

MEETING NOTES
Waste Management Area C RCRA Facility Investigation Report

MEETING DATE: May 4, 2016

LOCATION: Department of Energy – Office of River Protection, 2440 Stevens

ATTENDEES:

Alaa Aly (CHPRC)	MD M Rahman (INTERA)
Marcel Bergeron (WRPS)	Beth Rochette (Ecology)
Ryan Childress (WRPS)	Kristin Singleton (WRPS)
Cindy Tabor (WRPS)	James Hansen (DOE-RL)
Damon Delistraty (Ecology)	Ryan Beach (DOE-ORP)

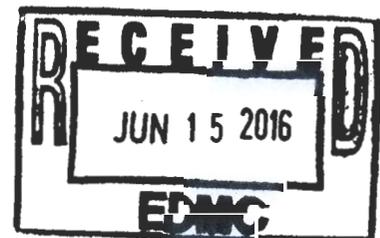
BACKGROUND INFORMATION: The meeting was called to promote continued Ecology, EPA, DOE, and WRPS discussion about comments associated with and revision of RPP-RPT-58339, Rev. A Draft *Phase 2 RCRA Facility Investigation Report for Waste Management Area C* (WMA C RFI Report). The report was submitted to 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 risk assessment comments on the Draft *Phase 2 RCRA Facility Investigation Report for Waste Management Area C*, RPP-RPT-58339, Draft Rev. A and the *Baseline Risk Assessment for Waste Management Area C* (BRA), RPP-RPT-58329, Rev. 0.

DISCUSSION OF SELECT ECOLOGY COMMENTS ON WMA C RFI REPORT AND BRA: The attendees discussed select Ecology risk assessment comment comments on the WMA C RFI and BRA reports and proposed responses.

Ms. Tabor identified that Dr. Delistraty agreed in an email on April 27, 2016 (Attachment 1) that the updated BRA Figure 3-1 was acceptable (associated with Comment Response Damon BRA 12). Attachment also contains the updated and approved figure. It was also noted that this figure is the same as Figure 7-3 in the RFI (associated with Comment Response Damon RFI 8).



The following identifies the topics and associated comments that were discussed:

- Food chain pathway
- Groundwater ingestion (multiple pathways)
- EPC/UCL calculations – exposure point concentration – upper confidence limit
- Hazard index calculations

Commenter	Document	Comment #
Damon	BRA	14, 16, 17, 19, 43, 44, 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.

The discussion started with the food chain pathway, then hazard index calculations, groundwater ingestion (multiple pathways), and finally EPC/UCL calculations. A spreadsheet was provided that presented the comments and responses (Attachment 2). Due to the small font size and readability of the information in the spreadsheet, two handouts were provided: Attachment 3 - Handout 1 (food chain pathway issue), Comments, Damon BRA 14, BRA 16, and RFI 11 and Attachment 4 - Handout 2 (hazard index calculations), Response to Comment Damon RFI 19.

Food chain pathway:

The issue discussed was whether the evaluation of food chain pathways for chemicals is required, necessary, and useful (i.e., used for more than just for informational purposes).

The response identified that the State of Washington has no requirement to evaluate this pathway and that the Risk Assessment Guidelines for Superfund (RAGS), Part A (EPA/540/1-89/002), Section 6.5.7 identifies that these equations are provided for situations where exposure is already taking place. It was also discussed that considerable uncertainties are introduced with respect to these evaluations. Dr. Delistraty pointed out that the uncertainty described in RAGS Section 6.5.7 for food pathways (for chemicals [non-radionuclides]) does not imply that these pathways should be omitted. He also stated that because the uncertainty between radionuclides vs non-radionuclides is similar for food exposure (and within the bounds of conventional risk assessment methods), both radionuclides and non-radionuclides should be included in evaluation of food pathways. It was identified that the BRA for the River Corridor (DOE-RL-2007-21, Volume II) presented the information associated with the chemical food chain pathway evaluation. Dr. Hansen identified a concern with presenting this kind of evaluation in other reports (i.e., WMA C BRA) and how it might be interpreted. Beth Rochette agreed that if the food chain pathway were evaluated, then there would need to be clear direction on how this information would be used.

