MEETING NOTES
Waste Management Area C RCRA Facility Investigation Report

MEETING DATE: April 21, 2016
LOCATION: Washington State Department of Ecology Office, Richland, WA
ATTENDEES:

Alaa Aly (CHPRC)	Andrea Hopkins (WRPS)	MD M Rahman (INTERA)
Mike Barnes (Ecology)	Chris Kemp (DOE-ORP)	Julie Robertson (Freestone)
Marcel Bergeron (WRPS)	Jeff Lyon (Ecology)	Beth Rochette (Ecology)
Ryan Childress (WRPS)	Alexander Pappas (WRPS)	Kristin Singleton (WRPS)
Mike Cline (DOE-RL)	Dan Parker (WRPS)	Cindy Tabor (WRPS)
Damon Delistraty (Ecology)	Anna Radloff (WRPS)	

BACKGROUND INFORMATION: The meeting was called to promote continued Ecology, EPA, DOE, and WRPS discussion about comments associated with and revision of RPP-RPT-58339, Rev. A Draft *Phase 2 RCRA Facility Investigation Report for Waste Management Area C* (WMA C RFI Report). The report was submitted to Ecology and EPA in December 2014 to meet *Hanford Federal Facility Agreement and Consent Order* (HFFACO) Milestone M-045-61. Ecology's February 23, 2015 response to the RFI report submittal (Letter 15-NWP-37) noted that holding "a recurring meeting to discuss statements, regulatory interpretations, and the process steps for obtaining an agreeable RFI/CMS process for WMA C Closure" would be beneficial. Ecology comments on the WMA C RFI Report and supporting documents were transmitted on July 7, 2015, "Department of Ecology's (Ecology) Completed Review of Phase 2 RCRA Facility Investigation Report for Waste Management Area C, RPP-RPT-58339, Revision A Draft" (15-NWP-120).

Lists of expectations, agreements, and actions (including the status of any actions) are documented in the meeting notes.

PURPOSE OF MEETING: This meeting was called to discuss select comments on the WMA C RFI Report, the *Baseline Risk Assessment for Waste Management Area C* (RPP-RPT-58329, Rev. 0; BRA), and .the *Screening-Level Evaluation of Groundwater Monitoring Data Collected in Vicinity of WMA C* (RPP-RPT-58297, Rev. 0; GWSC).

STATUS OF PRIOR MEETING NOTES: Ms. Robertson provided status information on the following sets of meeting notes:

- January 21, 2016, meeting: Entered into the HFFACO Administrative Record.
- February 23, 2016, meeting: Ecology comments are being incorporated.
- March 17, 2016, meeting: Signed during this April 21, 2016, meeting.
- March 29, 2016, meeting: Undergoing internal review.

DISCUSSION OF SELECT ECOLOGY COMMENTS ON WMA C RFI REPORT AND BRA: The attendees discussed select Ecology comments on the WMA C RFI Report and proposed responses. The discussion was divided into four parts, followed by a summary, as shown in Attachment 1.

- **Bigger Issue Comment Responses (Attachment 1, Item 1)**: Ms. Tabor reviewed the proposed DOE responses to six Ecology comments. Attachment 2 identifies these comments and proposed responses and provides a summary of the discussion. Ms. Tabor identified that these six responses were representative of 53 comment responses (listed in Attachment 1) that are associated with more complex matters related to WMA C soil remediation and integration with the 200-BP-5 Operable Unit (OU) groundwater information. In general, the six discussed responses addressed the following points:

  - DOE will develop a roadmap to identify what information is contained in various WMA C soil and 200-BP-5 OU documents and how information associated with these documents will be integrated. HFFACO Action Plan Appendix I and the *Single-Shell Tank Waste Management Area C RCRA/CERCLA Integration White Paper* (RPP-46459) also provide information on the integration process.
  - DOE will reference the *Remedial Investigation Report for the 200-BP-5 Groundwater Operable* Unit (DOE/RL-2009-127) in the revised WMA C RFI Report.
  - The HFFACO Action Plan Appendix I Performance Assessment (IPA) will assist in the determination of soil contamination with respect to WMA C.

  A brief summary of the outcome of the discussion on each of the six representative comments and proposed responses is provided below.

  Damon RFI 34: This comment response is representative of the responses associated with the GWSC and a subset of comments on the WMA C RFI Report.

  Remains Open – The meeting attendees felt that further discussion on this topic is needed and agreed to hold open this comment and all others it represents for the purposes of this discussion. The attendees agreed to modify Expectation 1 based on this discussion.

  ECY RFI 3: DOE stated their intention to hold a workshop in mid-May 2016 to discuss the integration between WMA C and the 200-BP-5 OU, during which the roadmap will be presented.

  Tentatively Agreed – Ecology tentatively agreed to the proposed responses to ECY RFI 3 and the related portions of responses to the associated comments, pending Ecology review of the roadmap. The attendees agreed to delete Expectation 2 and create a new action (2016-04-21-1) based on this discussion. Deleted Expectation 2 was dated March 17, 2016, and stated "By the end of May 2016, an agenda item will be added to allow for discussion of the results of Action Number 2015-10-28-2 regarding groundwater integration."

  ECY RFI 4: Ms. Tabor referred to an email from Ms. Skorska dated February 25, 2016, that indicates this comment was from Mr. Lyon (Attachment 3). As shown on page 2 of Attachment 2, there are three parts to the comment and response; the parts are associated with CERCLA integration, area outside of the WMA C fenceline (labeled #1), and pipeline issues (labeled #2).

  Tentatively Agreed – Ecology tentatively accepted the portion of the response related to the roadmap pending their review of the roadmap, as noted above. Ecology also tentatively accepted the portion of the response under paragraph #1, pending incorporation into the revised WMA C RFI Report.

Tentatively Agreed Pending Modification – Regarding the response under paragraph #2, Ecology asked that the last sentence of HFFACO Action Plan Appendix I, Section 2.2.2, be added to the revised RFI Report: "The extent to which Ecology will use the RCRA corrective action process to fulfill the requirements of WAC 173-303-610 will be selected through approval of the WMA Closure Action Plans." With this modification, Ecology tentatively accepted the response to the portion of the response under paragraph #2, pending incorporation into the revised WMA C RFI report.

Joe RFI 2: This comment pertains to nature and extent information.

Tentatively Agreed – Ecology tentatively accepted the proposed response to Joe RFI 2 and the related portions of responses to the associated comments, pending Ecology review of the Appendix I Performance Assessment documentation.

Joe RFI 17: This comment pertains to integration of groundwater information.

Remains Open – Mr. Barnes tentatively accepted the proposed response to Joe RFI 17. Mr. Barnes asked that WRPS/DOE follow up with Mr. Caggiano, who was not in attendance at the meeting. Ms. Tabor took an action to contact Mr. Caggiano.

Joe RFI 101: This comment pertains to the regulatory process associated with remediation including integration of groundwater information.

Remains Open – Mr. Barnes tentatively accepted the proposed response to Joe RFI 101. Mr. Barnes asked that WRPS/DOE follow up with Mr. Caggiano, who was not in attendance at the meeting. Ms. Tabor took an action to contact Mr. Caggiano.

- **Responses to Ecology Comments ECY RFI 2 and Joe RFI 6 (Attachment 1, Item 2)**:

ECY RFI 2: **Remains Open**. Ms. Tabor handed out Attachment 4 for discussion. The three emails that are referenced in Attachment 4 are provided as Attachments 3, 5, and 6 to these meeting notes. Attachment 3 is the referenced email from Ms. Skorska dated February 25, 2016. Attachment 5 is the referenced email from Ms. Skorska dated April 12, 2016. Ms. Tabor took an action to contact Ms. Skorska, who was not in attendance at the meeting, to discuss the proposed response to ECY RFI 2.

Ms. Tabor also noted that Ecology agreed to the proposed responses to comments ECY RFI 1, ECY RFI 5, and ECY RFI 6 in the email included as Attachment 3.

Joe RFI 6: **Tentatively Agreed**. Attachment 6 is the referenced email from Mr. Caggiano dated April 19, 2016. Attachment 6 documents Ecology acceptance of the proposed revised response to Joe RFI 6 (pending incorporation into the revised WMA C RFI Report).

- **Risk Comment Responses (Attachment 1, Item 3)**: Ms. Tabor handed out Attachment 7, covering 17 comments, for discussion.

Damon BRA 12: **Tentatively Agreed Pending Modification**. Dr. Delistraty tentatively agreed to the proposed revised response, pending modification to BRA Figure 3-1 and incorporation into the

revised BRA. The figure should be modified to delete the superscript "1" from the exposure routes for ingestion of fruit, vegetables, meat, and milk. Superscript "1" should remain for the exposure route for inhalation during showering. The figure should also be modified to add a superscript "2" to the pathway for dermal contact coming out of the groundwater exposure medium.

Damon BRA 14: **Remains Open.** Dr. Delistraty requested that clarifications he provided in his email dated April 15, 2015 (Attachment 8), be added to the Comment & and Basis/Justification column used to track the Ecology comments and proposed responses. Ms. Tabor took an action to do so.

Damon BRA 53: **Tentatively Agreed**. Dr. Delistraty tentatively agreed to the proposed revised response, pending incorporation into the revised BRA.

The meeting attendees deferred discussion of the following comments due to lack of time: Damon BRA 16, 17, 19, 43, 44, and 60; Damon RFI 8, 11, 12, 19, 20, 23, 32, and 45. The attendees agreed that having additional time to discuss the comments and proposed responses would be beneficial for the project. As a result, Mr. Kemp took an action to prepare a request extending the comment resolution period to June 5, 2016.

- **Responses emailed on April 19, 2016 (Attachment 1, Item 4):** Ms. Tabor stated that draft proposed responses to 44 comments were emailed to select Ecology commenters on April 19, 2016 (Attachment 9). The responses were provided for information only; however, Ms. Tabor requested that the commenters review the responses to identify any that cause significant concern.

EXPECTATIONS, AGREEMENTS, AND ACTIONS: Expectations, agreements, and actions are provided in the tables that follow.

NEXT MEETING: The next meeting will be scheduled for the morning of April 27, 2016. The discussion topic is the remaining risk comments for which there was insufficient discussion time at this April 21, 2016, meeting.

Ryan E. Beach	Ryan E Beach	6/6/16
DOE Project Manager (print)	DOE Project Manager (signature)	Date
Michael W Barnes	Michael W Barnes	6-8-16
Ecology Project Manager (print)	Ecology Project Manager (signature)	Date

DATE	EXPECTATIONS
01/23/2016	1. Ecology's expectation is that the 200-BP-5 OU documentation must be finalized and approved if the revised WMA C RFI Report refers to it for groundwater information needed to support WMA C soil cleanup decisions.

DATE	AGREEMENTS
04/15/2015	1. Regarding references in RPP-RPT-58339, Rev. A Draft *Phase 2 RCRA facility investigation Report for Waste Management Area C* to RPP-PLAN-37243 *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management* Areas: • References in the draft RFI report are adequate as is and do not require modification. • The HFFACO milestone (M-045-58) associated with the Master Work Plan is complete. • It would be beneficial to continue discussion on the topics covered in the Master Work Plan.

ACTIONS (2 pages)			
Action Number	**Actionee**	**Description**	**Status**
2015-08-26-1	Cindy Tabor	Evaluate whether internet links to reference documents can be added to the RFI report.	Available reference links will be added to the RFI Report. Closed 04/21/2016.
2015-10-28-1	Mike Barnes	Ms. Tabor, Ms. Radloff, and Messrs. Barnes, Caggiano, and Bergeron will work together to clarify what groundwater technical information Ecology needs to see in the RFI report. The parties will also identify whether that information is in 200-BP-5 documents, and if so, where.	In progress. See action 2015-10-28-2 and 2016-04-21-1.
2015-10-28-2	Ryan Beach	Develop a path forward for the groundwater integration approach.	In progress. See Action 2016-04-21-1.
2016-01-21-1	Cindy Tabor/Julie Robertson	Identify and report back regarding where WMA C RFI Report provides information on the currently agreed-to RFI/CMS process.	Completed with 04/19/16 email from Joe Caggiano (Attachment 6). Response to Joe RFI 6 will also be modified per email agreement. Closed 04/21/2016.
2016-01-21-5	Ryan Beach	Track DOE-RL responses to Ecology comments related to groundwater (200-BP-5) and report back at future WMA C RFI Report meetings.	In progress. See Action 2016-04-21-1.
2016-03-29-1	Marcel Bergeron	Identify and report back on correct citation to respond to WMA C RFI Report comment Joe 36.	Correct citation (WAC 173-160-460) was provided by Joe Caggiano on 03/29/16. Closed on 04/21/2016.

ACTIONS (2 pages)			
Action Number	**Actionee**	**Description**	**Status**
2016-04-21-1	Chris Kemp	Prepare a groundwater integration roadmap for presentation in May 2016.	New.
2016-04-21-2	Cindy Tabor	Contact Joe Caggiano regarding proposed responses to comments related to Joe RFI 17.	New.
2016-04-21-3	Cindy Tabor	Contact Joe Caggiano regarding proposed responses to comments related to Joe RFI 101.	New.
2016-04-21-4	Cindy Tabor	Contact Marysia Skorska regarding proposed response to comment ECY RFI 2.	New.
2016-04-21-5	Alaa Aly	Set up follow-up meeting for April 27, 2016.	New.
2016-04-21-6	Cindy Tabor	Add clarifications from Damon Delistraty email dated April 15, 2015 (Attachment 8), to the "Comment & Basis/Justification" column used to track the Ecology comments.	New.
2016-04-21-7	Chris Kemp	Submit a formal request to Ecology extending the comment resolution period for responding to Ecology comments on the WMA C RFI Report to June 5, 2016.	New.

Attachment 1 (2 pages)
WMA C RFI RCR Discussion

1. **Bigger Issue – Discussion 4/21/16 Meeting** (53 Comments)

Commenter	Document	Comment #
Damon	BRA	1 and 13
	RFI RFI (GWSC)	1 and 2 33, ***34***, 35, 38, 39, 40, 41, 42, 46, 47, and 48
Beth	GWSC	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19
	RFI (GWSC)	2
ECY	RFI	***3*** and ***4***
Joe	RFI RFI (GWSC)	1, ***2***, 3 4, 5, 9, 10, 16, ***17***, 24, 27, 94, ***101***, 102, 105, and 110 71 and 89
Mike	RFI (GWSC)	20

Highlighting indicates comment was referring to RPP-RPT-58297, *Screening-Level Evaluation of Groundwater Monitoring Data Collected in Vicinity of WMA C* or was referencing information from this report.
Numbers that are bold, italicized, and highlighted indicates responses for comment # were provided for meeting. All other responses for comment #s are similar to ones provided.

2. **ECY RFI 2 and Joe RFI 6 – Discussion 4/21/16 Meeting**

3. **Risk Comments – Discussion 4/21/16 Meeting** (17 Comments)

Commenter	Document	Comment #
Damon	BRA	12, 14, 16, 17, 19, 43, 44, 53, and 60
	RFI	8*, 11, 12, 19, 20, 23, 32, and 45

*Figure 7-3 (RFI report) and Figure 3-1 (BRA report) are the same figure.

4. **Emailed on 4/19/ 16 – Courtesy Copy prior to submittal of RCR** (44 Comments)

Commenter		Item
Joe	RFI	18, 53, 55, 56, 57, 58, 59, 60, 61, 65, 67, 68, 69, 72, 73, 74, 75, 77, 95, 97, 98, 99, 104, 106, 107, 108, 111, 112, 114, 115, 116, 117, and 118
Mike		1, 4, 14, 15, 16, 17, 18, 19, 21, and 22

Attachment 1 (2 pages)
WMA C RFI RCR Discussion

5. Summary of Responses:

280 Comments

163 Responses – Ecology has concurred
53 Responses are associated with Bigger Issues (4/21/16)
44 Responses sent as a Courtesy (4/19/16)
17 Responses are associated with the Risk Comments (4/21/16)
2 Responses remain open per Beth Rochette (BRA)
1 Response is associated with ECY 2 Comment (4/21/16)

Attachment 2 (5 pages)
Bigger Issue – Discussion 04/21/2016 (6 Comments)

Commenter	Item	Page #, Section #, Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response	Summary of 04/21/2016 Discussion
Damon	34	P 7-46, S 7.7.2, L 36-38	Text refers to Section 7.3.2, but there is none. Clarify that the data set contained 25738 records and 300 analytes (before removal of excluded analytes and nondetects) for consistency with Figure 7-8.	RFI	7 + GWSC	The information presented, with respect to the comment, pertains to the RPP-RPT-58297, *Screening-Level Evaluation of Groundwater Monitoring Data Collected in Vicinity of WMA C*. The WMA C RFI will be updated to reference and provide a brief summary of the 200-BP-5 Operable Unit Remedial Investigation and the WMA C Appendix I Performance Assessment documents with respect to groundwater information. RPP-RPT-58297 will no longer be referenced in the updated RFI. Please refer to the 200-BP-5 Remedial Investigation for current groundwater risk assessment information and for those constituents that have impacted groundwater from WMA C. If you have a comment with respect to the information in the 200-BP-5 Remedial Investigation, please provide your comment to Nina Menard at the Washington State Department of Ecology.	Mr. Lyon reiterated Ecology's expectation that if the updated WMA C RFI Report refers to the 200-BP-5 OU RI Report to support WMA C soil cleanup decisions, then the RI must be finalized and approved. He stated that Ecology comments on the WMA C RFI Report must be resolved. He added that there appear to be at least two pathways to achieve resolution: (1) DOE could incorporate groundwater information addressing the Ecology comments into the final, approved 200 BP-5 OU documentation, then cite that documentation in the revised WMA C RFI Report; or (2) DOE could incorporate the groundwater information into the revised WMA C RFI Report. Mr. Kemp stated that it may not be possible to achieve either of those alternatives in a time frame that will meet the HFFACO M-045-61A milestone date for submittal of the Rev. 0 update to the WMA C RFI Report, and that DOE may need to consider submitting a HFFACO change package to delay the milestone date. Outcome: The meeting attendees felt that further discussion on this topic is needed and agreed to hold open this comment and all others it represents for the purposes of this discussion. The attendees agreed to modify Expectation 1 based on this discussion.
ECY	3	1-9, lines 33-34	"The integration between the vadose zone program and the groundwater program is described in Section 5 of this master work plan (RPP-PLAN-37243)." The material is not in Section 5, please correct. **Email from Maria Skorska on 02/25/16, Subject WMA C RFI - ECY responses to proposed resolutions of ECY's comments** "The response is not accepted. The RFI needs to discuss the relationship between the vadose zone program and the groundwater program. (MBS)"	RFI	1	A "roadmap" (e.g., table, chart) that identifies what information is contained in WMA C and 200-BP-5 Operable Unit documents and how this information is integrated will be presented to Ecology prior to the WMA C RFI submittal. The roadmap will also be included in the updated WMA C RFI.	DOE anticipates holdng a workshop in mid-May 2016 to discuss the interface between the two projects, during which the roadmap will be presented. Outcome: Ecology tentatively agreed to the proposed responses to ECY RFI 3 and the related portions of responses to the associated comments, pending Ecology review of the road map. The attendees agreed to delete Expectation 2 and create a new action based on this discussion.

