 mL of groundwater added. Container blanks will consist of 200 mL of each concentration used in the test, which will be added to the same size container. The container blanks will be analyzed at the end of the testing.

An evaluation of the effect of the sediment/water ratio will be performed on the middle concentration of spiked water by adding additional containers with 25 g sediment and 200 mL water (1:8 ratio), and 75 g sediment with 150 mL water (1:2 ratio). These containers will be analyzed with the last set of samples (i.e., the third data point after reaching equilibrium).

For the total Cr and Cr^{+6} analytical measurements, a minimum of one duplicate sample, matrix spike, and matrix spike duplicate will be analyzed for each sample group or 5%, whichever is more frequent. A minimum of one matrix spike and one matrix spike duplicate will be analyzed for each matrix or 5%, whichever is more frequent. In addition, a minimum of one method blank and control standard will be analyzed per sample group or 5%, whichever is more frequent, to verify system control

All quality control samples analyzed during batch testing are applicable to column testing.

2.2 COLUMN TESTING

Column testing consists of packing a vertical column with a measured amount (weight and volume) of sediment and allowing a constant source of water to flow through the column at a constant rate. The flow is from bottom to top to minimize air entrapment and channeling. The amount of water that percolates through the sediment is monitored and compared to the pore volume. The column effluent is sampled at discrete intervals in relation to the number of pore volumes passed through the sediment. The sample data can be plotted with the time or volume of water to create a plot showing leach rate or cumulative mass leached. The distribution coefficient (i.e., the K_d determined during batch testing) can be related by comparing the effluent concentration, pore volumes, contact time, and remaining sediment concentration after the system has stabilized and is no longer leaching. Final sediment concentrations will be calculated using mass balance rather than being determined analytically, directly on the sediments.

2.2.1 Column Test Setup

Flow through column leach testing will be conducted on contaminated sediment using uncontaminated groundwater. The column test will be used to graph the desorption curve (i.e., leach rate) and to estimate the sediment pore volumes required for complete hexavalent chromium desorption. A single column test will be conducted to provide data points for evaluating the hexavalent chromium leach rate.

The initial concentration of the contaminated sediment will be within the range typically encountered in the field. The column will be contacted with the volume of water expected to be present in one year [914 mm (36 in.) of water that represents rainfall (6 in.) plus irrigation (30 in.)]. To get results in a more timely fashion the flow rate will be selected to be 10 times this rate such that 914 mm of water can be collected in 40 days instead of one year. Given the dimensions of the proposed column the residence time for a pore volume of water will be 4 days, which is long enough to expect minimal kinetic effects for the leaching of slightly soluble Cr^{+6} salts. Leachate will be collected in small aliquots at a minimum of one sample per pore volume. Each aliquot will be analyzed so the hexavalent chromium and co-constituents can be tracked. The column test will continue until leaching is no longer occurring or a year's worth of solution has exited the column. Based on the column dimensions 9.75 pore volumes will be collected in 40 days. Final sediment concentrations will be calculated using mass balance rather than being determined analytically, directly on the sediments.

Prior to any testing, an initial weight of 20 kg of contaminated sediments (as received) will be homogenized by cone and quartering to acquire a more representative and consistent subsample. The material used for packing the column (passing a #4 sieve) will be acquired through additional sieving of a sufficient quantity of the split material. Sieve fractions from this work will be saved for possible future analyses. General chemistry (pH, conductivity, etc.) will be measured using an aqueous extract (Sparks, 1996). Initial testing of the contaminated sediment will include the following:

- Moisture content (initial)
- Wet sieve analysis after initial splitting (percentage of material retained/passing a series of sieves: 4, 10, 20, 40, 60, 100,140 and 200 mesh)
- Moisture content (after passing #4 sieve)
- Sediment pH (50/50 mix with deionized water after 1 hour of contact)
- Conductivity (50/50 mix with deionized water after 1 hour of contact)
- Alkalinity (50/50 mix with deionized water after 1 hour of contact)
- ORP (50/50 mix with deionized water after 1 hour of contact)
- Major anions (50/50 mix with deionized water after 1 hour of contact)
- Major cations – acid digestion
- Total chromium – acid digestion
- Hexavalent chromium – alkaline extraction.