Outcome/Action(s): It was agreed to table further discussions on the responses during the meeting. Ms. Tabor took the action to follow-up with Mr. Kemp (DOE-ORP) and to look into commitments with respect to the WMA C Phase 2 RFI Work Plan.

Hazard index calculations:

Personnel in the meeting first attempted to edit the text from the Damon RFI 19 response that was recommended to be included in the update RFI Report. However, as this was attempted, it became clear that there were issues with how hazard indices were used with respect to evaluation of cumulative non-carcinogenic effects and the need to go beyond IRIS for additional effects information beyond those identified in IRIS as critical. The response referenced Washington State requirements – 2007 Model Toxic Control Act

(MTCA), Human Health and Risk Assessment Procedures. Ecology identified that there was federal guidance that should be reviewed (i.e., RAGS).

Outcome/Action(s): Dr. Hansen and Dr. Aly took the action to look at RAGS with respect to how the hazard indices should be calculated.

Groundwater ingestion (multiple pathways):

The primary issue appeared to be associated with the statement: "There is no requirement to add these pathways into a single calculation." (Refer to Response to Damon BRA 17 Comment). Beth Rochette indicated that the following Washington State Administrative Codes (WAC) should be reviewed: WAC 173-340-708(6), WAC 173-340-740(5)(a), and WAC 173-340-702(4).

Dr. Delistraty also indicated that the reference in Response to Damon BRA 17 Comment to WAC 174-340-740 should be WAC 173-340-740.

Outcome/Action(s): Dr. Hansen and Dr. Aly took the action to look at the WAC requirements with respect to the issue of adding pathways.

EPC/UCL calculations:

Dr. Hansen identified that DOE-RL had already been having discussions with Ecology on how EPCs were being calculated and that EPA guidance was being followed. He identified that several EPA personnel (Laura Buelow and Marc Stifelman) were contacted to review this issue and concur the guidance is being followed.

With respect to Response to Damon BRA 19 Comment, it was agreed to remove the last sentence.

Outcome/Action(s): No specific action was taken; however, it was identified that this issue was being addressed at a higher level.

Ryan E. Beach
DOE Project Manager (print)

Ryan E Beach
DOE Project Manager (signature)

6-15-16
Date

Michael W Barre
Ecology Project Manager (print)

Michael W Barre
Ecology Project Manager (signature)

6-9-16^{1b}
Date

Childress, Ryan D

From: Tabor, Cynthia L
Sent: Thursday, May 12, 2016 2:47 PM
To: Childress, Ryan D
Subject: FW: Figure 3-1

CYNTHIA TABOR | SCIENTIST
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CONTRACTOR TO THE UNITED STATES DEPARTMENT OF ENERGY

From: Delistraty, Damon A. (ECY) [mailto:DDEL461@ECY.WA.GOV]
Sent: Wednesday, April 27, 2016 3:05 PM
To: Tabor, Cynthia L <Cynthia_L_Tabor@rl.gov>
Subject: RE: Figure 3-1

Hi Cindy,

Yes, it looks good now.