Attachment 2 (5 pages)
Bigger Issue – Discussion 04/21/2016 (6 Comments)

Commenter	Item	Page #, Section #, Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response	Summary of 04/21/2016 Discussion
ECY	4	1-9, lines 34-37	"Additional detail regarding integration of RCRA and CERCLA requirements for closure of WMA C, specifically, is contained in RPP-46459, *Single-Shell Tank Waste Management Area C RCRA/CERCLA Integration White Paper*." **Email from Maria Skorska on 02/25/16, Subject WMA C RFI - ECY responses to proposed resolutions of ECY's comments** "To clarify the statement and specify our request, we do not know how USDOE is integrating the CERCLA requirements for WMA-C. Would you provide information and revise the document to include details of: 1. The installation of the Barrier outside of the fence line (this area is considered a part of the operable units [OU]) – I am not sure if you provided information that clarifies your investigation include soils outside of the barrier and will meet or exceed CERCLA requirements and they will be consistent with the decisions for the OU; 2. The pipelines extend from an OU to the WMA, what will you do? I am not sure but I think this is being discussed with RL and Ecology in regards to (200-EA-1); 3. Waste has migrated into the adjacent soil beyond the boundary of the WMA, and this occurs in the Groundwater. Have you included a discussion in regards to how this is integrated with the OU's (200-IS-1 and 200-BP-5)? (JL)"	RFI	1	As identified in the response to ECY #3 Comment, A "roadmap" (e.g., table, chart) that identifies what information is contained in WMA C and 200-BP-5 Operable Unit documents and how this information is integrated will be presented to Ecology prior to the WMA C RFI submittal. The roadmap will also be included in the updated WMA C RFI. #1) Phase 2 of the RFI sampling and analysis campaign evaluated soil outside of the WMA C fenceline and the Draft WMA C RFI and updated WMA C RFI provided and will provide information regarding soil contamination outside of the fenceline. The extent of the barrier will be defined in subsequent regulatory documents (e.g., Corrective Measures Implementation Plan). Integration between WMA C and 200-BP-5 Operable Unit will continue subsequent to the update of the WMA C RFI to ensure regulatory requirements are achieved and are consistent. #2) The updated WMA C RFI will provide information on this integration process. In regards to pipelines, the Single-Shell Tank Waste Management Area C RCRA/CERCLA Integration White Paper (RPP-46459) provides information on the pipelines that transect WMA C (Section 3.2): "The 200-IS-1 OU includes portions of the SST System ancillary equipment and associated contaminated soil that are located outside of and transect the WMA boundaries, including approximately 20 pipeline segments that transect the WMA C fence line"..... "The characterization of 200-IS-1 waste sites and the evaluation of remedial alternatives for the 200-IS-1 OU is being performed through integration of the ongoing CERCLA decision process with Site-Wide Permit conditions, as agreed to by Ecology, EPA, and DOE in Section 5 of the approved 2008 work plan Tanks/Lines/Pits/ Boxes/Septic Tank and Drain Field Waste Group Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan; Includes: 200-IS-1 and 200-ST-1 Operable Units (DOE/RL-2002-14)."..... "Characterization and cleanup actions will be organized separately for pipelines located within the fence line, vs. pipelines located well beyond the fence line (the latter being the 200-IS-1 operable unit)." Also refer to Section 2.2.2 (Ancillary Equipment Closure Actions) of Hanford Federal Facility Agreement and Consent Order Action Plan, Appendix I.	Ms. Tabor referred to an email from Ms. Skorska dated February 25, 2016, that indicates this comment was from Mr. Lyon (Attachment 3). There are three parts to the comment and response; the parts are associated with CERCLA integration, area outside of the WMA C fenceline (labeled #1), and pipeline issues (labeled #2). Outcome: Ecology tentatively accepted the portion of the response related to the roadmap pending their review of the roadmap, as noted above. Ecology also tentatively accepted the portion of the response under paragraph #1, pending incorporation into the revised WMA C RFI Report. Regarding the response under paragraph #2, Ecology asked that the last sentence of HFFACO Action Plan Appendix I, Section 2.2.2, be added to the revised RFI Report: "The extent to which Ecology will use the RCRA corrective action process to fulfill the requirements of WAC 173-303-610 will be selected through approval of the WMA Closure Action Plans." With this modification, Ecology tentatively accepted the response to the portion of the response under paragraph #2, pending incorporation into the revised WMA C RFI report.

Attachment 2 (5 pages)
Bigger Issue – Discussion 04/21/2016 (6 Comments)

Commenter	Item	Page #, Section #, Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response	Summary of 04/21/2016 Discussion
Joe	2	General Comment	An objective of this report in support of the PA and closure ought to be to account for the estimated volume/mass of contaminant inventory released and where it is currently located in space. The estimated volume of releases from tanks and ancillary equipment should be accounted for; i.e., is it in the vadose zone or the groundwater, or did it reach groundwater and has since moved downgradient. The estimated inventories in groundwater and the vadose zone are less than the estimated release volumes. So where is this inventory? Is it in the deeper vadose zone that continues to "bleed" contaminants into groundwater? Is it in the deeper part of the unconfined aquifer that hasn't been adequately characterized? Or is it elsewhere? This should be a program objective. Please include the search for this information in future plans of investigation.	RFI	5	Information to be presented in the upcoming Appendix I Performance Assessment will assist in the determination of contaminated soil with respect to WMA C. Note that the inventory information is used in the modeling efforts associated with the Performance Assessment, so release volumes/mass should be accounted for in the updated WMA C RFI.	Outcome: Ecology tentatively accepted the proposed response to Joe RFI 2 and the related portions of responses to the associated comments, pending Ecology review of the Appendix I Performance Assessment documentation.

Attachment 2 (5 pages)
Bigger Issue – Discussion 04/21/2016 (6 Comments)

Commenter	Item	Page #, Section #, Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response	Summary of 04/21/2016 Discussion
Joe	17	Pg. 2-23, lines 1-4.	CHPRC may be the contractor that monitors and characterizes groundwater, but the magnitude and extent of releases to groundwater from WMA C should be in this report, regardless of which contractor is responsible. It is the responsibility of DOE, as the owner/operator, to provide needed data on the contaminants and their spatial distribution in the vadose and saturated zones that have arisen from WMA C. Please correct.	RFI	2	As identified in the Response to ECY #3 Comment, a "roadmap" (e.g., table, chart) that identifies what information is contained in WMA C and 200-BP-5 Operable Unit documents and how this information is integrated will be presented to Ecology prior to the WMA C RFI submittal. The roadmap will also be included in the updated WMA C RFI. Additionally as identified in Section 1.1.3 - Groundwater Remediation - of the Draft WMA C RFI (lines 23 - 27): "The DOE, EPA, and Ecology have elected to investigate and remediate Hanford Site groundwater under a past practice process (HFFACO Action Plan Appendix I, Section 2.4). Characterization and remediation of groundwater in the vicinity of WMA C will occur solely through the past practice decision-making process associated with CERCLA Groundwater Operable Units (OU) 200-BP-5 and 200-PO-1." Please also refer to the Hanford Past-Practice Strategy (DOE/RL-91-40) and the Single-Shell Tank Waste Management Area C RCRA/CERCLA Integration White Paper (RPP-46459). The updated WMA C RFI will reference the Draft 200-BP-5 Remedial Investigation (RI) and a brief summary of groundwater information associated with WMA C will be provided. Also, information to be presented in the upcoming Appendix I Performance Assessment will assist in the determination of contaminated soil with respect to WMA C and will be included in the updated WMA C RFI.	Outcome: Mr. Barnes tentatively accepted the proposed response to Joe RFI 17. Mr. Barnes asked that WRPS/DOE follow up with Mr. Caggiano, who was not in attendance at the meeting. Ms. Tabor took an action to contact Mr. Caggiano.

Attachment 2 (5 pages)
Bigger Issue – Discussion 04/21/2016 (6 Comments)

Commenter	Item	Page #, Section #, Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response	Summary of 04/21/2016 Discussion
Joe	101	Pg. 8-4, lines 6-9.	Groundwater contamination arising from WMA C is still the responsibility of DOE (the owner/operator) and must be dealt with on the schedule for closure of WMA C. The schedule for 200-BP-5 is out of sync with most source facilities in the area underlain by BP-5. Furthermore, no decisions have been made as to the remedial measures to be implemented for BP-5. Furthermore, the scale of WMA C and the 200-BP- 5 groundwater operable unit are considerably different. At the BP-5 scale, e.g., remediation of CN released from WMA C might not be a controlling obligation. Please provide the needed information.	RFI	8	Remediation of contaminated groundwater will be addressed by 200-BP-5 Operable Unit. The remediation process will address both current groundwater contamination and additional issues that are identified by other source term evaluations, as needed. The regulatory process allows for revision of documents as needed (e.g., Record of Decision Amendments); therefore, it is anticipated that all future evaluation "issues" will be addressed appropriately. Also refer to Section 3.0 (SST System Closure/Integration with Other Central Plateau Activities) of Hanford Federal Facility Agreement and Consent Order Action Plan, Appendix I. In order to explain the integration process, a "roadmap" (e.g., table, chart) that identifies what information is contained in WMA C and 200-BP-5 Operable Unit documents and how this information is integrated will be presented to Ecology prior to the WMA C RFI submittal. The roadmap will also be included in the updated WMA C RFI.	Outcome: Mr. Barnes tentatively accepted the proposed response to Joe RFI 101. Mr. Barnes asked that WRPS/DOE follow up with Mr. Caggiano, who was not in attendance at the meeting. Ms. Tabor took an action to contact Mr. Caggiano.

Attachment 3 (5 pages)
Maria Skorska Email Dated February 25, 2016

From: Skorska, Maria (ECY)
To: "Tabor, Cynthia L"
Cc: Lyon, Jeffery (ECY); Barnes, Michael (ECY); "Beach, Ryan E"; Julie Robertson; Rochette, Beth (ECY); "Parker, Dan L (Danny"
Subject: WMA C RFI - ECY responses to proposed resolutions of ECY"s comments
Date: Thursday, February 25, 2016 4:49:52 PM
Attachments: WMAC RFI ECY RCR.xlsx

Hi Cindy:

Re #1: We will send an extension letter on Monday.
Re #2: Please see attached file with our responses.

Thank you.

Maria (Marysia) Skorska, PhD, PE
Nuclear Waste Program
Washington Department of Ecology
Richland, WA
(509) 372-7891

From: Tabor, Cynthia L [mailto:Cynthia_L_Tabor@rl.gov]
Sent: Thursday, February 25, 2016 2:09 PM
To: Lyon, Jeffery (ECY) <JLYO461@ECY.WA.GOV>
Cc: Barnes, Michael (ECY) <miba461@ECY.WA.GOV>; Beach, Ryan E <Ryan_E_Beach@orp.doe.gov>; Julie Robertson <JulieRobertson@gofreestone.com>; Rochette, Beth (ECY) <Broc461@ECY.WA.GOV>; Skorska, Maria (ECY) <msko461@ECY.WA.GOV>; Parker, Dan L (Danny) <Danny_L_Parker@rl.gov>
Subject: WMA C RFI (ECY comments and Written Approval of Extension)

Hi Jeff (Welcome Back)

I need to follow-up with you on a couple of things regarding the WMA C RFI:

1) **Written Approval on Extension for Comment Responses:** In the November 18, 2015 WMA C RFI meeting (http://pdw.rl.gov/arpir/index.cfm/viewDoc?accession=0078955H), Mike Barnes gave verbal approval to our letter request of extending the Comment Response due date to May 5, 2016 – as we are continuing to work through the issues. His verbal approval is on the 2nd page of the link under the heading "Extension on Comment Responses and Path Forward". We would like to receive a letter from Ecology that follows-up on this agreement, please – It will help with tracking. (The letter requesting the extension was: 15-TF-0118)

2) **Discussion on ECY Comments:** On the January 21, 2016 WMA C RFI meeting, we discussed

Attachment 3 (5 pages)
Maria Skorska Email Dated February 25, 2016

comments from "ECY" (it was not Joe, Mike, Beth, or Damon) and it was identified that we should provide them to you to identify the path forward for further discussions. There are only 5 comments (the first one was blank when it came over and we just want to make sure there really was supposed to be nothing there).

Regarding ECY 6, the red letters in question are qualifiers. I plan to add additional text to the response identifying that we will add text in Section 5, so the reader will know that the qualifiers are defined in Appendix M (Tables M-7 through M-9).

Greatly appreciate your assistance in these matters. Please let me know if you have any questions.
Thank you
Cindy

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Attachment 3 (5 pages)
Maria Skorska Email Dated February 25, 2016

Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	*Doc*	*Chapter(s)*	*Comment Category*	*Comment Sub-Category*	*ECY responses*
ECY	1	General Comment		RFI		***Response to be presented at 21 January WMA C RFI reporting meeting.***	What is the comment?	Close this item.
ECY	2	1-9, lines 31-33	RPP-PLAN-37243, Rev 2 states that the PA will be used to support the RFI (Section 3.4.1). That is no longer the case. Please identify what portions of the Master Plan are still applicable. Specific issues: • RPP-PLAN-37243, Rev 2, pg 4-2: "Specifically, this interrelationship shows the CMS feeding back into the performance assessment and closure plan "development & revision" in recognition that WMA contaminated soil is an integral component of the WMA final closure decision making process." – RFI shows CMS as separate from the closure plan with no feedback (see Fig 1-4)	RFI	1	***Response to be presented at 21 January WMA C RFI reporting meeting.***	The reference to the master work plan will be removed from this paragraph. ~~The master plan for integrating the RCRA corrective action process, the RCRA treatment, storage, and disposal (TSD) unit closure process, and the CERCLA groundwater OU remedial investigation/feasibility study (RI/FS) process is RPP-PLAN-37243, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*. The integration between the vadose zone program and the groundwater program is described in Section 5 of this master work plan (RPP-PLAN-37243). Additional detail regarding~~ Integration of RCRA and CERCLA requirements for closure of WMA C, specifically, is contained in RPP-46459, *Single-Shell Tank Waste Management Area C RCRA/CERCLA Integration White Paper*.	The response is not accepted. Please note that the referenced relationship between RFI, CMS, PA and Closure Plans is also illustrated in Figure I-1 of HHFACO Appendix I. Specifically, Figure I-1 shows the CMS feeding into the performance assessment and closure plans. (MBS)
ECY	3	1-9, lines 33-34	"The integration between the vadose zone program and the groundwater program is described in Section 5 of this master work plan (RPP-PLAN-37243)." The material is not in Section 5, please correct.	RFI	1	***Response to be presented at 21 January WMA C RFI reporting meeting.***	See ECY 2 Comment Response	The response is not accepted. The RFI needs to discuss the relationship between the vadose zone program and the groundwater program. (MBS)

Attachment 3 (5 pages)
Maria Skorska Email Dated February 25, 2016

Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	*Doc*	*Chapter(s)*	*Comment Category*	*Comment Sub-Category*	*ECY responses*
ECY	4	1-9, lines 34-37	"Additional detail regarding integration of RCRA and CERCLA requirements for closure of WMA C, specifically, is contained in RPP-46459, Single-Shell Tank Waste Management Area C RCRA/CERCLA Integration White Paper."	RFI	1	***Response to be presented at 21 January WMA C RFI reporting meeting.***	What is the comment?	To clarify the statement and specify our request, we do not know how USDOE is integrating the CERCLA requirements for WMA-C. Would you provide information and revise the document to include details of: 1. The installation of the Barrier outside of the fence line (this area is considered a part of the operable units [OU]) – I am not sure if you provided information that clarifies your investigation include soils outside of the barrier and will meet or exceed CERCLA requirements and they will be consistent with the decisions for the OU; 2. The pipelines extend from an OU to the WMA, what will you do? I am not sure but I think this is being discussed with RL and Ecology in regards to (200-EA-1); 3. Waste has migrated into the adjacent soil beyond the boundary of the WMA, and this occurs in the Groundwater. Have you included a discussion in regards to how this is integrated with the OU's (200-IS-1 and 200-BP-5)? (JL)
ECY	5	5-123, line 20	"Additionally, IX in the vadose zone can significantly impact the mobility of some contaminants" Is "IX" defined?	RFI	5	***Response to be presented at 21 January WMA C RFI reporting meeting.***	No change required. It (ion exchange - IX) is defined on page xv in the Acronym list and when it is first used on page 3-11 line 29.	The response is accepted