All sediment metals testing (total and hexavalent chromium) will be performed on samples collected in triplicate. Each sample will be analyzed in duplicate for a total of 6 analyses

The sediment column will be 41-mm diameter by 244-mm deep (322.1 cm^3 of sediment) contained in an inert Teflon tube. Pore volume will be measured gravimetrically by the weight difference between the packed and fully saturated column. A 41-mm diameter by 914-mm tall column represents a volume of 1,207 mL. The 36 inch annual application rate is equivalent to 3.3 mL applied each day. At this rate the first pore volume (porosity assumed to be 38%) would take 37 days to elute. To speed up the process, the flow rate will be increased about 10 times the annual infiltration rate to equal a column residence time of 4 days.

All liquid will be collected and volumetrically measured for analysis and calculation of mass balance. The first pore volume will be collected in roughly four equal aliquots. The next four pore volumes will be collected using a frequency of 2 samples per pore volume, and the remainder of the samples will be collected at a frequency of one sample pore volume. Samples will be filtered prior to analysis with 0.45-micron membrane filters. These filters will have been shown to have no effect on total or hexavalent chromium.

2.2.2 Column Test Sampling Requirements

Prior to column testing, all sediment and groundwater will be sampled to determine the initial levels of contaminants and characteristics, if data are not already available. If project staff are confident of the samples collected, the testing may proceed prior to receipt of the lab data on the assumption it will confirm the material meets the project requirements. Table 2 summarizes the sampling requirements and analytical parameters for column test sampling.

Table 2. Column Test Sampling Requirements.

Analyte	Frequency of Sample	Laboratory
Sediment Analyses Required		
Sieve analysis	Split sediments	PNNL
Moisture	Initial sediments (in triplicate) Split sediments (in triplicate)	PNNL
pH (aqueous extract)	Split sediments	PNNL
ORP (aqueous extract)	Split sediments	PNNL
Conductivity (aqueous extract)	Split sediments	PNNL
Alkalinity (aqueous extract)	Split sediments	PNNL

Table 2. Column Test Sampling Requirements.

Analyte	Frequency of Sample	Laboratory
Cr^{+6} (alkaline extraction)	Split sediments (in triplicate)	Quanterra
Total chromium (acid digestion)	Split sediments (in triplicate)	Quanterra
Major cations (acid digestion)	Split sediments	Quanterra
Major anions (aqueous extraction)	Split sediments	PNNL
Water Analyses Required		
pH	Initial characterization Pore volume samples	PNNL
Conductivity	Initial characterization Pore volume samples	PNNL
ORP	Initial characterization Pore volume samples	PNNL
Cr^{+6}	Initial characterization Pore volume samples	PNNL
Total chromium	Initial characterization Pore volume samples	PNNL
Major cations	Initial characterization Pore volume samples	PNNL
Major anions	Initial characterization Pore volume samples	PNNL

2.2.3 Column Test Quality Control Requirements

For the total Cr and Cr^{+6} analyses, a minimum of one duplicate sample, matrix spike, and matrix spike duplicate will be analyzed for each sample group or 5%, whichever is more frequent. A minimum of one matrix spike and one matrix spike duplicate will be analyzed for each matrix or 5%, whichever is more frequent. In addition, a minimum of one method blank and control standard will be analyzed per sample group or 5%, whichever is more frequent, to verify system control.

All quality control samples analyzed for column testing are applicable to batch testing.

3.0 FIELD SAMPLE COLLECTION

To obtain the most representative contaminated and uncontaminated sediment for the test, actual sediment from the site will be collected from the pre-established sampling grid. Uncontaminated sediment should be free of chromium above background levels but may contain trace levels of constituents typically found within the deep zone (greater than

4.6 -m deep) sediments. Rock and cobble should typify the natural geology, provided that these items are compatible with laboratory equipment.

Groundwater used during testing will consist of uncontaminated groundwater from the 100-HR-3 groundwater unit aquifer. This is based on the assumption that water entering the vadose sediment will have been conditioned with these minerals and ions as the water percolates downward into the contaminated zone.

Sampling will follow standard operating procedures per BHI-EE-01, *Environmental Investigations Procedures*. Sample container requirements will be specified on a Sample Authorization Form in accordance with BHI-EE-01, Procedure 2.0, "Sample Event Coordination." Sample preservation will rely upon cold storage, and the addition of chemicals will not be permitted. Samples will be packaged in accordance with BHI-EE-01, Procedure 3.1, "Sample Packaging and Shipping," and will be sent directly to the laboratory to minimize holding times. Samples will be managed in accordance with applicable Environmental Restoration Contractor procedures. Samples will be controlled from the point of origin as required by BHI-EE-01, Procedure 3.0, "Chain of Custody." The sample event and pertinent details will be recorded in the project field logbook.