Damon

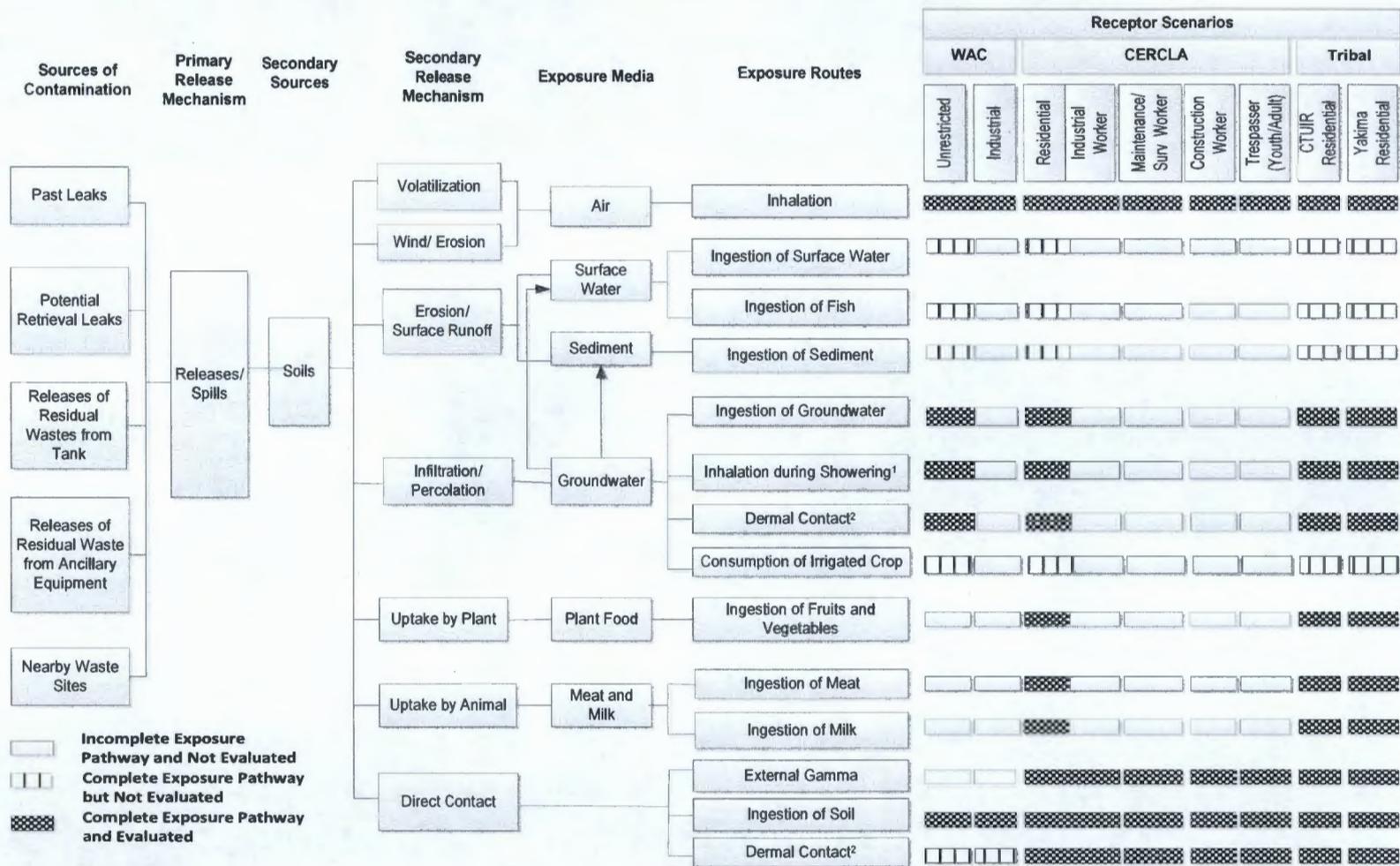
From: Tabor, Cynthia L [mailto:Cynthia_L_Tabor@rl.gov]
Sent: Wednesday, April 27, 2016 2:55 PM
To: Delistraty, Damon A. (ECY)
Cc: Julie Robertson ; Childress, Ryan D
Subject: FW: Figure 3-1

Damon

Please look at the attached Figure 3-1 ..it is updated based on discussion in our last meeting. Please let us know if you are ok with it.

Thank you
Cindy

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 2 (3 pages) Comments and Response on Risk Issues

Commenter	Item	Page #/ section #/ line #	Comment & Basis/Justification	Issue	Character	Response
Demom	14	P 3-12, 5.3.2.1.4, 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 radi and nonradi should be evaluated in food chain pathways. REFER TO HANDOUT 1	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 #: 00833831) did not evaluate these pathways for chemicals.
Demom	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. REFER TO HANDOUT 1	BRA		Please see response to the BRA comment no 14.
Demom	17	P 3-15, 5.3.2.1.4.7, L 34-35	In addition to soil ingestion and soil inhalation, MTCA Method B unrestricted land use scenario includes soil dermal contact (WAC 173-340-7403)(ii)(B)) 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 173-340-7403(ii), 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 pathways" 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 the 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.
Demom	19	P 3-17, 5.3.2.2, L10-34; 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., Half'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<3), 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 these 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 RU 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 if 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.
Demom	43	P 3-01, 5.3.6.1, 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 soil) 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 Demom Comment Response 1, groundwater within WMA C is identified as an area of interest within the 200-BP-5 groundwater DU. 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.
Demom	44	P 3-02, 5.3.6.2, 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.
Demom	60	P 4-23, 5.4.6.1, L3-46; 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.