Attachment 3 (5 pages)
Maria Skorska Email Dated February 25, 2016

Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	*Doc*	*Chapter(s)*	*Comment Category*	*Comment Sub-Category*	*ECY responses*
ECY	6	5-127, line 1 5-127, line 26 5-127, line 38 5-128, line 16 5-128, line 20 5-128, line 23 5-129, lines 9-11 5-129, line 22	"maximum concentration was 30,600 J µg/kg from" "The maximum concentration was 101,000 U at Investigation Group P from a depth of 5 m (15 ft) bgs (shallow)." "...concentration was 110,000 M µg/kg at a depth of..." Also "The maximum reported concentration was 3.13 U pCi/g from Investigation Group P" "concentration was 9.45 U pCi/g from Investigation Group P" "Iodine-129 was detected in one sample at a concentration of 0.808 B pCi/g..." "maximum reported value was a non-detect result of 76 BYUJ pCi/g from Investigation Group L1+L2 at a depth of 35 m (115 ft) bgs (deep), however, the highest detected value was 53.5 Y pCi/g from Site U at a depth of 39 m" "The maximum concentration was 1.85 B pCi/g from" Typos?	RFI	5	***Response to be presented at 21 January WMA C RFI reporting meeting.***	These are qualifers (laboratory, review, and validation) and are defined in Appendix M (Tables M-7 through M-9).	The response is accepted

Attachment 4
ECY RFI 2 and Joe RFI 6 – Discussion 4/21/2016 Meeting

Commentor	Item	Page #/ section # Line #	Comment & Basis/Justification	*Doc*	*Chapter(s)*	Response
ECY	2	1-9, lines 31-33	RPP-PLAN-37243, Rev 2 states that the PA will be used to support the RFI (Section 3.4.1). That is no longer the case. Please identify what portions of the Master Plan are still applicable. Specific issues: • RPP-PLAN-37243, Rev 2, pg 4-2: "Specifically, this interrelationship shows the CMS feeding back into the performance assessment and closure plan "development & revision" in recognition that WMA contaminated soil is an integral component of the WMA final closure decision making process." – RFI shows CMS as separate from the closure plan with no feedback (see Fig 1-4) **Email from Maria Skorska on 02/25/16, Subject WMA C RFI - ECY responses to proposed resolutions of ECY's comments** "The response is not accepted. Please note that the referenced relationship between RFI, CMS, PA and Closure Plans is also illustrated in Figure I-1 of HHFACO Appendix I. Specifically, Figure I-1 shows the CMS feeding into the performance assessment and closure plans. (MBS)" **Email from Maria Skorska on 04/12/16, Subject WMA C RFI - ECY responses to proposed resolutions of ECY's comments** "We need to understand DOE's intent for the relationship between the CMS and the work plans. In that respect, Figure 1-4 is inconsistent with Figure I-1 in Appendix I, where the CMS feeds into the development of the (Tier 1, 2, and 3) work plans."	RFI	1	Figure 1-4 of the Draft WMA C RFI will be replaced with Figure I-1 of the HFFACO Action Plan Appendix I.
Joe	6	Pg. 1-2, Lines 5– 9.	As the TWEIS has already determined that wastes will be left in place and a work plan will be developed to characterize the releases, then why is this statement even present in this document here? Furthermore, it is known that there are SST contaminants from WMA C in the soil and groundwater, so assessing the need for corrective measures is moot. Please re-think and revise this document. **Email from Joe Caggiano on 4/19/16, Subject Re: Closure of WMA C RFI Report Meeting Action 2016-01-21-1** "Here's the change I proposed. I thought I copied you. If you will make the change, then I'm OK and we can close this comment/action... Information generated during the RFI is used to develop a CMS that will aid in the selection and implementation of corrective measures."	RFI	1	Page 1-2, Lines 6-7, will be modified to read "Information generated during the RFI is used to develop a CMS that will aid in the selection and implementation of corrective measures."

Attachment 5 (2 pages)
Maria Skorska Email Dated April 12, 2016

From: Skorska, Maria <MSKO461@ECY.WA.GOV>
Sent: Tuesday, April 12, 2016 3:06 PM
To: Tabor, Cynthia L
Subject: RE: WMA C RFI - ECY responses to proposed resolutions of ECY's comments

We need to understand DOE's intent for the relationship between the CMS and the work plans. In that respect, Figure 1-4 is inconsistent with Figure I-1 in Appendix I, where the CMS feeds into the development of the (Tier 1, 2, and 3) work plans.

Maria (Marysia) Skorska, PhD, PE
Nuclear Waste Program
Washington Department of Ecology
Richland, WA
(509) 372-7891

From: Tabor, Cynthia L [mailto:Cynthia_L_Tabor@rl.gov]
Sent: Friday, April 08, 2016 4:02 PM
To: Skorska, Maria (ECY) <msko461@ECY.WA.GOV>
Cc: Julie Robertson <JulieRobertson@gofreestone.com>; Childress, Ryan D <Ryan_D_Childress@rl.gov>
Subject: FW: WMA C RFI - ECY responses to proposed resolutions of ECY's comments

Hi Marysia
I have a question about ECY 2 (your Column I input) regarding CMS feeding into the PA and closure plans. We do not disagree with this...but the section that it says this comment is associated with is Section 1.1.3 Groundwater Remediation. Is your issue with Figure 1-4? Please let me know..We are discussing replacing this figure with the Appendix I figure.

Thank you
Cindy

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From: Skorska, Maria (ECY) [mailto:msko461@ECY.WA.GOV]
Sent: Thursday, February 25, 2016 4:50 PM
To: Tabor, Cynthia L <Cynthia_L_Tabor@rl.gov>
Cc: Lyon, Jeffery <jlyo461@ecy.wa.gov>; Barnes, Michael (ECY) <miba461@ECY.WA.GOV>; Beach, Ryan E <Ryan_E_Beach@orp.doe.gov>; 'Julie Robertson' <JulieRobertson@gofreestone.com>; Rochette, Beth <broc461@ecy.wa.gov>; Parker, Dan L (Danny) <Danny_L_Parker@rl.gov>
Subject: WMA C RFI - ECY responses to proposed resolutions of ECY's comments

Hi Cindy:

Re #1: We will send an extension letter on Monday.

Attachment 5 (2 pages)
Maria Skorska Email Dated April 12, 2016

Re #2: Please see attached file with our responses.

Thank you.

Maria (Marysia) Skorska, PhD, PE
Nuclear Waste Program
Washington Department of Ecology
Richland, WA
(509) 372-7891

From: Tabor, Cynthia L [mailto:Cynthia_L_Tabor@rl.gov]
Sent: Thursday, February 25, 2016 2:09 PM
To: Lyon, Jeffery (ECY) <JLYO461@ECY.WA.GOV>
Cc: Barnes, Michael (ECY) <miba461@ECY.WA.GOV>; Beach, Ryan E <Ryan_E_Beach@orp.doe.gov>; Julie Robertson <JulieRobertson@gofreestone.com>; Rochette, Beth (ECY) <Broc461@ECY.WA.GOV>; Skorska, Maria (ECY) <msko461@ECY.WA.GOV>; Parker, Dan L (Danny) <Danny_L_Parker@rl.gov>
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Greatly appreciate your assistance in these matters. Please let me know if you have any questions.
Thank you
Cindy

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Attachment 6 (3 pages)
Joe Caggiano Email Dated April 19, 2016

From: Caggiano, Joseph (ECY)
To: Julie Robertson
Cc: Tabor, Cynthia L; Childress, Ryan D
Subject: RE: Closure of WMA C RFI Report Meeting Action 2016-01-21-1
Date: Tuesday, April 19, 2016 3:10:51 PM

Yes, that's fine. Go ahead and close the action item. I don't even remember why this comment on the RFI evolved into an Action Item.

From: Julie Robertson [mailto:JulieRobertson@gofreestone.com]
Sent: Tuesday, April 19, 2016 3:07 PM
To: Caggiano, Joseph (ECY) <Jcag461@ECY.WA.GOV>
Cc: Tabor, Cynthia L <Cynthia_L_Tabor@rl.gov>; Childress, Ryan D <Ryan_D_Childress@rl.gov>
Subject: RE: Closure of WMA C RFI Report Meeting Action 2016-01-21-1

I'm sorry I left such a long voicemail message. ☺

I did receive your response but was confused. The red text you added modifies the response to the original comment. I don't think anyone has any issue with adding that text and we can document the change during our meeting Thursday. However, I'm seeking to close a related action that is being tracked in our meeting notes. The proposed response to the action that I'd like to close is at the end of my first email. It is now highlighted blue below so you can find it easily. Thanks again, Joe.

Julie R. Robertson
Senior Regulatory Specialist
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1100 Jadwin Ave., Suite 250 • Richland, WA 99352
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www.gofreestone.com

From: Caggiano, Joseph (ECY) [mailto:Jcag461@ECY.WA.GOV]
Sent: Tuesday, April 19, 2016 2:59 PM
To: Julie Robertson <JulieRobertson@gofreestone.com>
Cc: Tabor, Cynthia L <Cynthia_L_Tabor@rl.gov>; Childress, Ryan D <Ryan_D_Childress@rl.gov>
Subject: RE: Closure of WMA C RFI Report Meeting Action 2016-01-21-1

Here's the change I proposed. I thought I copied you. If you will make the change, then I'm OK and we can close this comment/action. I'm not sure I fully understood your phone message.

From: Julie Robertson [mailto:JulieRobertson@gofreestone.com]
Sent: Tuesday, April 19, 2016 11:29 AM
To: Caggiano, Joseph (ECY) <Jcag461@ECY.WA.GOV>
Cc: Tabor, Cynthia L <Cynthia_L_Tabor@rl.gov>; Childress, Ryan D <Ryan_D_Childress@rl.gov>

Attachment 6 (3 pages)
Joe Caggiano Email Dated April 19, 2016

Subject: Closure of WMA C RFI Report Meeting Action 2016-01-21-1

Hi, Joe. I'm hoping there is a chance we could close the subject meeting note action at our upcoming WMA C RFI meeting this Thursday. I've been carrying this action for a few months now, so I'm going to review the history then discuss my response to the action. Please read through the info below and let me know if you have any questions or concerns. We'll follow up at our meeting this Thursday.

The Action – 2016-01-21-1:
Identify and report back regarding where WMA C RFI Report provides information on the currently agreed-to RFI/CMS process.

The History:
The action stemmed from discussion of your comment 6 on the RFI report: "As the TWEIS has already determined that wastes will be left in place and a work plan will be developed to characterize the releases, then why is this statement even present in this document here? Furthermore, it is known that there are SST contaminants from WMA C in the soil and groundwater, so assessing the need for corrective measures is moot. Please re-think and revise this document."

The RFI report text you were commenting on was this: If the potential need for corrective measures is identified, a CMS is prepared to identify specific measures to address the release. Information generated during the RFI is used to develop a CMS that will aid in the selection and implementation of corrective measures. Implementation of corrective measures includes designing, constructing, operating, maintaining, and monitoring selected corrective measures.

The agreed to disposition of the comment was this: "No change required. The first several paragraphs of Section 1 of the RFI report provide general background information about the RCRA corrective action process as modified by HFFACO Action Plan Appendix I for SSTs. The information is provided as a framework for this particular RFI report. The text on page 1-2, lines 5-9, is modified from EPA 530/SW-89-031, Interim Final RCRA Facility Investigation (RFI) Guidance Volume I of IV Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations, which states "If the potential need for corrective measures is identified during the RFI process, the owner or operator is then responsible for performing a CMS" (Section 1.2, Page 1-7). This introductory text does not presuppose knowledge of the results of the RFI, and so simply reflects the basic regulatory drivers behind the corrective action process."

The Proposed Response to Action 2016-01-21-1: The RFI/CMS process that will be implemented at WMA C is described in RFI Report Section 1, beginning on Page 1-1, line 18, and extending through Page 1-2, line 13. The WMA C RFI/CMS process is described in HFFACO Appendix I. The cited portion of the RFI report weaves together references to Appendix I and the over-arching Federal RFI guidance (EPA 530/SW-89-031). Section 1.1.2 of the RFI report (Page 1-6, line 13, through Page 1-10, line 12) also addresses the Appendix I process for integrating various WMA C closure actions with the soil RFI/CMS process.

Please let me know what you think.

Attachment 6 (3 pages)
Joe Caggiano Email Dated April 19, 2016

Thank you,

Julie R. Robertson
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Attachment 7 (6 pages)
Risk Comments – Discussion 4/21/2016 (17 Comments)

Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response
Damon	12	P 3-9, Figure 3-1	For transparency, Figure 3-1 should be labeled as human health conceptual exposure model and should present all exposure pathways (even if all are not evaluated). Therefore, in addition to soil ingestion and soil inhalation, MTCA (WAC 173-340) includes soil dermal contact and soil contaminants leaching to groundwater with subsequent ingestion of groundwater by residential receptors. Also, CERCLA includes soil contaminants leaching to groundwater with subsequent ingestion of groundwater by residential and tribal receptors or other subsequent uses (e.g., showering, irrigation of crops). Contaminated groundwater may also impact fish in the Columbia River which may be consumed by residential or tribal receptors. **Email from Damon Delistry on 2/18/16, Subject Re: Updated BRA and RFI/BRA comments** *Damon BRA 12* The updated Figure 3-1 should be titled, "Human health conceptual exposure model." Footnote 2 applies to nonrad COPCs (not rads). Also, add contaminants transported from groundwater to surface water and sediment with subsequent ingestion of contaminated surface water, sediment, and fish by the WAC resident (unrestricted land use), CERCLA resident, and tribal receptors.	BRA		Figure 3-1 will be revised. The title of the Figure 3-1 will be labeled as "Human Health Conceptual Exposure Model" Three types of exposure pathways - (1) Complete and Evaluated; (2) Complete, but not Evlauated; and (3) Incomplete, hence not Evaluated will be included in the updated Figure 3-1. The pathways listed in the comments will be included as completed by not evluated. Text will be updated to state the reasoning for not evaluating those completed exposure pathways.
Damon	14	P 3-12, S 3.2.1.4, L 1-6	Text states, "Food chain pathways were evaluated for radiological COPCs. They were not evaluated for nonradiological COPCs as EPA does not provide intake equations or recommend performing food chain analyses for chemicals (EPA/540/1-89/002)." This is not true. EPA (RAGS) does recommend evaluating intake of chemicals in food (e.g., fish, produce, meat, dairy), and RAGS provides intake equations for chemicals in food. Therefore, both rads and nonrads should be evaluated in food chain pathways. **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** *Damon BRA 14, Damon BRA 16, Damon RFI 11* There is extensive precedent with Hanford risk assessments for evaluating both rad and nonrad COPCs via foodchain exposure (e.g., ingestion of plants, meat, milk, fish) for resident, farmer, fisher, and tribal receptors. USDOE's Hanford Site Risk Assessment Methodology [HSRAM] (DOE/RL-91-45, Rev 3) recommends evaluating these pathways. The following Hanford reports serve as examples, where foodchain exposure for both rad and nonrad COPCs is estimated: 1) Screening Assessment and Requirements for a Comprehensive Assessment/Columbia River Comprehensive Impact Assessment [CRCIA] (DOE/RL-96-16, Rev 1) 2) Waste Treatment Plant [WTP]/Risk Assessment Work Plan [RAWP] (24590-WTP-RPT-ENS-03-006, Rev 3) 3) Exposure Scenarios and Unit Factors for Hanford Tank Waste Performance Assessments (HNF-SD-WM-TI-707, Rev 5) 4) River Corridor Baseline Risk Assessment [RCBRA] (DOE/RL-2007-21, Rev 0). Examples of sources of transfer factors for nonrads are USDOE's RESRAD (metals) and EPA's Human Health Risk Assessment Protocol [HHRAP] for Hazardous Waste Combustion Facilities (organics). Perhaps other useful references on transfer factors (found in RCBRA Appendix D1) are Baes et al (1984), Wang et al (1993), and Kennedy and Strenge (1992). Uncertainty due to omitting this pathway is arguably greater than uncertainty in modeling this pathway.	BRA		It is correct that equations are provided in RAGS Part A (EPA/540/1-89/002; Section 6.6.4) includes intake equations for food chain models. However, it must be noted that the introductory text (Section 6.5.7 Estimate Chemical Concentrations in Food) states clearly that these equations and pathways are provided for situations where exposure is already taking place: "Site-related chemicals may be present in plants as a result of direct deposition onto plant surfaces, uptake from the soil, and uptake from the air. When possible, samples of plants or plant products should be used to estimate exposure concentrations. In the absence of monitoring data, several modeling approaches are available for estimating exposure concentrations in plants. Use of these models, however, can introduce substantial uncertainty into an exposure assessment. If deposition onto plants is the source of the chemical, air deposition modeling can be used in conjunction with plant interception fractions to estimate uptake. The plant interception fraction can be estimated by methods published in the literature or can be developed for a specific crop by considering crop yield and the area of the plant available for deposition." Most of the uncertainty associated with the food chain pathway is related to the ingestion of fruits and vegetables pathway. The RAGS text states clearly that these considerations will introduce substantial uncertainties to the evaluation. This conclusion has been confirmed by previous studies conducted at the Hanford Site such as the River Corridor Baseline Risk Assessment (DOE/RL-2007-21, Volume II; Record Accession #: 0093675 and 0093676). There are no State of Washington requirements to evaluate these pathways. Other approved Baseline Risk Assessments for Hanford Site uplands areas (100-DH Area; DOE-RL-2010-95, Rev 0; Record Accession #: 0083383H) did not evaluate these pathways for chemicals.
Damon	16	P 3-15, 3.2.1.4.6, L 12-14	Exposure pathways for the CERCLA resident for food intake (produce, meat, milk) should include both rad and nonrad COPCs. **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** *Damon BRA 14, Damon BRA 16, Damon RFI 11* There is extensive precedent with Hanford risk assessments for evaluating both rad and nonrad COPCs via foodchain exposure (e.g., ingestion of plants, meat, milk, fish) for resident, farmer, fisher, and tribal receptors. USDOE's Hanford Site Risk Assessment Methodology [HSRAM] (DOE/RL-91-45, Rev 3) recommends evaluating these pathways. The following Hanford reports serve as examples, where foodchain exposure for both rad and nonrad COPCs is estimated: 1) Screening Assessment and Requirements for a Comprehensive Assessment/Columbia River Comprehensive Impact Assessment [CRCIA] (DOE/RL-96-16, Rev 1) 2) Waste Treatment Plant [WTP]/Risk Assessment Work Plan [RAWP] (24590-WTP-RPT-ENS-03-006, Rev 3) 3) Exposure Scenarios and Unit Factors for Hanford Tank Waste Performance Assessments (HNF-SD-WM-TI-707, Rev 5) 4) River Corridor Baseline Risk Assessment [RCBRA] (DOE/RL-2007-21, Rev 0). Examples of sources of transfer factors for nonrads are USDOE's RESRAD (metals) and EPA's Human Health Risk Assessment Protocol [HHRAP] for Hazardous Waste Combustion Facilities (organics). Perhaps other useful references on transfer factors (found in RCBRA Appendix D1) are Baes et al (1984), Wang et al (1993), and Kennedy and Strenge (1992). Uncertainty due to omitting this pathway is arguably greater than uncertainty in modeling this pathway.	BRA		Please see response to the BRA comment no 14.