3.1 SEDIMENT SAMPLE REQUIREMENTS

To the degree possible, sediments should typify those found at the site. All samples shall be completely homogenized prior to use. Rock and cobble size should not exceed 64 mm (2.5 in.) to be compatible with laboratory equipment. If available, field screening shall be used to aid in identifying the contamination within the ranges specified in Table 3. Table 3 also summarizes the size of sample and typical constituent levels.

Table 3. Sediment Sample Requirements[a]

Sample Type or Intended Use	Amount Required	Constituent Levels	Likely Location at 116-D-7
Uncontaminated batch sample	20 kg	Cr^{+6}: ND Total Cr: #18.5 mg/kg	Overburden
Contaminated (leaching column sample	20 kg	Cr^{+6}: 25 mg/kg Total Cr: >500 mg/kg	Sample Area C8

[a]These requirements represent ideal circumstances and may not be feasible due to logistical constraints.
ND = nondetect

3.2 GROUNDWATER SAMPLE REQUIREMENTS

To the degree possible, uncontaminated groundwater should typify natural precipitation that has percolated through the upper 4.6 m (15 ft) of sediment above the contaminated zone. This type of water may be obtained from uncontaminated well water. Quarterly

groundwater sample records should be consulted to confirm the absence of hexavalent chromium from groundwater wells. Approximately 40 liters (10 gallons) will be required for the testing. The groundwater samples will be kept under refrigeration.

4.0 QUALITY CONTROL REQUIREMENTS

For the total Cr and Cr^{+6} analyses, a minimum of one duplicate sample, matrix spike, and matrix spike duplicate will be analyzed for each sample group or 5%, whichever is more frequent. A minimum of one matrix spike, and matrix spike duplicate will be analyzed for each matrix or 5%, whichever is more frequent. In addition, a minimum of one method blank and control standard will be analyzed per sample group or 5%, whichever is more frequent, to verify system control.

To achieve the test objectives, minimum data quality requirements have been established for samples and their associated analysis (Table 4).

Table 4. Sample Analysis Requirements

Analyte (Matrix)	Detection Limit	Percent Recovery	Relative Percent Difference	Preferred Analytical Method
Sieve analysis (sediment)	230 mesh	NA	NA	ASTM D 422 and ASTM D 2217
Moisture (sediment)	0.1%	NA	30	ASTM D 2216
pH (sediment extract)	0.1 Units	NA	30	9045C, SW-846, Ch. 6
ORP (sediment extract)	NA	NA	30	Pt/Calomel electrode
Conductivity (sediment extract)	10 uS/cm	NA	30	9050A, SW-846, Ch. 6
Alkalinity (sediment extract)	5 mg/L as $CaCO_3$	NA	30	301.1, 600/4-79-020
Alkaline extraction for Cr^{+6}	NA	NA	NA	3060A, SW-846
Cr^{+6} (sediment extract)	0.050 mg/kg	70-130	30	7196A, SW-846, Ch. 3.3
Acid digestion – total sediment	NA	NA	NA	3050A, SW-846, Ch. 3.2
Total chromium (sediment digestion)	0.005 mg/kg	70-130	30	7190, SW-846, Ch. 3.3
Major cations (sediment digestion)	0.050mg/kg	70-130	30	0200.7, 600-R-94-111
Major anions (sediment water extract)	0.1 mg/kg	70-130	30	9056, SW-846, Ch. 5
pH (water)	0.1 Units	NA	20	9040B, SW-846, Ch. 8.2
Alkalinity (water)	5 mg/L	NA	20	301.1, 600/4-79-020
Conductivity (water)	10 uS/cm	NA	20	9050A, SW-846, Ch. 6
ORP (water)	NA	NA	20	Pt/Calomel electrode
Cr^{+6} (water)	0.005 mg/L	80-120	20	7196A, SW-846, Ch. 3.3
Acid digest – total water	NA	NA	NA	3005A, SW-846, Ch. 3.2
Total chromium (water digestion)	0.005 mg/L	80-120	20	7190, SW-846 Ch 3.3
Major cations (water digestion)	0.01 mg/L	80-120	20	0200.7, 600-R-94-111
Major anions (water)	0.01 mg/L	80-120	20	9056, SW-846, Ch. 5

NA = not applicable
References for SW-846 were obtained from EPA 1979.

5.0 REFERENCES

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APPENDIX A

116-D-7 RETENTION BASIN ANALYTICAL DATA

Table A-1. 116-D-7 Hexavalent Chromium and Total Chromium Analytical Results.

Sample Location	Sample Number	Cr^{+6} (mg/kg)	Total Chromium (mg/kg)	Notes
A1	B0PK25	1.3	117	
A2	B0PK19	2.9	153	
A3	B0PK24	0.80 U	144	
B4	B0PK17	0.80 U	226	
B5	B0PK23	8.5	339	
B6	B0PK21	0.80 U	131	
C7	B0PK26	1.4	117	
C7	B0PK27	3.0	142	Duplicate of B0PK26
C7	B0PK16	5.89	209	Split of B0PK26
C8	B0PK20	18.0	152	
C9	B0PK18	3.8	90.9	

U = not detected

Figure A-1. Chromium Levels at 116-D-7.

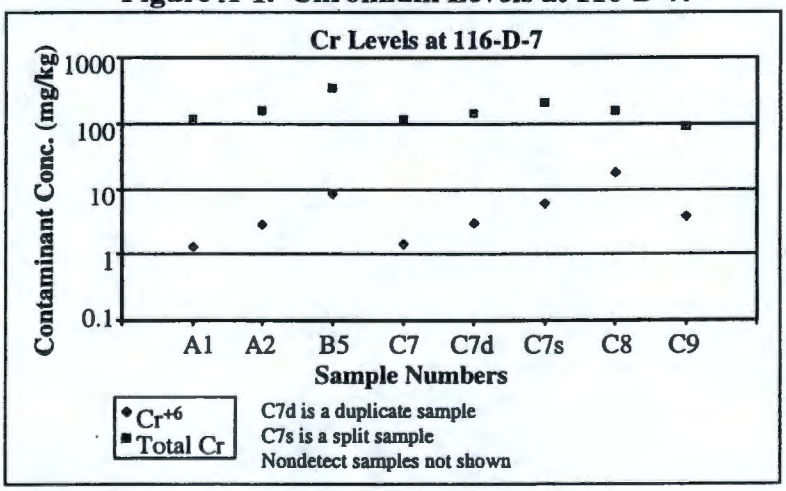
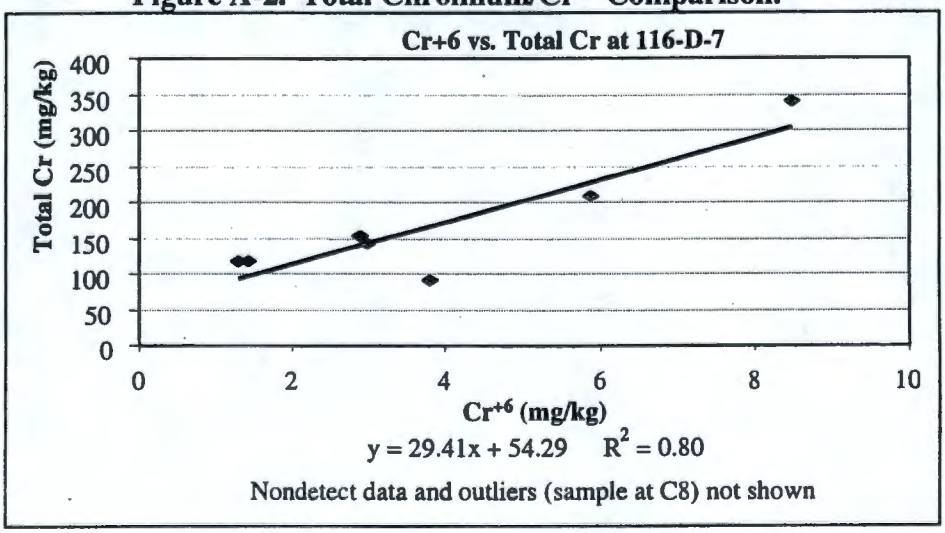


Figure A-2. Total Chromium/Cr^{+6} Comparison.



APPENDIX B

BATCH TEST DATA FORMS

Table B-1. Batch Test Matrix. (3 pages)

Time	pH	Cond.	ORP	T- Cr	Hex Cr
First					
Conc. #1					
A					
B					
C					
Conc. #2					
A					
B					
C					
Conc. #3					
A					
B					
C					
Conc. #4					
A					
B					
C					
Conc. #5					
A					
B					
C					
Time	pH	Cond.	ORP	T- Cr	Hex Cr
Second					
Conc. #1					
A					
B					
C					
Conc. #2					
A					
B					
C					
Conc. #3					
A					
B					
C					
Conc. #4					
A					
B					
C					

Table B-1. Batch Test Matrix. (3 pages)