Attachment 7 (6 pages)
Risk Comments – Discussion 4/21/2016 (17 Comments)

Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	*Doc*	*Chapter(s)*	Response
Damon	17	P 3-15, S 3.2.1.4.7, L 34-35	In addition to soil ingestion and soil inhalation, MTCA Method B unrestricted land use scenario includes soil dermal contact (WAC 173-340-740[3][c][iii]) and soil contaminants leaching to groundwater (WAC 173-340-747[4]) with subsequent ingestion of groundwater.	BRA		Concur. For comment related to dermal contact, the following text will be added to Section 3.2.1.4.7: Under WAC 174-340-740[c][iii], dermal contact pathway is applicable for other hazardous substances under receptor scenario based on Modified Method B soil cleanup levels. This particular section of the WAC is only applicable when "the proposed changes to Equations 740-1 and 740-2 would result in a significantly higher soil cleanup level than would be calculated without the proposed changes". For WMA C, the risk assessment was performed for the standard MTCA Method B unrestricted land use receptor scenario; and no modification is proposed. Under standard MTCA Method B unrestricted land use receptor scenario, dermal contact pathway is applicable for petroleum mixture hydrocarbon, which is not a contaminant of concern for WMA C. Therefore, dermal contact pathway was not evaluated. **Note:** Groundwater ingestion issue remains open. During this BRA, an assessment referred to as the "protection of groundwater pathway" was performed as part of the WMA C BRA (section 3.5.11) to evaluate the potential impacts to groundwater from leaching of contaminants in contaminated soil through the vadose zone to the aquifer. However, risk due to subsequent ingestion of groundwater was not evaluated in this BRA. For groundwater ingestion, the MTCA methods require the evaluation of groundwater protection and this is already performed within the WMA C BRA. MTCA Methods (B and C) require the evaluation of pathways separately. There is no requirements to add these pathways into a single calculation. It must be stated that the groundwater protection evaluation was not complete in the BRA (Section 3.5.11) that was developed in support of the RFI because the vadose zone models were under development at the time. Future revisions of this BRA will provide a complete evaluation of groundwater protection for all contaminants (chemicals and radionuclides). For completeness, the following text can be added to the BRA text when human health direct contact is discussed: "(groundwater protection is also evaluated as detailed in sections 3.5.11)". **Groundwater ingestion issue remains open based on 02/23/16 meeting.**
Damon	19	P 3-17, S 3.2.2, L10-24; P 3-18, Figure 3-2	For EPC selection rationale, text refers to Figure 3-2. This figure recommends the max in cases where 95UCL is not calculated, 95UCL>max and Chebyshev UCL is not calculated, and Chebyshev UCL>max. However, ProUCL (version 5.0) states, "It is recommended not to use the maximum observed value to estimate the EPC term representing the average exposure contracted by an individual over an EA. For the sake of interested users, ProUCL displays a warning message when the recommended 95% UCL (e.g., Hall's bootstrap UCL) of the mean exceeds the observed maximum concentration. For such scenarios (when a 95% UCL does exceed the maximum observed value), an alternative 95% UCL computation method based upon Chebyshev inequality is recommended by the ProUCL software." Therefore, when possible, a 95UCL should be calculated to represent EPC. Only in cases where UCL cannot be not calculated (i.e., statistical analysis is not appropriate or not possible) should EPC defer to the observed max, noting the uncertainty in EPC. Exceptions where defaulting to max is allowed might include small sample sizes (e.g., n<5), low FOD (e.g., <20%), or focused sampling. Ecology has made this comment repeatedly.	BRA		The approach used in this BRA follows EPA guidance. It is reasonable to discuss these exceptions in the uncertainty evaluation. The following text will be added to address these uncertainties. A review of the EPC calculations utilizing for WMA C showed that the calculated 95% UCLs for two site contaminants - silver and tritium are greater than their corresponding maximum detected concentrations. However, due to very few detected sample results, ProUCL did not calculate 97.5% and 99% chebyshev UCLs for those contaminants. It should be noted that all measured concentrations for silver are less than its 90th percentile background concentration; therefore, the range of measurements for silver reflect natural background variability. In addition, no site-specific release information related to silver is available. Therefore, there will be no impact to the risk characterization results due to presence of silver at WMA C. For tritium, the calculated UCL is 110 pCi/g, and it is based on 99% KM (Chebyshev) UCL. The recommended UCL is higher than its corresponding maximum detected concentration of 75.8 pCi/g. It should be noted that the median tritium concentration for that EU is only 4 pCi/g. Since, ProUCL 5.0 can calculate the 95%UCL for fewer detected samples as compared to that for ProUCL 4.0, the 95%UCL was calculated for tritium (with # of detected sample =4) using ProUCL 5.0. The calculated 95%UCL using ProUCL 5.0 for tritium is 31 pCi/g. Therefore, using the maximum detected concentration as the EPC for tritium resulted in a more conservative risk estimate.
Damon	43	P 3-91, S 3.6.1, L 41-44	Text states, "Since, the RME receptors are exposed to contamination present in the shallow surface soil, soil sampling results from the shallow surface zone (0 to 15 ft bgs) for each EA were then used to determine the source term during the risk assessment." This source term (shallow soils) does not capture a groundwater drinking scenario, where receptors ingest groundwater that has been contaminated by soil COPCs leaching to groundwater through the full depth of the vadose zone.	BRA		As mentioned in BRA Damon Comment Response 1, groundwater within WMA C is identified as an area of interest within the 200-BP-5 groundwater OU. Therefore, groundwater drinking water scenario was being evaluated as a part of site-wide and well-specific groundwater risk assessment in 200-BP-5 RI (DOE/RL-2009-127, Draft A) report. However, sampling results for both shallow soil and deep vadose soil were considered during the protection of groundwater pathway evaluation in this BRA. Text will be updated in Section 2.5 to clarify this.
Damon	44	P 3-92, S 3.6.2, L35-38	Text states, "Therefore, maximum detected concentrations were selected as the EPCs for small sample size." However, OSWER 9285.6-10 (EPA, 2002) states, "It is important to note, however, that defaulting to the maximum observed concentration may not be protective when sample sizes are very small, because the observed maximum may be smaller than the population mean." Therefore, defaulting to max with small sample size (e.g., n<5) is allowed, only because UCL cannot be reliably calculated, not due to alleged conservatism.	BRA		Please see response to the BRA comment no 19.

Attachment 7 (6 pages)
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Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response
Damon	53	P 4-11, S 4.4.1.1, L 38-42	Text states, "Therefore, both dermal and inhalation exposure were assumed to be negligible." Re inhalation, this may not be true in burrowing animals for inhalation of VOCs (e.g.,; Gallegos et al, 2007 [ETC 26:1299-1303]; Carlsen, 1996 [Risk Anal 16:211-219]) and inhalation of metals (e.g., Bench et al, 2001 [ES&T 35:270-277]). **Email from Damon Delistry on 2/18/16, Subject Re: Updated BRA and RFI/BRA comments** *Damon BRA 53* Cite Gallegos et al (2007) and Carlsen (1996) in the new text to support inhalation exposure to VOCs by burrowing animals.	BRA		Concur. Text will be updated as follows: "Inhalation is generally considered a relatively minor pathway for exposure relative to direct ingestion by wildlife of chemicals of concern. For example, the USEPA's Exposure factors and bioaccumulation models for derivation of wildlife Eco-SSLs, OSWER Directive 9285.7-55. Revised November 2005, did not use inhalation of soil particles in deriving the national ecological soil-screening levels, because exposure is accounted for by the soil-ingestion route. As stated in the comment, an evaluation of risk to receptors via the inhalation pathway may be warranted, in cases where VOCs are expected site chemicals and pathways of exposure are complete. One possible pathway for inhalation is the potential for volatilization of chemicals and exposure to burrowing animals in subsurface soils (e.g.,; Gallegos et al, 2007 [ETC 26:1299-1303], Carlsen, 1996 [Risk Anal 16:211-219]). However, methods and data necessary to calculate inhalation exposures are poorly developed (EPA/600/R-93/187). Bench et al (2001), also noted olfactory bulb uptake in fossorial mammals affords a significant exposure route to manganese and cadmium in soils. However, methods for olfactory exposure and risk characterization are not well established. However, VOCs were not found to be elevated in general for shallow soils on the Hanford Site Central Plateau, including WMA C. Similarly, managanese and cadmium are not significant Hanford Site contaminants that needed to be evaluated using such site-specific methods.Therefore, inhalation pathway was not considered during the development of SSLs." The following references will be included. Bench, G., Carlsen T., Grant, P., Wollett J., Martinelli, R., Lewis, J. and Divine, K.K. "Olfactory bulb uptake and determination of biotransfer factors in the California ground squirrel (Spermophilus beecheyi) exposed to Manganese and Cadmium in environmental habitats," Environmental Science and Technology, V35 (N2), (2001), 270-277 Carlsen TM. 1996. Ecological risks to fossorial vertebrates from volatile organic compounds in soil. Risk Anal 16:211–219 Gallegos, P., J. Lutz, J.T. Markwiese, R.T. Ryti, and R. Mirenda, 2007, "Wildlife Ecological Screening Levels for Inhalation of Volatile Organic Chemicals," Environ. Toxicol. Chem. 26(6):1299-1303.
Damon	60	P 4-23, S 4.6, L 43-46; P 4-24, L 1-2	A 95UCL should preferably be calculated to represent EPC, independent of receptor type when local populations are considered. For example, a population of individuals of sessile biota (e.g., plants) or mobile biota (e.g., birds or mammals) may be distributed over a range of concentrations of a given soil COPC. As a representative measure of COPC soil concentration, EPC should capture variability in COPC concentration which is independent of receptor mobility/immobility. Therefore, a UCL95 (rather than max), which contains a measure of variability (standard deviation), is the best estimate of EPC for sessile biota (just as it is for mobile biota). In addition, use of max ignores most of the information in the data set.	BRA		Concur with the statement. Therefore, instead of maximum detected concentration, the EPC will be used as source term during performing site-specific screening evaluation of SLERA. It should be noted that for small sample size, the maximum detected concentration will be considered as the source term.
Damon	8	P 7-8, Figure 7-3	In addition to soil ingestion and soil inhalation, MTCA (WAC 173-340) includes soil dermal contact and soil contaminants leaching to groundwater with subsequent ingestion by residential receptors. Also, CERCLA includes soil contaminants leaching to groundwater with subsequent ingestion by residential and tribal receptors or other subsequent uses (e.g., showering, irrigation of crops). Perhaps an intruder driller (accessing groundwater) should be included too. Contaminated groundwater may also impact fish in the Columbia River which may be consumed by residential or tribal receptors. **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** *Damon RFI 8* RFI Figure 7-3 (Human CSM) should be the same as updated BRA Figure 3-1 (Human CSM).	RFI	7	Please see response to the BRA comment no 17.

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Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response
Damon	11	P 7-10, S 7.2.2.1, L 44-46	Text notes that consumption of fruits/vegetables/grains, meat, and milk are only applicable to rad COPCs for the CERCLA resident receptor. Nonrad COPCs should also be included here for these food ingestion pathways. **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** *Damon BRA 14, Damon BRA 16, Damon RFI 11* There is extensive precedent with Hanford risk assessments for evaluating both rad and nonrad COPCs via foodchain exposure (e.g., ingestion of plants, meat, milk, fish) for resident, farmer, fisher, and tribal receptors. USDOE's Hanford Site Risk Assessment Methodology [HSRAM] (DOE/RL-91-45, Rev 3) recommends evaluating these pathways. The following Hanford reports serve as examples, where foodchain exposure for both rad and nonrad COPCs is estimated: 1) Screening Assessment and Requirements for a Comprehensive Assessment/Columbia River Comprehensive Impact Assessment [CRCIA] (DOE/RL-96-16, Rev 1) 2) Waste Treatment Plant [WTP]/Risk Assessment Work Plan [RAWP] (24590-WTP-RPT-ENS-03-006, Rev 3) 3) Exposure Scenarios and Unit Factors for Hanford Tank Waste Performance Assessments (HNF-SD-WM-TI-707, Rev 5) 4) River Corridor Baseline Risk Assessment [RCBRA] (DOE/RL-2007-21, Rev 0). Examples of sources of transfer factors for nonrads are USDOE's RESRAD (metals) and EPA's Human Health Risk Assessment Protocol [HHRAP] for Hazardous Waste Combustion Facilities (organics). Perhaps other useful references on transfer factors (found in RCBRA Appendix D1) are Baes et al (1984), Wang et al (1993), and Kennedy and Strenge (1992). Uncertainty due to omitting this pathway is arguably greater than uncertainty in modeling this pathway.	RFI	7	Please see response to the BRA comment no 14.
Damon	12	P 7-11, S 7.2.2.2, L 35	For EPC selection rationale, text refers to Figure 3-2 in the BRA (RPP-RPT-58329). This figure recommends the max in cases where 95UCL is not calculated, 95UCL>max and Chebyshev UCL is not calculated, and Chebyshev UCL>max. However, ProUCL (version 5.0) states, "It is recommended not to use the maximum observed value to estimate the EPC term representing the average exposure contracted by an individual over an EA. For the sake of interested users, ProUCL displays a warning message when the recommended 95% UCL (e.g., Hall's bootstrap UCL) of the mean exceeds the observed maximum concentration. For such scenarios (when a 95% UCL does exceed the maximum observed value), an alternative 95% UCL computation method based upon Chebyshev inequality is recommended by the ProUCL software." Therefore, when possible, a 95UCL should be calculated to represent EPC. Only in cases where UCL cannot be not calculated (i.e., statistical analysis is not appropriate or not possible) should EPC defer to the observed max, noting the uncertainty in EPC. Exceptions where defaulting to max is allowed might include small sample sizes (e.g., n<5), low frequency of detection (e.g., <20%), or focused sampling. Ecology has made this comment repeatedly.	RFI	7	Please see the response to the BRA comment no 19.
Damon	19	P 7-21, S 7.2.5.7, L 1-3	Text identifying EAs with ELCR>1E-5 for nonrads does not match up with Table 7-8 data (child or adult). **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** *Damon RFI 19* For the CERCLA Residential Child, Table 7-8 shows nonrad ELCR>1E-5 (EA C and J), although below background ELCR (<5E-5). With the exception of EA F+G (HI=0.6), noncancer HI>1 for the CERCLA Residential Child for all other EAs (Table 7-8), although below background HI (<3). Note, however, comparison of EA vs background (for ELCR and HI) is apparently being eliminated (see Damon RFI 15).	RFI	7	Concur. The following text changes will be made: **CERLCA Residential Adult** For nonradiological carcinogenic COPCs, the total ELCR for all EAs were less than or equal to the 2007 MTCA ("Human Health Risk Assessment Procedures" [WAC 173 340 708(5)]) cumulative risk threshold of 1 × 10-5. Therefore, nonradiological risk contributors were not identified. For noncarcinogenic COPCs, the HI for all EAs was less than the 2007 MTCA ("Human Health Risk Assessment Procedures" [WAC 173 340 708(5)]) target HI of 1. Therefore, nonradiological noncancer hazard contributors were not identified. **CERCLA Residential Child** For carcinogenic COPCs, the cumulative ELCR at EA C is greater than the 2007 MTCA ("Human Health Risk Assessment Procedures" [WAC 173 340 708(5)]) cumulative risk threshold of 1 × 10-5. Arsenic was identified as the major risk contributor for those EAs. For noncarcinogenic COPCs, all EAs report an HI greater than the 2007 MTCA target HI of 1. Aluminum, antimony, arsenic, cadmium, chromium, cobalt, iron, lithium, manganese, and vanadium were identified as hazard contributors. Therefore, an evaluation was performed for each EA to segregate the HIs associated with those hazard contributors by similar mechanisms of action (critical effect) and toxicological effects. When the HI based on similar mechanism of action is greater than 1, those hazard contributors will be retained. However, the results of risk evaluation showed that the HI based on similar mechanism of action is less than one. Therefore, no analytes were retained as hazard contributors.