Time	pH	Cond.	ORP	T- Cr	Hex Cr
Conc. #5					
A					
B					
C					
Time	pH	Cond.	ORP	T- Cr	Hex Cr
Third					
Conc. #1					
A					
B					
C					
Conc. #2					
A					
B					
C					
Conc. #3					
A					
B					
C					
Conc. #4					
A					
B					
C					
Conc. #5					
A					
B					
C					
Time	pH	Cond.	ORP	T- Cr	Hex Cr
Fourth					
Conc. #1					
A					
B					
C					
Conc. #2					
A					
B					
C					
Conc. #3					
A					
B					
C					

Table B-1. Batch Test Matrix. (3 pages)

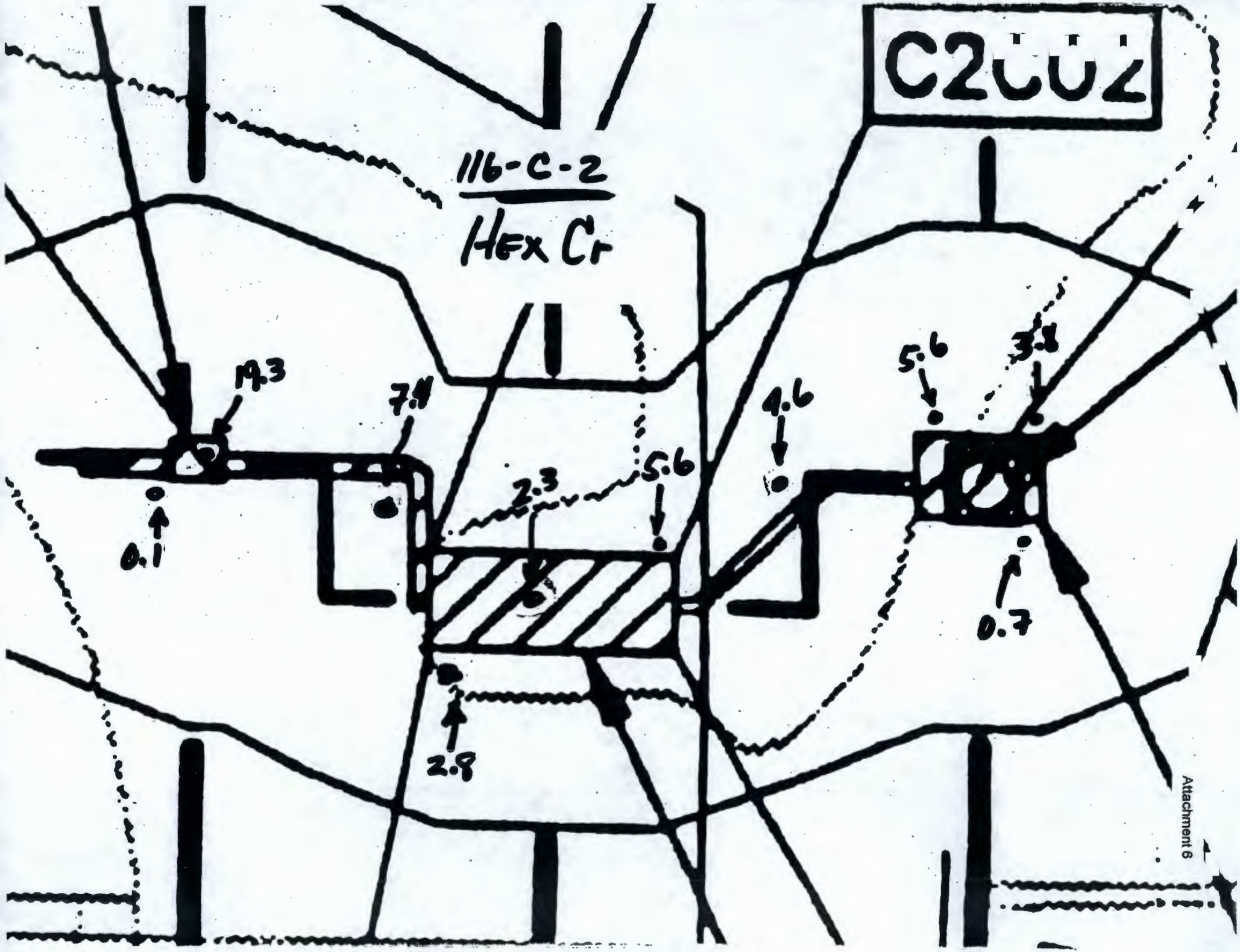
Time	pH	Cond.	ORP	T- Cr	Hex Cr
Conc. #4					
A					
B					
C					
Conc. #5					
A					
B					
C					
Time	pH	Cond.	ORP	T- Cr	Hex Cr
Fifth					
Conc. #1					
A					
B					
C					
Conc. #2					
A					
B					
C					
Conc. #3					
A					
B					
C					
Conc. #4					
A					
B					
C					
Conc. #5					
A					
B					
C					

Table B-2. Sediment Ratio Batch Test Matrix.

Sediment Ratio Variation 1:2 (75 g sediment + 150 mL conc. #3)					
	pH	Cond	ORP	T- Cr	Hex Cr
Conc. #3					
A					
B					
C					
Sediment Ratio Variation 1:8 (25 g sediment + 200 mL conc. #3)					
	pH	Cond	ORP	T- Cr	Hex Cr
Conc. #3					
A					
B					
C					

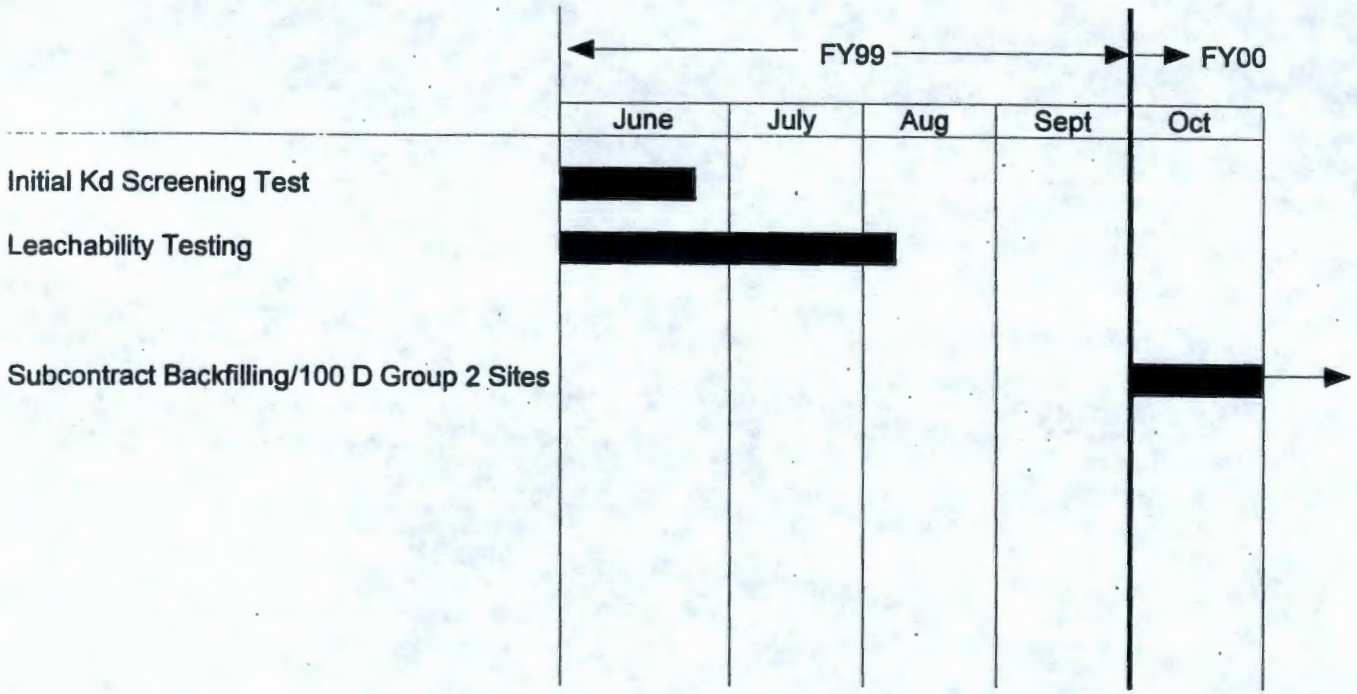
Table B-3. Quality Assurance/Quality Control Samples.

Blank Sediment with Groundwater					
	pH	Cond	ORP	T- Cr	Hex Cr
A					
B					
C					
Container Blanks					
	pH	Cond	ORP	T- Cr	Hex Cr
Conc. #1					
Conc. #2					
Conc. #3					
Conc. #4					
Conc. #5					



Attachment 6

100 D Kd/Leachability Testing Schedule - Relative to Backfill Schedule



Attachment 7

Waste Site: 116-C-5	**BACKFILL CONCURRENCE CHECKLIST** (Concurrence to Proceed with Waste Site Backfill Operations)	WIDS No.: 116-C-5