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Commenter	Item	Page #/ section # Line #	Comment & Basis/Justification	Doc	Chapter(s)	Response
Damon	20	P 7-23, S 7.2.5.8, L 2	Text identifying EAs with ELCR>1E-5 does not match up with Table 7-9 data. **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** *Damon RFI 20* For the MTCA Method B resident, Table 7-9 shows ELCR>1E-5 (EA C), although equal to background ELCR (3E-5). Also, HI<1 (EA F+G) for the MTCA resident (Table 7-9). However, HI>1 at all other EAs (Table 7-9) but below background HI (2.3), with the exception of HI at EA C (HI=2.4). Note, however, comparison of EA vs background (for ELCR and HI) is apparently being eliminated (see Damon RFI 15).	RFI	7	The following text changes will be made: For carcinogenic COPCs, the cumulative ELCR at EA C is greater than the 2007 MTCA ("Human Health Risk Assessment Procedures" [WAC 173 340 708(5)]) cumulative risk threshold of 1 × 10-5. Arsenic was identified as the major risk contributor for those EAs. For noncarcinogenic COPCs, all EAs report an HI greater than the 2007 MTCA ("Human Health Risk Assessment Procedures" [WAC 173 340 708(5)]) target HI of 1. Aluminum, antimony, arsenic, cadmium, chromium, cobalt, iron, lithium, manganese, and vanadium were identified as hazard contributors. Therefore, an evaluation was performed for each EA to segregate the HIs associated with those hazard contributors by similar mechanisms of action (critical effect) and toxicological effects. When the HI based on similar mechanism of action is greater than 1, those hazard contributors will be retained. However, the results of risk evaluation showed that the HI based on similar mechanism of action is less than one. Therefore, no analytes were retained as hazard contributors.
Damon	23	P 7-27, S 7.2.7, L 13-14	Text states, "...maximum detected concentrations were selected as the EPCs for small sample size." However, OSWER 9285.6-10 (EPA, 2002) states, "It is important to note, however, that defaulting to the maximum observed concentration may not be protective when sample sizes are very small, because the observed maximum may be smaller than the population mean." Therefore, defaulting to max with small samples is allowed, only because UCL cannot be reliably calculated, not due to alleged conservatism.	RFI	7	Please see the response to the BRA comment no 19.
Damon	32	p 7-43, S 7.5.5, L 36-41	A 95UCL should preferably be calculated to represent EPC, independent of receptor type when local populations are considered. For example, a population of individuals of sessile biota (e.g., plants) or mobile biota (e.g., birds or mammals) may be distributed over a range of concentrations of a given soil COPC. As a representative measure of COPC soil concentration, EPC should attempt to capture variability in COPC concentration which is independent of receptor mobility/immobility. Therefore, a UCL95 (rather than max), which contains a measure of variability (standard deviation), is the best estimate of EPC for sessile biota (just as it is for mobile biota). In addition, use of max ignores most of the information in the data set.	RFI	7	Please see response to the BRA comment no 60.
Damon	45	P 7-52, S 7.8.1, L 36-41	Text states, "For nonradiological COPCs, cancer risks and noncancer hazards indices fell below the acceptable risk value of 1 x 10-5 for multiple contaminants and multiple pathways (WAC 173-340-708[5])..." While true for the MTCA Method C industrial scenario (Table 7-3), this is not true for the MTCA Method B residential scenario (Table 7-9). ELCR≥1E-5 in several EAs for the resident (Table 7-9). However, with the exception of HI=2.4 in EA C, risks and HI≤background (Table 7-9). **Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments** Damon RFI 6, Damon BRA 5, Damon BRA 45 Except for EA C for the MTCA Method B resident (Table 7-9) and EA C and J for the CERCLA residential child (Table 7-8), nonrad ELCR<1E-5 for other EAs for MTCA and CERCLA residential exposure scenarios. Except for EA F+G for the MTCA Method B resident (Table 7-9), EA F+G for the CERCLA residential child (Table 7-8), and all EAs for the CERCLA residential adult (Table 7-8), noncancer HI>1 for other EAs for MTCA and CERCLA residential exposure scenarios. However, only HI at EA C for the MTCA Method B resident was above background (Table 7-9). Note, however, comparison of EA vs background (for ELCR and HI) is apparently being eliminated (see Damon RFI 15).	RFI	7	Concur, text will be updated as follows: Except for EA C under MTCA B residential scenario, the total ELCRs for all EAs underl all other CERLCA and WAC receptor scenarios were less than the 2007 MTCA ("Human Health Risk Assessment Procedures" [WAC 173 340 708(5)]) cumulative risk threshold of 1×10^{-5}. Arsenic was identified as the major risk contributor for EA C under MTCA Method B for direct contact . For noncarcinogenic COPCs, the HI for all EAs under all CERCLA and WAC receptor scenarios were less than the 2007 MTCA target HI of 1. Therefore, no noncancer hazard contributors were identified.

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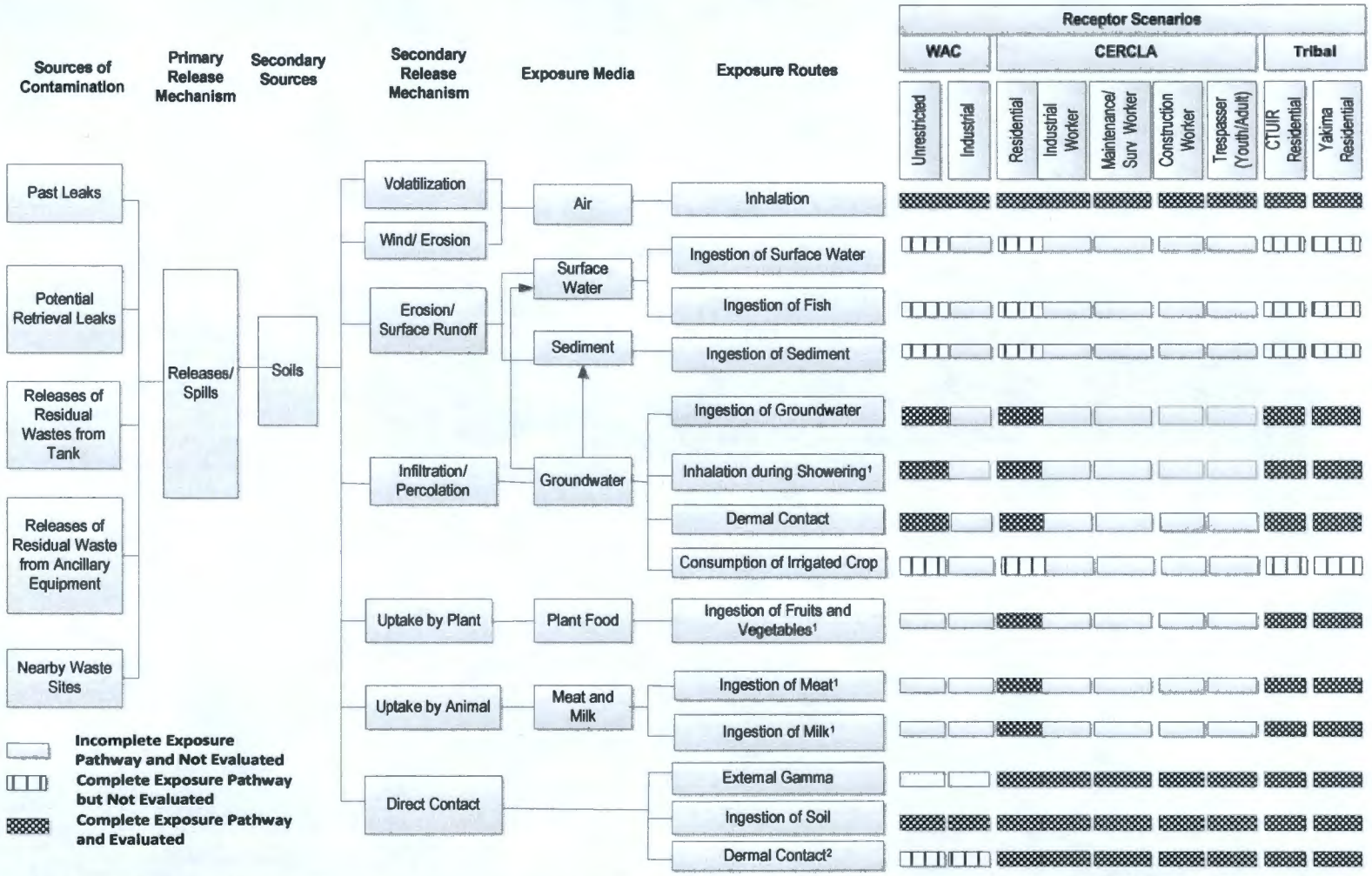
Figure 3-1: Human Health Conceptual Exposure Model



[1] Inhalation during Showering is a complete exposure pathway and will be evaluated for both CTUIR and Yakama Nation Sweat Lodge Uses exposure scenario
[2] Applicable for nonradiological contaminants

Attachment 8 (2 pages)
Damon Delistraty Email Dated April 15, 2016

From: Delistraty, Damon A. (ECY)
To: Julie Robertson; Barnes, Michael (ECY); Lyon, Jeffery (ECY); Rochette, Beth (ECY); Whalen, Cheryl (ECY); Skorska, Maria (ECY)
Cc: Beach, Ryan E; Parker, Dan L (Danny); Tabor, Cynthia L; Bergeron, Marcel P; Childress, Ryan D
Subject: RE: Review of Draft March 17, 2016 Meeting Notes Regarding WMA C RFI Report
Date: Friday, April 15, 2016 12:18:51 PM

Hi Julie,

Here's my input to the draft Meeting Notes for 3/17/2016 (with 3 attachments, including a subset of my comments).

The following comments are OK:
Damon RFI 6, 22, 25, 28
Damon BRA 5, 18, 38 (1,2,3), 45, 48, 52, 56, 61

The following comments are open:
Damon RFI 11, 19, 20, 45
Damon BRA 14, 16

I noted several additional open RFI and BRA comments in a previous email (dated 4/1/2016).

Here's some additional response to the open food pathway comments (Damon RFI 11, Damon BRA 14, Damon BRA 16):

Re the CERCLA residential scenario and tribal scenarios, pathways for rads and nonrads should be the same (with the exception of external rad exposure). Re ingestion of food, the overall uncertainty in risk estimation for rads and nonrads should be approximately equal. The uncertainty of omitting a pathway (underestimation) may be greater than attempting to model it (underestimation or overestimation).

Many rads and nonrads have toxicity factors (i.e., risk coefficients for rads, slope factors and RfDs for nonrads), and many exposure factors are independent of a rad vs. nonrad grouping (e.g., food intake rates, wet to dry wt conversion factors, exposure duration).

Various contaminant transfer factors (across environmental compartments) are used in modeling human food consumption (e.g., soil to plant, plant to beef, plant to milk, plant to chicken, water to fish). When empirical data are lacking, transfer factors for contaminants can be approximated, based on similar structural properties. For example, all rad isotopes of an element are assigned the same transfer factor (e.g., see RESRAD). Stable isotopes (nonrad) of an element would also have the same transfer factor as corresponding unstable isotopes (rads).

With respect to soil to plant transfer factors, perhaps greater uncertainty exists for contaminants which rely on a median of simple concentration ratios of tissue/media (BAFs) vs. a regression equation of tissue vs media concentrations (https://www.epa.gov/sites/production/files/2015-09/documents/ecossl_attachment_4-1.pdf). The BAF is a point estimate, accurate only at the concentration upon which it is based. In comparison, regression equations tend to better model bioaccumulation, flattening as concentration increases (Sample et al, 2014. ETC 33:2386-2398). A regression equation (derived from paired tissue and media concentration data) is generally

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Damon Delistraty Email Dated April 15, 2016

preferred over a median BAF method when specified statistical criteria for the regression are met (i.e., R2>0.2, p<0.05), as long as predictions are constrained within data range and domain limits.

Damon

From: Julie Robertson [mailto:JulieRobertson@gofreestone.com]
Sent: Wednesday, April 13, 2016 12:34 PM
To: Barnes, Michael (ECY) <miba461@ECY.WA.GOV>; Delistraty, Damon A. (ECY) <DDEL461@ECY.WA.GOV>; Lyon, Jeffery (ECY) <JLYO461@ECY.WA.GOV>; Rochette, Beth (ECY) <Broc461@ECY.WA.GOV>
Cc: Beach, Ryan E <Ryan_E_Beach@orp.doe.gov>; Parker, Dan L (Danny) <Danny_L_Parker@rl.gov>; Tabor, Cynthia L <Cynthia_L_Tabor@rl.gov>; Bergeron, Marcel P <Marcel_P_Bergeron@rl.gov>; Childress, Ryan D <Ryan_D_Childress@rl.gov>
Subject: Review of Draft March 17, 2016 Meeting Notes Regarding WMA C RFI Report

Good day. Attached for your review are the draft meeting notes from our March 17, 2016, meeting regarding the Draft Phase 2 RCRA Facility Investigation Report for WMA C (RPP-RPT-58339). Please review the attached notes and provide comments back to me by the close of business on **Wednesday, April 20, 2016**.

Thank you.

Julie R. Robertson
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Attachment 9 (19 pages)
Cindy Tabor Email Dated April 19, 2016

From:	Tabor, Cynthia L
To:	Barnes, Michael; Caggiano, Joseph
Cc:	Lyon, Jeffery; Beach, Ryan E; Kemp, Christopher J; Julie Robertson; Childress, Ryan D; Hildebrand, R D (Doug)
Subject:	WMA C RFI RCRs - Courtesy
Date:	Tuesday, April 19, 2016 10:27:50 AM
Attachments:	FYI WMAC RFI RCR.pdf Joe75 Corrosion Encrustation 1-14-14.docx Joe 108 221-C WIDS.pdf

Hi Mike and Joe

We have been working very hard on all the responses to your comments on the WMA C RFI, and as you know - have been having quite a few meetings to go over our responses. We will have a lot to cover on this Thursday and we know we will not be able to verbally discuss all responses with you. I spoke with Ryan Beach and got concurrence to send you some responses (44) that we will not be covering this Thursday – but thought you would like to see in advance to our May 5th deliverable.

The following files are included:

- PDF file: FYI_WMAC_RFI_RCR – Response to 44 comments from Joe and Mike (the light shaded blue responses include input from BP5 – Greg Thomas)
- WORD file: Attachment to supplement response to Joe Comment #75
- PDF file: Attachment to supplement response to Joe Comment #108

I greatly appreciate all the time both of you have spent discussing comments and issues with the WMA C RFI...and look forward to continuing discussions as the RFI is updated.

Thanks Cindy

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CONTRACTOR TO THE UNITED STATES DEPARTMENT OF ENERGY

Attachment 9 (19 pages)
Cindy Tabor Email Dated April 19, 2016

Commentor	Item	Page #/ section # Line #	Comment & Basis/Justification	*Doc*	*Chapter(s)*	Response
Joe	18	Pg. 2-31, lines 1-3.	This statement is not entirely true. Correlation and comparison of the elevation of high-moisture zones provide evidence of the possible correlation and the effect of these finer lamina/lenses on fluid flow through the vadose zone. These contribute to significant lateral flow that must be addressed. Please correct.	RFI	2	The sentence in question will be modified as follows: Thin silt lenses are occasionally present. ~~that occur on a scale to small to correlate between boreholes.~~
Joe	53	Pg. 5-6, bullets.	CN is present in groundwater, but is not on this list of constituents at this or other sites. Did it show in any of the analyses of these samples? Please add.	RFI	5	The location associated with this comment is C4297, which was sampled during Phase 1. Cyanide was not part of the analysis list for soil prior to Phase 2. It was analyzed during Phase 2 soil sampling and analysis campaign; however, it was not detected in any samples (identified on page 5-14 lines 22-23).
Joe	55	Pg. 5-7, lines 22-27	Any guestimates as to why Ca is so high in this zone? Also, what might be the source of the elevated Cl? Please address.	RFI	5	The comment is associated with UPR-82 and text that is solely presenting analytical results (i.e., no interpretation which is later in the document, Section 5.6). The following is provided for informational purposes and will be included as appropriate in the updated RFI Nature and Extent Data Interpretation Section. Per RPP-RPT-42294, Revision 2 (Hanford Waste Management Area C Soil Contamination Inventory Estimate), UPR-82 release is thought to be comprised of waste type P2 (PUREX high-level waste) and is expected to have higher sodium, calcium, and chloride concentrations (Also see Appendix X of the RFI). Also refer to Section 5.6.1.1 of the RFI, Geochemical Processes: "In general, tank waste is consider caustic (in excess of 1,000,000 free hydroxide), which in-turn impacts geochemical processes that occur when this waste is released to the underlying soil. In particular, when waste containing high concentrations of dissolved sodium (in excess of 4,000,000) contact the soil, the sodium exchanges with calcium, which is one of the most dominant cations present in vadose zone soil. When a waste release has moved through an area, it is expected that the naturally present calcium would be removed from the soil. For this reason, sodium and calcium, were identified as select constituents based on their exchange capacity. Other common cations and anions were selected to potentially enhance discussions (e.g., potassium).
Joe	56	Pg. 5-8, lines 4-11.	Why is the Na so high? Is there evidence of cation exchange in certain locations in C Farm soils? Please address.	RFI	5	Please refer to the Response to Joe Comment #55.
Joe	57	Pg. 5-8, lines 25-30.	Tc-99 is present in groundwater, but is not present here. What are the likely sources of Tc-99 in the vadose zone? Please address.	RFI	5	The comment in question is associated with UPR-82. This section of the report is merely presenting results of the sampling and analysis campaign; however as identified technetium-99 was detected (lines 25 - 30). The 200-BP-5 Remedial Investigation - Table 4-4 identifies a concentration of 143,861,328 pCi/L north of Well 299-E27-23. Per RPP-RPT-42294, Revision 2 (Hanford Waste Management Area C Soil Contamination Inventory Estimate), UPR-82 release is thought to be comprised of waste type P2 (PUREX high-level waste) and is expected to have elevated Tc-99 concentrations (Also see Appendix X of the RFI), however it is noted that for UPR-82 "the volume estimate appears to be high based on waste site investigations." Also, the data suggest that the leak fluids and mobile contaminants have penetrated at least 24 m (80 ft) bgs and could be present at greater depths.