This checklist is a summary of cleanup verification results for this site. The checklist is intended as an agreement allowing the ERC subcontractor to backfill this site prior to the issuance of the final cleanup verification package. 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 calculated by RESRAD is 14.6 mrem/yr (not accounting for clean backfill).	Yes	A
Direct Exposure – Nonradionuclides	1. Attain individual COC RAGs.	1. All individual COC concentrations are below the RAGS.	Yes	B
Meet Nonradionuclide Risk Requirements	1. Hazard quotient ratio of <1 for noncarcinogens.	1. All hazard quotient ratios are below 1.	Yes	B
	2. Cumulative hazard quotient ratio of <1 for noncarcinogens.	2. Cumulative hazard quotient ratio is 0.023.		B
	3. Excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	3. Excess cancer risk for individual carcinogens are all less than 1×10^{-6}.		B
	4. Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	4. Cumulative excess cancer risk is 6×10^{-10}.		B
Groundwater/River Protection – Radionuclides	1. Attain single COC groundwater & river RAGS.	1. All single COC Groundwater and river RAGs have been attained.	Yes	C
	2. Attain National Primary Drinking Water Regulations 4-mrem/yr (beta/gamma) dose standard to target receptor/organ.	2. All organ specific doses are below the 4-mrem/yr dose standard.		C
	3. Meet National Primary Drinking Water Regulations 15 pCi/L (alpha activity) standard.	3. The alpha activity is 0 pCi/L for all years.		C
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater & river RAGs.	1. All the groundwater and river RAGs have been attained.	Yes	A,B
Other Supporting Information	1. The maximum excess cancer risk from radionuclides (calculated via RESRAD modeling) is 1.3×10^{-4} at present.			A
	2. Sample variance calculation (available upon request).			D
	3. Sample location design (available upon request).			E

All citations above and references on attached sheet are on record with Bechtel Hanford, Inc., Document and Information Services. Above noted regulatory requirements have been attained.

BHI Task Manager	Date	BHI Project Engineer	Date	DOE Project Manager	Date
[signature]	5/27/99	[signature]	5/27/99	[signature]	5/27/99

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.

EPA Project Manager	Date	Ecology Project Manager	Date
[signature]	6-1-99	N/A	N/A

Backfill Concurrence Checklist Attachments/References

Attachment	Ref.	Description
1	***	Summary of cleanup verification results
2	A	RESRAD Calculations Supporting Closeout of the 116-C-5 Remediation Site, 0100B-CA-N0010
3	B	116-C-5 95% UCL Calculations for Compliance with Cleanup Standards, 0100C-CA-V0007
4	C	116-C-5 Comparison to Drinking Water Standards, 0100C-CA-V0008
	D	Sample Variance Calculation, 0100B-CA-V0016 (available upon request)
	E	Sample Location Design, 0100B-CA-V0015 (available upon request)
5		116-C-5 Deep Zone Cleanup Verification Model, 0100B-CA-V0018

ROUTINE USE OF HEPA-FILTERED VACUUM AT THE N-SPRINGS PUMP AND TREAT PROJECT

Background

Action are being taken under the *Comprehensive Environmental Response, Compensation, and Liability Act* at the N Springs to reduce the strontium-90 flux to the groundwater that feeds N Springs. This is being accomplished through extracting contaminated groundwater, removing strontium-90 utilizing clino resins, and re-injecting the treated groundwater.

Description of Routine Use

A HEPA-filtered vacuum is routinely used during resin change out at the N-Springs pump and treat project. The vacuum is used to cleanup up the area surrounding the resin tanks. When the vacuum is emptied, the material is sent the Environmental Restoration Disposal Facility (ERDF) for disposal.

Evaluation of Potential-to-Emit

The potential for radioactive air emissions from the routine use of the HEPA-filtered vacuum has been evaluated. The evaluation is based on: 1) utilizing the vacuum once per month during resin change out, 2) the conservative assumption that up to 12 cubic feet of resin could be spilled and vacuumed in a given year, 3) resin sample analysis data for disposing the resin to ERDF, and 4) a release fraction of 1, which is conservative as the material is wetted.

The potential dose to the maximally exposed individual, located at 17,320 meters east of N Area, is 8.08 E-06 mrem/yr. This dose if far less then the 0.1 mrem/yr dose that is used to define a significant emission source.

Documentation

When the vacuum is emptied for disposal, an estimate will be made of the volume contained in the vacuum. This will be documented (e.g., field logbook) and maintained by BHI project personnel for review by the regulatory agencies upon request.

Concurrence

A. W. Conklin, WDOH	Date	Ecology	Date
A. C. Tortoso, RL	Date	A. V. Ingle, RL	Date

PASSIVELY VENTED EMISSIONS
PUMP AND TREAT PROJECTS

PURPOSE

- This briefing is to inform EPA and Ecology Project Managers of a potential issue raised by DOH concerning radioactive air emissions from passively vented sources at the Hanford Site.

- This issue could apply to the tanks located at the various pump and treat projects.

AIR OPERATING PERMIT

- The draft Hanford Site Air Operating Permit (AOP) (to be issued in the summer of 1999) identifies a compliance schedule for passively ventilated point sources (rad sources):
  - "In a time not to exceed 12 months from the effective date of this permit, the licensee shall identify categories of passively ventilated point sources or other specific emission units"
  - "In a time not to exceed 18 months from the effective date of this permit, the licensee shall establish a statement of methods for determining compliance, including a description of measurement methods, recordkeeping, and reporting for each category of passively ventilated point sources or other specific emissions units."

CERCLA ACTIONS

- CERCLA projects are exempt from permitting (under CERCLA permitting is an administrative requirement that does not have to be met). AOP acknowledges that CERCLA activities are exempt.
- CERCLA must meet the substantive requirements that are applicable, relevant, or appropriate.
- DOH has identified that passively ventilated point sources must be evaluated for compliance with WAC 246-247. (see above)

PUMP AND TREAT ABILICABILITY

- Each of the pump and treat projects utilize tanks that are passively ventilated to the atmosphere.
- With the exception of the 200-ZP-1 Pump and Treat project, the radionuclide concentrations in the tanks are above MCLs.
- The HR-3/KR-4 ROD does not identify WAC 246-247 as an ARAR. The Action Memorandum for N Springs does not identify WAC 246-247. The two CMS documents for N Area do identify WAC 246-247 as an ARAR. The draft ROD for N Area identifies WAC 246-247 but does not provide any specifics about what it applies to (e.g., soil or groundwater activities)

- An estimate of the inventory and potential emissions from the Pump and Treat projects have been calculated. (see attached sheet).
- The emission estimates are low and very conservative as the DOH release fraction of 1 E-03 was assumed.

100-HR-3 Pump and Treat

Attachment 10

077094

Isotope	Annual Possession Quantity, Ci	Release Fraction	Potential to Emit, Ci/yr
H-3	9.18E-01	1.00E+00	9.18E-01
Sr-89/90	1.44E-03	1.00E-03	1.44E-06
Tc-99	1.18E-02	1.00E-03	1.18E-05
U-234	4.88E-04	1.00E-03	4.88E-07
U-235	1.98E-05	1.00E-03	1.98E-08
U-238	4.84E-04	1.00E-03	4.84E-07
Y-90	1.44E-03	1.00E-03	1.44E-06

100-KR-4 Pump and Treat

Isotope	Annual Possession Quantity, Ci	Release Fraction	Potential to Emit, Ci/yr
H-3	3.42E+00	1.00E+00	3.42E+00
Sr-89/90	1.45E-03	1.00E-03	1.45E-06
Tc-99	2.97E-04	1.00E-03	2.97E-07
U-234	3.75E-04	1.00E-03	3.75E-07
U-235	1.52E-05	1.00E-03	1.52E-08
U-238	3.71E-04	1.00E-03	3.71E-07
Y-90	1.45E-03	1.00E-03	1.45E-06

100-NR-2 Pump and Treat

Isotope	Annual Possession Quantity, Ci	Release Fraction	Potential to Emit, Ci/yr
H-3	2.52E+00	1.00E+00	2.52E+00
Co-60	2.20E-04	1.00E-03	2.20E-07
Cs-137	6.02E-05	1.00E-03	6.02E-08
Ba-137m	5.69E-05	1.00E-03	5.69E-08
Eu-155	1.64E-05	1.00E-03	1.64E-08
Sr-89/90	1.96E-01	1.00E-03	1.96E-04
Sr-90	4.01E-02	1.00E-03	4.01E-05
U-234	1.43E-05	1.00E-03	1.43E-08
U-235	5.82E-07	1.00E-03	5.82E-10
U-238	1.42E-05	1.00E-03	1.42E-08
Y-90	4.01E-02	1.00E-03	4.01E-05

100-HR-3: The unabated offsite dose and the location to the MEI 10,480 meters E is 5.50E-05 mrem/yr.
100-KR-4: The unabated offsite dose and the location to the MEI 14,020 meters W is 1.08E-04 mrem/yr.
100-NR-2: The unabated offsite dose and the location to the MEI 17,320 meters E is 9.36E-05 mrem/yr.

+/- 20%