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Joe	58	Pg. 5-11, lines 35, 36.	The absence of Cs-137 which is generally ubiquitous in C Farm and the absence of Co-60 are curious. Any thoughts on why this is and what it means for flow and transport? Please address.	RFI	5	The comment is associated with UPR-86 and text that is solely presenting analytical results (i.e., no interpretation which is later in the document, Section 5.6). The following is provided for informational purposes and will be included as appropriate in the updated RFI Nature and Extent Data Interpretation Section.Per RPP-RPT-42294, Revision 2 (Hanford Waste Management Area C Soil Contamination Inventory Estimate), UPR-86 release (17,000 gals) is thought to be comprised of waste type P2 (PUREX high-level waste) and is expected to have higher cesium-137 and cobalt-60 concentrations with respect to the release. It is true that these constituents were not detected during the soil sampling and analysis campaign. However, it is noted in RPP-RPT-42294 that the "volume estimate appears to be high based on waste site investigations." Additionally, it is possible that the soil sampling and analysis was not in the actual area of the release or that cobalt-60 has decayed and migrated out of the area. Per RPP-RPT-42294: "Logging and sampling of the holes showed low levels of activity around the area of the suspected release, inconsistent with a release volume of 17,000 gal of P2 waste. Although there was no evidence of a large P2 leak based on the direct push data, the volume and inventory of 17,000 gal of P2 liquid waste containing 1.35 Ci/gal of 137Cs estimated in 1971 was determined to provide a bounding estimate for the line leak."Also as identified in Section 5.6.1.1 of the RFI, ion exchange in the vadose zone can significantly impact the mobility of some contaminants (e.g., cesium) in vadose zone sediments. For example, cesium-137 is generally quite immobile in the vadose zone. When a large amount of sodium has leaked from a tank, it displaces the cesium from the soil, thus allowing the cesium to be free to move with porewater and travel significant distances. As the concentration of sodium is reduced, cesium once again binds tightly with the soil. Cesium-137 was identified as a select constituent because it is a primary contaminant of interest and because of its geochemical interaction with sodium."
Joe	59	Pg. 5-12, lines 41-43.	Are these the correct units of measure for Tc-99? Please check and correct as needed.	RFI	5	The results for UPR-81 are presented in PNNL- SA-61511 (rather than PNNL-15503, which is incorrectly referenced on page 5-12). The technetium-99 results were provided in ug/g.
Joe	60	Pg. 5-14, line 22.	CN is present in groundwater, but it was not detected in any Phase 2 samples. Has it been detected in any soil analyses? Please address.	RFI	5	Refer to Response to Joe Comment #53.
Joe	61	General Comment	Bulleted analyses results might be better presented and easier to compare if they were compiled in tabular or graphic form (i.e., strip logs). Please consider.	RFI	5	Concur. Information in various appendices present the data in both tabular and graphiic form.
Joe	65	General Comment	There ought to be a rationale for selecting the various sites that were investigated; i.e., why this locale and not somewhere else? Known release sites? HRR/SGE? Or? Please include.	RFI	5	Section 4 and Section 5 identify that: "Phase 2 sampling efforts did not represent a random statistical sampling scheme at WMA C. The Phase 2 investigation targeted locations where contamination was expected to be found based on historic records of waste losses" (refer to page 5-159, lines 13-15 with respect to Section 5). This approach was agreed upon during the data quality objective process.
Joe	67	Pg. 5-98, Sect. 5.3.4	The concentration/activity in the various waste streams differ. Potential for detection is affected by both the volume and concentration/activity. Please clarify.	RFI	5	It appears that your comment is associated with Figure 5-22 (SGE results from Site N, including Target Waste Stream Components). It is agreed that the concentration/activity in the various waste streams differ and that the volume and concentration/activity of waste releases impact SGE detection.

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Joe	68	Pg. 5-100, Fig. 5-23	On page 5-98, you indicate that C-101, 104 and 108 are the largest "known release" sites. Then, why does the maximum resistivity anomaly show around C-104 only? And why was an initial anomaly under C-104 and then, with further processing of the data, mapped under C-101? How does one know what to believe when "further processing" of the data cause the anomalies to shift to a new location? Doesn't this suggest that the technique, while promising, hasn't lived up to its potential when "ground truthing" is done via bore- and push holes? As a planning tool, it seems to be invalid. Please explain.	RFI	5	The following text is provided on page 5-105 (lines 1 - 12): "The 2006 analysis was limited to the available computer processing capabilities at that time. Recent advancements in computer processing have facilitated the ability to complete the analysis in a more technically correct approach. The 2006 modeling analysis broke the survey area into multiple overlapping sub-domains, and the results were presented by combining the smaller subdomain results to represent the larger domain. This approach can skew target locations depending on the number of, and relative locations of, the sub domains. Figure 5-23 identifies the relative locations of the subdomains used in the 2006 model. Note that domain "iv" does not incorporate the area surrounding Tanks C-104 and C-101. Because of the shape and positioning of this domain, when it was included the final 2006 results, the anomaly now thought to be located at Tank C-101, was skewed to the west and shown at Tank C-104. The 2011 analysis was completed using a single model that incorporated the entirety of the survey area into one domain. As such, these results represent the best available model of this data set to date."Your point is noted regarding "ground truthing". SGE has been used to assist in identifying where potentially contaminated areas would more likely be; however, it is understood that it does have limitations (e.g., things like infrastructure can cause false positives). Text will be added to Appendix G of the RFI, "Overview of Field Technologies" will be updated to included limitations associated with SGE.
Joe	69	Pg. 5-105, Fig. 5-27.	There are known pipeline releases between C-105 and C-105, and the maximum Cs-137 in drywell 30- 05-07 does not show as an anomaly. Please explain.	RFI	5	It is thought that the comment is referring to "known pipeline releases between C-105 and C-104....." Note that there is increased infrastructure in the vicinity of the WMA C 100-series tanks that impacts the interpretation confidence of SGE results. SGE has been used to assist in identifying where potentially contaminated areas would more likely be; however, it is understood that it does have limitations. Text will be added to Appendix G of the RFI,"Overview of Field Technologies" will be updated to include limitations associated with SGE.
Joe	72	Pg. 5-108, Table 5-8.	CN is a contaminant of interest for WMA C because it is found in several C Farm monitoring wells. As the source seems to be WMA C, please identify the specific source and/or plans to locate/identify the specific source source.	RFI	5 + GWSC	The updated RFI will include discussion on sources of contamination as necessary. Cyanide levels are considered to be associated with Ferrocyanide waste (TFeCN) from 244-CR vault treatment of tributyl phosphate waste.
Joe	73	Pg. 5-110, Sect. 5.4.1.2	NO3 is said to be dispersed throughout the saturated unconfined aquifer based on the depth of occurrence in a few wells. If it is dispersed from top to bottom throughout the unconfined aquifer, what are the plans for installing more deep monitoring wells to see how it is distributed near the tank farm proper, as well as the vertical distribution of all contaminants throughout the aquifer? Please include.	RFI	5 + GWSC	The 200-BP-5 Operable Unit will identify in their documents if there is a need to install additional wells. The following is provided for information purposes: At this time, 200-BP-5 Remedial Investigation field work has been completed and there are no additional drilling investigation planned. Any additional well drilling will be defined in the future remedial design/remedial action work plan.
Joe	74	Pg. 5-111, Sect. 5.4.1.3	The presence of SO4 migrating into WMA C suggests more than just other waste management facilities. Pyrite is present as an accessory mineral in the basalt. Is there a hydraulic connection to flows in the basalt that contain pyrite? Please address.	RFI	5 + GWSC	The 200-BP-5 Operable Unit Remedial Investigation will address "flows in the basalt" as a secondary source, as necessary. The WMA C RFI will identify if sulfate is considered to be attributable from WMA C and its source within WMA C.
Joe	75	Pg. 5-111, Sect. 5.4.1.4	Please provide the specific basis for assuming that Ni is coming from dissolution/corrosion of carbon steel well casings.	RFI	5 + GWSC	The following is provided for informational purposes: Periodic elevated nickel results are seen in the groundwater across 200 East Area. Video surveys, which have been conducted, appear to show that amorphous iron is associated with well screening corrosion. The amorphous material has been tested and contains elevated nickel, chromium, and iron along with other diagnostic constituents. The concentration of these constituents appear to confirm casing corrosion, which is anticipated given the corrosive nature of the groundwater. For additional information a white paper is attached that discusses casing corrosion.
Joe	77	Pg. 5-122, footnote.	Drywell logging detects gamma emitting radionuclides only. Tc-99 is a beta emitter and will NEVER be detected in any cased borehole. Please revise this footnote.	RFI	5	The footnote, in question, will be revised to state that technetium-99 cannot be detected in the vadose zone with logging methods in cased boreholes.

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Joe	95	Pg. 8-2, lines 3-6.	Justify these statements in light of the fact that groundwater from WMA C and other SST WMAs was known to have been contaminated by releases from WMA C. Please address and also whether this bias continues.	RFI	8	This section, summary and conclusion, will be rewritten in the updated RFI. Note that the referenced text was only identifying "initial expectations", not conclusions. Text was only trying to provide background discussion.
Joe	97	Pg. 8-2, lines 4-13.	In light of the fact that Tc-99 has been in the groundwater under WMA C for at least a decade, justify this statement.	RFI	8	This section, summary and conclusion, will be rewritten in the updated RFI. Note that the referenced text was only identifying "initial expectations", not conclusions. Text was only trying to provide background discussion.
Joe	98	Pg. 8-2, lines 29–30.	This statement needs to be qualified to state that sampling was depth limited to ~ 160 ft. and did not extend all the way to groundwater. Please address.	RFI	8	This section, summary and conclusion, will be rewritten in the updated RFI and will not include this text. Additionally, Section 4 of this document identifies the boundaries of the Phase 2 WMA C RFI.
Joe	99	Pg. 8-2, lines 40-43.	This statement conflicts with statements given on pg. 8-1 that transport was assumed to be predominantly vertical. Please clarify.	RFI	8	This section, summary and conclusion, will be rewritten in the updated RFI and conflicting statements will be removed.
Joe	100	Pg. 8-4, lines 1-4.	This statement implies that you know the depth of effectiveness of a store-release (or any other) type of surface barrier; and also that you have estimated the area to be covered by a barrier. Please explain/justify these statements.	RFI	8	This section, summary and conclusion, will be rewritten in the updated RFI will not include this text.
Joe	104	Pg. 8-4, lines 38-39.	No mention was made of retrieving the waste from the C-301 catch tank. Is this being considered? Please clarify and explain why no further characterization is needed.	RFI	8	DOE's baseline plans include retrieval of waste from 241-C-301 Catch Tank; however, decisions regarding how retrieval will occur and how much waste will be retrieved will be made based on visual inspections of the tank and waste, and characterization of the tank contents. As stated in RPP-RPT-45723, *Catch Tank 241-C-301 Retrieval Feasibility Study*, "[f]ollowing sampling and analysis of the solids inventory in 241 -C-301, the characteristics of the waste may be used to establish alternate (e.g., risked based) retrieval criteria." Also as stated in RPP-RPT-45723, "[w]aste retrieval technology selection for C-301 will be a function of two primary criteria that include: 1) the integrity of the tank, and 2) how much waste needs to be removed from the tank." Note that the letter cited does not direct ORP to retrieve 241-C-301 Catch Tank. The letter provides comments on RPP-RPT-45723 and specifically requests that "....USDOE-ORP include Ecology in discussions involving future plans and activities for [241-C-301 Catch Tank]. Ecology requests USDOE-ORP provide a schedule that includes the completion of the following decision points: · Initial sampling. · Potential for flammable gas. · Assessment of methods of retrieval. · Evaluation of methods of retrieval. · Basis for the selection of retrieval technology. · Development of a Tank Waste Retrieval Work Plan. · Final assessment of the tank residuals. · A completion date for retrieval of this tank." Letter S. Samuelson (ORP) to J. Hedges (Ecology), "RESPONSE TO WASHINGTON STATE DEPARTMENT OF ECOLOGY (ECOLOGY) COMMENTS CONCERNING THE CATCH TANK C-301 RETRIEVAL FEASIBILITY STUDY, RPP-RPT-45723", 11-TPD-085, dated November 7, 2011, closed out Ecology's comments on RPP-RPT-45723 and provided the scheduled baseline dates for characterization and retrieval activities for 241-C-301 Catch Tank as of that time. It was noted in 11-TPD-085 that the schedule for baseline activities associated with the retrieval of the 241-C-301 Catch Tank were being reevaluated and will likely change from the dates provided, and that ORP would brief Ecology on new dates as those dates are developed.
Joe	106	Pg. 8-5, lines 15-21.	These statements need justification. Furthermore, they provide little basis for proceeding to a CMS. To be able to propose corrective measures in the CMS, one should know the areal and vertical extent of contaminated soil. Please explain and justify these statements.	RFI	8	This section, summary and conclusion, will be rewritten.
Joe	107	Section 9 General Comment	This is a huge reference list. What might make it more usable is some organization by general topics, such as DOE, Regulatory, and Technical. Another suggestion might be to make it searchable, or provide hot links in the document itself. Please consider.	RFI	9	Links will be added, as possible, to the updated RFI to help facilitate the review of the document.

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Joe	108	Appendix E, p. E-1, lines 10-11	Where was the 221-C plant to be located? What happened to the open hole that had been excavated? What is the current status at that location? Was any piping installed from the location to C Farm? Please clarify.	RFI	E	Accept, information associated with Waste Information Data System (WIDS) 216-C-9, the current designation for the 221-C excavation, will be added to Appendix E and Appendix F. The WIDS summary identifies that the site was graveled and stabilized. Pipelines associated with the site are also shown in the attached information.
Joe	111	Appendix X	Great information, but how is this distributed in the vadose; how do the concentrations/activities vary with horizontal and vertical distance? The total volume of contaminated soil and its distribution is needed for PA and BRA modeling as well as for planning for corrective measures for the CMS. Please provide.	RFI	X	The information in this appendix is displaying soil contamination inventory estimates from RPP-RPT-42294. Information will be updated with current inventory estimates and information to be presented in the upcoming Appendix I Performance Assessment will assist in the determination of contaminated soil with respect to WMA C.
Joe	112	Appendix S General Comment	There are a lot of tables and graphics discussing the SGL logging programs, but there are no actual logs which would seem to be a simpler and more direct presentation of the information. Tabulating and illustrating "shallow" and "deep" information seems a lengthy and verbose way of presenting the information. I think the reader is intelligent enough to understand the actual logs if they are reading this section. Please consider including the actual logs.	RFI	S	Appendix T includes geophysical logging information.
Joe	114	Appendix U Fig Q-11	Is this total Cr? Is any of this Cr+6? Please clarify.	RFI	Q	The constituent shown in Figure Q-11 is chromium (total) not hexavalent (Table 4-6 identifies of Section 4 lists all the constituents that were analyzed per the Phase 2 Work Plan).
Joe	115	Appendix U General Comment	In the contaminant distribution profiles, certain constituents show only one dot, whether detect or non-detect. Does this mean that only one sample from the selected depth was analyzed? If so, justify the basis for sampling only at the selected single depth. Please clarify.	RFI	U	It is anticipated that information in this appendix will be updated; however, note that Figures U-9 through U-20 show soil analysis results (one time sample event) and groundwater sample results ,last one available from 2013 (as identified on page U-1, lines 33-35).
Joe	116	Appendix U, soil/contaminant profiles	For some constituents, the analysis method is clear from the reporting units. For others, the results could be from spectral gamma logging and/or sample data in some combination (e.g., averaging). Please clarify the source of the data as to sample, log, or other means. I have seen data from different methods differ by an order of magnitude. In such a case, how does one choose?	RFI	U	Page U-1, lines 31-35, identify what is displayed on the figures. The results are for soil analysis and groundwater analysis (units are provided in the legend).
Joe	117	Appendix W General Comment	Good information, but again no logs. Please include.	RFI	W	Appendix T includes geophysical logging information.
Joe	118	Appendix X General Comment	Good information, but it includes estimated inventory released from tanks, both graphically and in tabular form; however, there is no indication of the vertical and/or lateral extent of this inventory for the various constituents released. Please provide, as this information is needed for the CMS and closure.	RFI	X	The information in this appendix is displaying soil contamination inventory estimates from RPP-RPT-42294. Information will be updated with current inventory estimates and information to be presented in the upcoming Appendix I Performance Assessment will assist in the determination of contaminated soil with respect to WMA C.
Mike	1	General Comment	Chapter 1 discusses the expectations for the content, context, and uses of this WMA C RFI. It is noted this document will serve as the basis for other documents meeting milestones for the WMA C corrective action process. It is suggested that all parties review the milestone dates and content of documents to make sure all required items are covered.	RFI	ALL	Agree, DOE-ORP and Ecology have been having discussions on milestone dates and document content.
Mike	4	2.4.6.2	Please discuss in the final report the status of complete barometric corrections at WMA C wells. This should be updated and included in the final report. Final report should discuss if this change in flow direction has changed or been enhanced.—goes to future GW flow patterns---	RFI	2	The 200-BP-5 Operable Unit will evaluate barometric corrections as necessary. The following is provided for informational purposes: A method for determining the groundwater gradient and magnitude is discussed in SGW-58828, Water Table Maps for the Hanford Site 200 East Area, 2013 and 2014. At the B complex and WMA C, this method has produced gradients that provide a nearly identical flow rate as derived by concentration, distance, and time for well pairs. Barometric corrections at wells across the 200 East Area do not appear to be needed.

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Mike	14	Ground water detected species	From the December 2010 Groundwater Monitoring Report SGW-49716-VA Rev. 0 Please discuss. SST C – Dangerous constituents detected in groundwater in December 2010: cyanide, nickel, vanadium, acetone, and chloroform – Contaminants above drinking water standards include nitrate, sulfate, I-129, and Tc-99 SST C organics assessment – Acetone and chloroform were detected in December 2010; the results are under investigation because they are near the detection limit, and other organics indicate potential blank contamination – Chloromethane and tetrachloroethene also were detected in December 2010 samples, but were detected in lab QC blank, so they are likely caused by lab contamination	RFI	5 + GWSC	The following pertains to 200-BP-5 Operable Unit scope and is provided for informational purposes: SGW-51057 and DOE/RL-2011-118 explains why constituents other than cyanide were excluded as dangerous waste constituents. Specifically, the Hanford Site Groundwater Monitoring Report for 2011 (DOE/RL-2011-118) page 3.4-32 identifies that nickel, vanadium, and chloroform were excluded: - Nickel, like manganese (discussed in Section 3.4), was determined to be associated with well screen degradation based on the investigation associated with similar findings at wells 299-E33-337 and 299-E33-339. -Elevated vanadium was determined to be associated with an upgradient source because of the levels in wells north of WMA C. -Chloroform was continuously detected in well 299-E27-12, but excluded because this well is an upgradient well (see SGW-51057, WMA C April through June 2011 Quarterly Groundwater Monitoring Summary Report, for further explanation). Additionally, the Hanford Site Groundwater Monitoring Report for 2010 (DOE/RL-2011-01) page 9-48 identifies that acetone was excluded: - Acetone was detected in two wells (299-E27-23 and 299-E27-155) at 1.90 and 5.60 µg/L, respectively. The result in well 299-E27-23 was the only detect value in six samples since the assessment began, and the result is considered a false positive because the duplicate result was nondetect. The detected result in well 299-E27-155 also had a duplicate result reported as nondetect. In addition, the detected value was the only detected value in nineteen samples over the past 3 years when this well was first installed. Therefore, both acetone results are considered false positives.
Mike	15	Iodine 5.4.1.6	The text description grossly understates of the magnitude of the iodine contamination when compared to the 2012 contaminant plume map (SGRP\GISProjects|MXD\CP\200PO1\CHSGW20140770.mxd). The plume map shows an iodine plume that extends for miles and includes both BP-5 and PO-1 groundwater units; of which WMA C is but a small part of this plume. It is correct that no location impacts of iodine or potential releases from WMA C are known to have occured. Significantly more information of the nature of these iodine releases is warranted as well as any other information of constituent releases with the iodine is necessary.	RFI	5 + GWSC	The WMA C RFI will be updated with the 200-BP-5 Remedial Investigation Report as necessary.

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Mike	16	Sulfate comments: 5.4.1.3 p 5-110	In the last paragraph of the section you say E27-24, E27-14, E27-7 and E27-25 are impacted by a local release of sulfate from WMAC.In the preceding paragraph you say E27-25 has a comparable trend with E27-10 (near B-2 ditches) and with the historical trend and southward groundwater flow these wells are impacted by releases from 216-B-2 ditches. Wouldn't other wells in the vicinity of E27-25 be similarly impacted? What about well E26-8? According to Phoenix 26-8 was last sampled in 2013 with a value of 33,200 with E-27-25 with a recent sulfate value of 308,000. If sulfate migrated from the B-2 ditches why would it not migrate to E 26-8? I judge E26-8 to be about 600 feet from E27-25.Please clarify and provide a trend comparison of E27-25 with E27-10.What other groundwater constituents were discharged at B-2 ditches and could thus be expected in the groundwater at WMA C or in the vicinity.In general, how do the sulfate concentrations in the groundwater at WMA C compare to other tanks farms and the rest of the site?	RFI	5 + GWSC	The WMA C RFI will be updated with information from the 200-BP-5 Remedial Investigation Report as necessary. Specifically to address this comment: Well 299-E26-8 is screened across a separate aquifer, the Rattlesnake Ridge confined aquifer. There has been no apparent communication between the unconfined aquifer and confined aquifer between the northeast portion of the 200 East Area and the underlying confined aquifer. In addition, the confined aquifer has a greater head than the unconfined aquifer, resulting in upward migration in areas where the two are in communication. Additionally, a sulfate trend plot for wells 299-E27-10 and 299-E27-25 is provided in SGW-59423.Elevated sulfate concentrations could be associated with the 216-B-2-1 and 216-B-2-2 Ditches. Source information will be added to the WMA C RFI as needed.The following information is provided for informational purposes: Sulfate analyses were completed at more than 120 wells across the 200-BP-5 OU. The distribution of sulfate above the secondary DWS (250 mg/L) is limited to three locations within the OU: the BY Cribs, the east side of WMA C, and the southeast corner of LLWMA-2. The highest concentrations are associated with the BY Cribs and LLWMA-2 because of the thin aquifer. Concentrations are comparable at all three sites in wells with equal aquifer thickness as well 299-E27-14.
Mike	17	Nitrate 5.4.1.2 p 5-110	Here, you say the elevated nitrate at well E27-25 may be associated with unplanned releases associated with discharges to the 216 B-2 Ditches. How far are the B-2 ditches from WMA C? Why would a release from this area impact only well E27-25 and no other wells in the vicinity of WAC? Again E26-8 had a reported value in PHOENIX of 753 ug/L in 2013 with a high of ~4000 ug/L in 2006. I note the nitrate concentrations at E27-10 are ~50-60,000ug/L.	RFI	5 + GWSC	Source information will be added to the WMA C RFI as needed. As per 200-BP-5 Operable Unit, the main contaminants at the 216-B-2-1 and 216-B-2-2 Ditches are nitrate and strontium-90; these contaminants are associated with partially refined fractionation product releases. The product contained high levels of stronitium-90 activity and was being temporarily stored in a nitric acid solution at the time of the releases (ISO-986, B-Plant Phase III Flowsheets).

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Mike	18	Technetium-99 5.4.1.7 p 5-112-113	Your suggestion on Tc-99 ratios in wells E27-21 and E27-23 is interesting; however, there is another possibility to explain this. That is the nitrate associated with the technetium-99 release(s) makes up just a small component of the nitrate in the groundwater due to nitrate releases within WMA C. The change in groundwater flow has dramatically reduced the Tc-99 at E27-23 with a slight decrease in nitrate concentration and at E27-21 there has been a dramatic increase in Tc-99 with little change in nitrate. Several other wells (A-AX) have seen recent increase in tc-99 to above the drinking water standard E24-33 and E24-22. Is the Tc-99 increase in wells E24-33 and E24-22 due to technetium releases from WMA C?What is the current extent of technetium-99 contamination from WMA C in 2015 and do you have a projection of where the plume will be in 2025? Describe the basis for the extent of technetium contamination as shown in the 2012 contaminant plume map.Do you have an estimate of the Tc-99 curie content present in and around the WMA C technetium plume?Has this technetium-99 plume from WMA C now responsible for the recent rise in technetium at WMA A/AX groundwater wells?	RFI	5 + GWSC	The WMA C RFI will be updated with the 200-BP-5 Operable Unit Remedial Investigation Report as necessary. The following information is provided from 200-BP-5 Operable Unit.Groundwater flow direction at WMA C and technetium-99-to-nitrate log plot comparisons for upgradient-downgradient well pairs at WMA C and WMA A-AX: wells 299-E27-23, 299-E27-21, and 299-E24-22 display similar ratios over time as presented in Figure 3 of SGW-59423. The 2015 technetium-99 plume extends into the northwest portion of WMA A and west part of WMA A. According to numerical modeling, as presented in DOE/RL-2009-127, the current technetium-99 groundwater plume beneath WMA C will have migrated out of the 200 East Area and dispersed to levels between 450 and 900 pCi/L by 2025. The 2012 technetium-99 plume connected to the technetium-99 at WMA C (Well 299-E24-33) was mistakenly extended.The estimated technetium-99 curie content within the drinking water standard (DSW) plume at WMA C is ~2.3 Ci. 200-BP-5 Operable Unit identifies that WMA C is responsible for the technetium-99 plume and concentration increases at wells 299-E24-20, 299-E24-22, and 299-E24-33.
Mike	19	Cobalt-60	Cobalt-60 has been detected in some WMA C wells. See PNNL-15837 page 4.111 for discussion of cobalt60 detection in 1992-1994. PHOENIX also has detectable quantities of cobalt in 2013. Please include a full discussion on what this means for cobalt being detected in E27-12 and E27-14 at the same period given they are on the north side and one on the south side of the farm and implications of cobalt contamination within the farm around tanks C-105 and C-108.	RFI	5 + GWSC	The following is provided for informational purposes: The values reported in the early 1990s were from a Richland laboratory that does not exist any more. Current laboratories have a method detection limit of 25 pCi/L. Based on this, it appears that the laboratory did not have a mechanism for reporting non-detect values.

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Mike	21	Data Gaps 8.2.3	Ecology takes a broader view of further information needs to complete an investigation into the nature, extent, and pathway(s) of contamination at WMA C. Tank retrievals will continue for some time (C- 102, C-105 and C-111) are not done. Completion of these tank retrievals, sampling, and reaching a decision that no more tank retrievals are necessary will take considerable time and extend well past December 31, 2016 date for the final RFI submittal. Ecology, thus has concerns about the areas defined below; that will require discussion, evaluation, and potentially much more information. 1. Disconnect between known leaks within WMA C and the high TC-99 at perimeter wells 2. Investigate the Nez Perce idea that C-105 and C-108 had previously leaked (presented in the WMA C PA) over 100 Ci of Tc-99 3. The information on contamination in the ancillary equipment is incomplete at this point in time. 4. Investigate 30-08-02 and possible leak of C-108 during retrieval Cobalt and cesium both showed movement in the latest well logging. The cesium movement could be explained by a leak of sodium hydroxide during the hard heel retrieval of tank C-108. 18M sodium hydroxide was used for dissolution of the aluminum heel. 5. Confirm no leaks at C200s during retrieval No leak detection was available or employed during retrieval of all four of these tanks; only a crude water mass balance was used. Ecology may want to confirm no additional constituents of concern were added to WMA C soils here as well as investigate leaks from the C200 tanks and/or pipelines during operational days. 6. Two possible leak scenarios from tank C-101 are given in the leak loss evaluation; a small leak of waste from the tank or a larger volume of waste diluted with condensate. 7. Site L1 Tc99 was found at bottom of the hole at 135 feet; the drill string broke and decision was made to sample at depth. Could more Tc-99 be below this site? 8. Proposed in the plan was an idea to run SGE around the perimeter of what would be defined the cap perimeter area. This would/could be done in the final closure process/evaluation but would like to mention it here as a data gap. 9. The Nez Perce have suggested a push hole twinning groundwater wells E27-7 and E27-14 to sample and evaluate soil contamination found in drilling the original wells.	RFI	8	This section, summary and conclusion, will be rewritten in the updated RFI. The following is provided for informational purposes with respect to items 1-9 of the comment:1), 2), 4), 5), 6), and 7) Information gained from the Appendix I Performance Assessment with respect to sources, groundwater impacts and soil contamination - will be incorporated into the updated RFI.3) Ancillary equipment will be discussed in other WMA C documents as identified in Appendix I of the HFFACO Action Plan.5) and 6) Most current leak loss and inventory information will be used in the updated WMA C RFI.7) Yes, this is possible.8) The issue identified would be addressed in other documents such as the WMA C Corrective Measures Implementation Plan. Additionally, there are some limitations to SGE so the tool on its own is unlikely able to define the barrier area.9) During 2016, Well 299-E27-7 was replaced. Soil samples were collected at the new well location and available information will be provided in the updated RFI.
Mike	22	Appendix X	Table X-1 and other tables I do not understand the information it is presenting. What is it trying to tell me??	RFI	X	The information in this appendix is displaying soil contamination inventory estimates from RPP-RPT-42294. Information will be updated with current inventory estimates and information to be presented in the upcoming Appendix I Performance Assessment will assist in the determination of contaminated soil with respect to WMA C.

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The elevated nickel, copper, and cobalt groundwater concentrations at WMA B/BX/BY have been assessed in accordance with the requirements of 40CFR265 Subpart F. The assessment was initiated in accordance with the Groundwater Quality Assessment Plan for the Single-Shell Tank Waste Management Area B-BX-BY (DOE/RL-2012-53. Based on the assessment these constituents appear to be associated with well corrosion and/or biofilms associated with iron bacteria. The conclusion is drawn from the observations at Wells 299-E33-337 and 299-E33-339, which have elevated levels of nickel, copper, and cobalt and are part of the WMA B/BX/BY monitoring network, and literature reviews. Supporting this conclusion include: elevated dissolved iron and manganese at these wells, visual observation of encrustation on the well screens, the presences of aqueous copper (e.g., not considered to be a Hanford waste product), and low total organic carbon levels. Elevated dissolved iron in the 200 East Area is limited and appears to be either associated with corrosion/bacteria generated encrustation or cyanide complexes. When iron values peaked at Wells 299-E33-337 and 299-E33-339 cyanide was not detected. In addition, television surveys of the casing associated with these wells portrays heavy encrustation. Elevated dissolved manganese in the 200 East Area is also limited and appears to be either associated with corrosion/bacteria generated encrustation or galvanized pipe corrosion. The below discussion describes the plausibility of corrosion and bacteria interactions based on the current conditions seen in these wells and within the 200 East Area aquifer as compared with past investigator studies here at Hanford and at similar hydrogeological sites.

Dissolved oxygen levels, oxidation potential, pH, color of encrustation along the casing, and low to nondetect levels of filtered iron in groundwater samples in the regional aquifer indicate the natural state of iron is a ferric oxide near the upper stability limit of water in the aquifer. Under these regional conditions dissolved iron over 100 µg/L is found mainly in groundwater wells beneath and downgradient the BY Cribs and WMA B/BX/BY. The presence of dissolved iron is predominantly associated with the disposal of a ferrous cyanide complex associated with the BY Cribs liquid waste disposal site. However, the presence of dissolved iron at Wells 299-E33-337 and 299-E33-339 began before cyanide was detected at these wells and therefore appears to be associated with localized casing corrosion and possible biological activity as explained further in the following paragraphs.

Literature studies of casing corrosion with similar groundwater conditions has shown dissolved ferrous ions are quickly oxidized by the deprotonization of hydrated waters[1]. As oxidation continues, the water becomes supersaturated with respect to amorphous ferric hydroxide [$Fe(OH)^{o}_{3}$], which is one possible explanation of the encrustation seen along the casing in Wells 299-E33-337 and 299-E33-339. The oxidation rate of ferrous iron is most sensitive to pH, but is also dependent on the concentration of the ferrous iron and partial pressure of oxygen. Experimentally, the half-life oxidation of ferrous oxide to ferric oxide, based on similar

[1] Aplin, Kenneth R. and Zhao, Naiyu, "The Kinetics of Fe(II) Oxidation and Well Screen Encrustation" (1989), Groundwater Vol 27 No.2 March-April

dissolved oxygen and pH levels as at WMA B/BX/BY, is approximately three minutes[2]. Theoretically, the half-life oxidation rates are even lower, less than a minute. Because the calculated average residence time in Well 299-E33-337 is about seven minutes (e.g., based on the purging rate and borehole parameters), the dissolved iron results may be half or less than what may be seen at the well casing considering homogeneous corrosion. If corrosion is localized the dissolved iron concentration at the casing wall may be significantly greater due to mixing in the well. Based on encrustation along the well screens at Wells 299-E33-337 and 299-E33-339 localized corrosion effects appear more probable.

Alternatively, a study in Suffolk County, New York theorized encrusting material was produced by supersaturated iron and quartz rich water as well as iron-related bacteria[3]. Aplin and Zhao indicated that certain bacteria catalyze the oxidation of ferrous iron for generation and use of carbon dioxide. The source of most of the ferrous iron was determined to be from ferrous iron deposits of lignite. At Hanford several types of ferrous iron containing minerals exist including magnetite, ilmenite, goethite, and iron phyllosilicates[4]. The encrustation in the Suffolk County wells were described as weakly crystalline to amorphous with concentrations of iron ranging from 168,000 to 513,000 mg/Kg. The encrustation seen in Wells 299-E33-337 and 299-E33-339 appears to be amorphous with the same color as described by Aplin and Zhao. Disequilibrium redox conditions explained the presence of ferrous iron found in the groundwater near the Suffolk County wells. A similar explanation could explain the dissolved iron seen in Wells 299-E33-337 and 299-E33-339.

Dissolved manganese concentrations increased from nearly non-detect values to 256 µg/L in March 2011 at Well 299-E33-337. The concentrations peaked in July 2011 at 556 µg/L and have been decreasing since. Manganese was also found in the study at Suffolk County. The US Environmental Protection Agency (EPA) has noted three main types of bacteria associated with pitting attack on stainless steel and one of those is an aerobic iron and manganese oxidizing bacteria[5]. During the pitting attack as explain by EPA, microbial biofilm is formed on the casing causing a local change in chemistry at the metal-liquid interface. Changes include pH decreases; however, a significant pH change was not seen in either Well 299-E33-337 or 299-E33-339.

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[2] Pham, A. N., and Waite, T. D., "Oxygenation of Fe(II) in natural waters revisited: Kinetic modeling approaches, rate constant estimation and importance of various reaction pathways" (2008), The University of South Wales, School of Civil and Environmental Engineering, UNSW Water Research Centre, Sydney, Australia

[3] Walter, D. A., "Geochemistry and Microbiology of Iron-related well-screen Encrustation and Aquifer Biofouling in Suffolk County, Long Island, New York" (1997), Government Documents. Paper 29

[4] Zachara, J. M. et. al., "Geochemical Processes Data Package for the Vadose Zone in the Single-Shell Tank Waste Management Areas at the Hanford Site" (2007), Pacific North National Laboratory (PNNL-16663).

[5] "Report on Corrosion of Certain Alloys," (2001), United State Department of Environmental Protection Agency, Washington, D.C.

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EPA also indicates that biofilms tend to be spatially heterogeneous, creating sharp chemistry gradients both parallel and perpendicular to the metal surface. The description of spatially heterogeneous biofilms fit the observations of the encrustation seen on the well screens in both wells. Furthermore, EPA indicates chloride accumulation at microbe mat-metal interface has been identified as the cause of pitting and cracking in 304 stainless steel. The details of the chemical reaction in the EPA report are similar to the summary discussed above.

Dissolved copper concentrations rose sharply in 2011 at Wells 299-E33-337 and 299-E33-339. For example, nondetect dissolved copper concentrations were continuous from November 2003 to March 2011 in Well 299-E33-337. In March 2011, dissolved copper concentrations rose from nondetect to 6 µg/L and peaked in July at 51 µg/L. Concentrations have trended downward since and were nondetect in August 2013. No other well in the 200 East Area has had continuous concentrations of copper, except Well 299-E33-339 which is located to the northwest of Well 299-E33-337. Studies of iron-related well-screen encrustation for wells in Suffolk County, New York found copper as part of the encrusting material with concentrations as great as 1000 mg/Kg. The copper was present in black encrusting material and the organic part of the orange and brown encrusting material[4]. Although copper was not detected above detection limits in collected water samples, Walter postulated that dissolved copper concentrations were reduced because of the high flow rates of the water around the well and the ability of iron oxyhydroxide to effectively sorb trace elements. Alternatively, EPA indicated that stainless steel contains 0.06 to 0.2 percent copper[5]. Another investigator determined copper to be an important scavenger of superoxide created during the oxidation of ferrous iron for groundwater similar to that of 200 East Area[3]. Under the current 200 East groundwater conditions copper (II) oxide would be expected as the dominant copper compound in the encrustation material[6]. Copper (II) oxide is a black amphoteric oxide and dissolves in mineral acids such as hydrochloric acid. The increase of dissolve copper was coincident with increased chloride at Wells 299-E33-337 and 299-E33-339. If pit or crevice corrosion is ongoing along the well casing at these wells then part of the increasing chloride concentrations at these wells may be due to corrosion. During corrosion of stainless steel it has been shown that chloride and hydrogen ions concentrate at the point of corrosion. If this is occurring then chloride ions may dissolve some of the copper (II) oxide creating copper chloride and a plausible mechanism for the presence of dissolved copper at Wells 299-E33-337 and 299-E33-339. Other copper salts that are soluble in water include $Cu(NO_3)_2$ $6H_2O$ and $CuSO_4$ $5H_2O$[7], which may also have contributed because nitrate and sulfate concentrations increased with the copper levels. However, copper is not mentioned as part of

[6] Garrels, R. M. and Christ, C. L., Solutions, Minerals, and Equilibra (1965)
[7] Handbook of chemistry and Physics. 1968. 48th Edition. The Chemical Rubber Company.

any of the separation processes or associated wastes at Hanford[8,9]. Thus, copper does not appear to be derived from a dangerous waste or dangerous waste constituent.

Dissolve nickel concentrations rose sharply in 2011 at Wells 299-E33-337 and 299-E33-339. For example, at Well 299-E33-337 dissolved nickel concentrations were only occasionally detected at concentrations near detection limits prior to 2011. In March 2011, dissolved nickel concentrations rose from 6 to 1,580 µg/L and peaked in July at 3,640 µg/L. Concentrations have trended downward since and in August 2013 were 406 µg/L. Nickel has not rose above 188 µg/L at any other wells (e.g., besides 299-E33-337 and 299-E33-339) in the 200 East Area since 2011. The significant nickel concentrations at Wells 299-E33-337 and 299-E33-339 may be associated with well corrosion because hydrogeologic conditions in the 200 East Area is not conducive of significant dissolved nickel[6,10]. In addition, although nickel has been associated with Hanford waste streams, the presence of a possible mobilizing organic nickel complex is considered low, because of the relatively low total organic carbon concentration in groundwater compared to dissolved nickel concentrations. Alternatively, electrolytes in pit or crevice corrosion in stainless steel attract negative chlorine (Cl^-) ions increasing acidity of the electrolyte according to the reaction:

$$FeCl_2 + 2H_20 = Fe(OH)_2 + 2HCl^{11}.$$

The pH of the electrolyte inside the pit has been shown to decreases from 6 to 2-3, which causes further acceleration of the corrosion process[11]. Fong noted possible causes of pit or crevice corrosion are localized chemical or mechanical damage. Observations of the maintenance history indicated that the pumps in both these wells were replaced just before the spike in iron, manganese, copper, nickel, cobalt and chromium. Walter indicated that changing of pump equipment from one bacteria infested well to another well with no bacteria had led to bacteria infestation where bacteria were not present previously. EPA indicated that bacteria infestation occurs rapidly, within a couple of days. The new pumps were put into the wells less than a week before the March 2011 sampling event. Alternatively, if a biofilm had already been present then changing out the pump may have dislodged some of the biofilm. This may explain why unfiltered results of iron, manganese, copper, nickel, cobalt and chromium were also elevated. The solubility of nickel chloride hexahydrate [$NiCl_2 + 6H_2O$] compared to other apparently dissolved metal chlorides may explain why dissolved nickel concentrations rose more significantly compared to the other metals. EPA also indicates that nickel will leach above

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[8] Thomas, G. S., "Data Quality Objective Summary Report in Suuport of the 200-BP-5 Groundwater Operable Unit Remedial Investigation/Feasibility Study Process," (2008), CH2MHill Plateau Remediation Company, Richland Washington.
[9] Larson, D. E., "B-Plant Phase III Flowsheets," (1967), ISOCHEM Inc., Richland, Washington.
[10] Rhoads, K., "Estimation of the Release and Migration of Nickel Through Soils and Groundwater at the Hanford Site 218-E-12B Burial Ground," (1994), Pacific Northwest Laboratory, Richland, Washington.
[11] Fong Yuan Ma, "Corrosive Effects of Chloride on Metals," Department of Marine Engineering, NTOU Republic of China (Taiwan)

detectable levels from alloys that contain significant amount of nickel and that in aerobic waters at pHs <9 the predominate form of nickel is the hexahydrate ion[5]. EPA also states that complexes with naturally occurring anions such as sulfate and chloride occur. However, in anaerobic systems, insoluble nickel sulfide forms.

Dissolved cobalt metal concentrations rose sharply in 2011, despite nondetect concentrations of cobalt-60. For example, nondetect cobalt concentrations were nearly continuous from installation in 2001 to 2011 at Well 299-E33-337. The nondetect values in groundwater are consistent with investigator studies of cobalt adsorption on Hanford sediments which concluded cobalt is highly immobile[12]. In March 2011, dissolved cobalt concentrations rose from nondetect to 26 µg/L and peaked in July at 62 µg/L. Concentrations have been decreasing since, but have remained above detection. No other well in the 200 East Area has had continuous concentrations of cobalt, except Well 299-E33-339 located to the northwest of Well 299-E33-337. The lack of cobalt in 200 East Area groundwater is consistent with various batch adsorption experiments ran at Hanford over the years where organic complexes are not present[13]. Hanford investigators did indicate that because of the ionic radii of cobalt it is often found in solid solution with in minerals and may substitute in the crystal lattice for metals such as ferrous and ferric iron and manganese[13]. Zachara found that substituted cobalt in goethite could be mobilized and reduced to cobalt (II) as a result of bacterial iron reduction[13]. In addition, Zachara found the concentration of dissolve cobalt increased as a result of the bioreduction process. This finding fits with the other findings associated with iron, manganese, copper, and nickel and appears to be a plausible explanation for the dissolve cobalt.

In conclusion, the rapid increase of apparent biofilm/corrosion products (e.g., iron, manganese, copper, cobalt, and nickel) along with the change in pumps at Wells 299-E33-337 and 299-E33-339 less than a week before these metals increased indicates bacteria may have been transferred to these wells via the replacement pumps and associated equipment or dislodged existing biofilm exposing areas of ongoing corrosion. In addition, copper which has not been identified as a mineral associated with Hanford separation process chemistry or wastes indicates the sudden rise in concentration of these constituents are not associated with dangerous wastes or dangerous waste constituents from WMA B/BX/BY. Thus, these constituents are determined to not be dangerous wastes or dangerous waste constituents associated with releases from WMA B/BX/BY. This determination is made as required by interim action sites in assessment in accordance with 40CFR265 Subpart F.

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[12] Serne, R. J. and Krupka, K. M., "Geochemical Factors Affecting the Behavior of Antimony, Cobalt, Europium, Technetium, and Uranium in Vadose Sediments," (2002), Pacific National Northwest Laboratory, Richland, Washington.

[13] Zachara, J. M. et. al., (2001). "Solubilization of Fe(III) Oxide-Bound Trace Metals by a Dissimilatory Fe(III) Reducing Bacterium." Geochimica et Cosmochimica Acta, 65:75-93.

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Waste Information Data System
General Summary Report

Code: 216-C-9 **Classification: Accepted** Page 1

Names: 216-C-9; 216-C-9 C Canyon Excavation Semiworks Swamp; 216-C-9 Pond; 216-C-9 Swamp; Former 221-C Canyon Excavation; Semi-Works Swamp; 216-C-7 Swamp

Type:	Pond	**OU/WMA:**	200-SW-2
Pipe Type:	Not Specified	**Hanford Area:**	200E
Status:	Inactive	**Implementation Area:**	Not Specified
Start Date:	06/01/1953	**SQUID:**	Not Specified
End Date:	01/01/1985		

Description:

The entire site is currently backfilled and surface stabilized. It is posted as an Underground Radioactive Material area. The solid waste burial portion of the site is not separately marked or posted from the liquid waste portion of the site.

Location Description:

The unit is located north of 7th Street and north of the Hot Semi Works Area.

Process Description:

The 221-C facility excavation was divided into sections with dikes. Piping was arranged to provide three discharge points, one to each section.

Associated Structures:

Pipelines that fed the 216-C-9 Pond are sitecodes 200-E-254-PL, 200-E-255-PL, 200-E-256-PL, 200-E-257-PL, 200-E-258-PL and 200-E-259-PL.

Comment:

The excavation was originally intended to be the foundation for the 221-C Canyon Facility that was never built. It was modified to receive cooling water from the 201-C Semiworks Facility. The Hot Semiworks ceased operation in 1967 and remained in a standby mode until 1983. During that time the pond decreased in size until it was only a small marshy area in the excavation bottom. No radioactivity was identified along the swamp perimeter in a radiological survey performed in 1978. The pond area was backfilled with approximately 0.9 meters (3 feet) of washed gravel.

The Semiworks facility decommissioning began in 1983. All liquid discharge pipes were isolated. In December 1985, the east end of the dried pond excavation began to be used as a solid waste burial ground for waste associated with the Semiworks decommissioning (refer to waste site 218-C-9). The area was backfilled to grade and interim stabilized in 1989 with material from the 200 East Powerhouse ash pile. The site name designation was changed to 218-C-9 to reflect the dry waste inventory added to the pit from the Hot Semiworks decommissioning activities.

Waste Information:

Type:	Water	**Amount:**	1,030,000,000.00
Category:	Radioactive	**Units:**	Liters
Physical State:	Liquid	**Reported Date:**	
Start Date:	1/1/1953	**End Date:**	1/1/1985

Description:

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Until August 1960, the site received process cooling water from the 201-C Building; 201-C, 215-C, 271-C, and 276-C Building floor drains; and miscellaneous water from the 209-E Building and the Hot Semiworks facilities. From August 1960 to October 1969, the site received the same effluents as above plus miscellaneous wastewater from the 209-E Building. From October 1969 to December 1985, the site received miscellaneous wastewater from the Hot Semiworks facilities and the 209-E Building.

References:

1. KH Cramer, 5/1/1987, Hanford Site Waste Management Units Report, May 1987.
2. William M. Hayward, 11/15/1991, Comments on the 1992 Hanford Site Waste Management Units Report Draft.
3. LP Diediker, 8/1/1999, Radionuclide Inventories of Liquid Waste Sites on the Hanford Site, HNF-1744.
4. F. M. Coony, D. B. Howe, L. J. Voigt, Westinghouse Hanford Company Effluent Releases and Solid Waste Management Report for 1987: 200/600/1100 Areas, WHC-EP-0141.

Dimensions:

Length:		383.00	Meters	1256.56	Feet
Width:		70.00	Meters	229.66	Feet
Depth/Height:		7.62	Meters	25.00	Feet
Sq. Area:		26,810.00	Square Meters	288580.16	Square Feet
Site Shape:	Irregular				

Comments:

The length and width have been calculated from the Arcview image. The exact size and shape of the pond varied with time and usage. The dimensions of the surface stabilized area posted as underground Radioactive material is 383 meters by 70 meters (calculated from GPS'ed Arcview image).The slope of the open pond was 2:1.5. A field observation in 1991 and engineering drawings confirmed that the original unit was approximately 2.4 meters (8 feet) deep. Drawing H-2-4606 states the pond is 25 feet below the road grade. The distribution lines for the original pond section were approximately 1.5 meters (5 feet) above bottom. The lines for the new section were 0.3 meters (1 foot) above the bottom.

References:

1. KH Cramer, 5/1/1987, Hanford Site Waste Management Units Report, May 1987.
2. HL Maxfield, 4/1/1979, Handbook - 200 Area Waste Sites (Volumes 1, 2 and 3), RHO-CD-673.
3. 216-C-9 Pond Modifications, H-2-4606, Rev 2.
4. 5/3/1973, C-Plant Liquid Waste Disposal Sites, H-2-32523.
5. 5/4/1965, Strontium Semiworks and Vicinity outside lines, H-2-4010.

Field Work:

Type:	Site Walkdown
Begin Date:	2/11/1999
End Date:	2/11/1999
Purpose:	Verification

References:

1. CR Webb, 1/2/1997, Field Logbook assigned to Christine Webb (pages 77 and 80), EL-1255 and EL-1255-1.

Regulatory Information:

Programmatic Responsibility

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Responsible Contractor/Subcontractor:	CHPRC	CH2M HILL Plateau Remediation Company
Reclassifying Contractor/Subcontractor:	None	None
Responsible Project:	CPSM	Waste & Fuels Management Project - Central Plateau Surveillanc

Site Evaluation

Solid Waste Management Unit: Yes
TPA Waste Management Unit Type: Waste Disposal Unit

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:		**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Remedial/Removal Action
TPA Appendix: C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //gisweb.rl.gov/widsimg/200e/0461/0461_01.jpg **Date Taken:** 2/12/1999

Description:
Photo shows the backfilled and surface stabilized pond.

Pathname: //gisweb.rl.gov/widsimg/200e/0461/0461_02.jpg **Date Taken:** 8/26/1969

Description:
Photo number 0692608-13cn shows the open excavation with vegetation growing inside.

References:

1. KH Cramer, 5/1/1987, Hanford Site Waste Management Units Report, May 1987.
2. William M. Hayward, 11/15/1991, Comments on the 1992 Hanford Site Waste Management Units Report Draft.
3. HL Maxfield, 4/1/1979, Handbook - 200 Area Waste Sites (Volumes 1, 2 and 3), RHO-CD-673.
4. LP Diediker, 8/1/1999, Radionuclide Inventories of Liquid Waste Sites on the Hanford Site, HNF-1744.
5. F. M. Coony, D. B. Howe, L. J. Voigt, Westinghouse Hanford Company Effluent Releases and Solid

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Waste Management Report for 1987: 200/600/1100 Areas, WHC-EP-0141.
6. RE Wheeler to FA Ruck III, 6/24/1988, Comments and Revisions to the 200/600 Area Waste Units listed in the 3004(u) Report, WHC Mem. #80322-88-076.
7. D. B. Erb, 5/4/1993, Semiworks Source Aggregate Area Management Study Report, DOE/RL-92-18.
8. CR Webb, 1/2/1997, Field Logbook assigned to Christine Webb (pages 77 and 80), EL-1255 and EL-1255-1.
9. 216-C-9 Pond Modifications, H-2-4606, Rev 2.
10. 5/3/1973, C-Plant Liquid Waste Disposal Sites, H-2-32523.
11. 5/4/1965, Strontium Semiworks and Vicinity outside lines, H-2-4010.