Attachment 2 (3 pages)
Comments and Response on Risk
Issues

Issue	Commenter	Item	Page of section # Line #	Comment & Basis/Justification	Doc	Character(s)	Response
	Damon	45	P 7-52, 5 7.8.1.1 136-41	<p>Text states, "For nonradiological COPCs, cancer risks and noncancer hazards indices will be 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). ELCR1E-5 is several EAs for the resident (Table 7-9). However, with the exception of HI=2.4 in EA C, risks and HIs/background (Table 7-9).</p> <p>Email from Damon Delbraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments Damon RFI 6, Damon BRA 5, Damon BRA 45</p> <p>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 ELCR1E-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).</p>	RFI	7	<p>Cannot text will be updated to follow:</p> <p>Except for EA C under MTCA B residential scenario, the total (combined) identified all other CERCLA and WAC receptor scenarios are below the 10⁻⁵ MTCA "Human Health Assessment Exemption" [WAC 173-340-708(5)] residential child threshold of 1 x 10⁻⁵. Arsenic was identified as the major risk contributor for EA C under MTCA Method B for direct contact. For nonradiological COPCs, the HI for all EAs for all CERCLA and WAC receptor scenarios were less than the 10⁻⁵ MTCA hazard level of 1. Therefore, no noncancer hazard contributors were identified.</p> <p>Reference: "Additional Data" Attachment to Comment RFI 15.</p>

Handout 1

Damon BRA 14, Damon BRA 16, Damon RFI 11 – Food Chain Issue

Email from Damon Delistraty on 02/18/16, Subject Re: Next Set of WMA RFI Comments (contained within 02/22/16 email from Cindy Tabor attached to 02/23/16 meeting notes)

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 Streng (1992). Uncertainty due to omitting this pathway is arguably greater than uncertainty in modeling this pathway.

Email from Damon Delistraty on 04/15/16, Subject RE: Review of Draft March 17, 2016 Meeting Notes Regarding WMA C RFI Report

Damon BRA 14, Damon BRA 16, Damon RFI 11

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 preferred over a median BAF method when specified statistical criteria for the regression are met (i.e., $R^2 > 0.2$, $p < 0.05$), as long as predictions are constrained within data range and domain limits."

Handout 2

Response to Damon RFI 19 – Hazard Index Issue

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.

During the WMA C BRA, an evaluation was performed to segregate the HIs associated with those hazard contributors by similar mechanisms of action (critical effect) and toxicological effects. During the evaluation, the toxicological properties for each chemical included in the IRIS database were utilized during the selection of critical effect and target organs. Even though, the ATSDR or other sources for toxicological values identify a number of additional adverse effects of the chemicals, however, such information was not included for the following reasons:

1. IRIS RfD/RfC Development Method - IRIS establishes the RfD/RfC of a chemical to protect the organ or system that is most sensitive to that chemical. Those RfD/RfCs based on the most sensitive organs may be orders of magnitude more sensitive than other organs so that use of single RfD/RfC for other target organs may be excessively conservative.
2. Uncertainty Associated using RfD/RfC Value for other target Organ - IRIS evaluates overall confidence in the non-cancer toxicity values, and summaries provide qualitative confidence rankings of low, medium, and high for database completeness and critical study quality when conducting non-cancer assessments. If uncertainties are sufficiently large (i.e., the total uncertainty factor (UF) is greater than 3,000), EPA's IRIS program may decide against developing a toxicity value.

3. Uncertainty of Toxicity Assessments in presence of multiple chemicals – There are a number of uncertainties associated with the behavior of multiple chemicals for a target organ. Therefore, a new approach regarding target-organ-specific hazard index for chemicals targeting the same organ or system is currently being investigated for a number of mixtures. For example, target organ specific HI are being computed for the mixtures of three chemicals – arsenic, cadmium and manganese. All of those chemicals have potential effects on the neurological system. However, if mode of action data demonstrate that each chemical may effect a different structures of the brain without cumulative effect to a single end point, it is possible to overestimate the HI of the total mixture. Therefore, before calculating the additive HI, one needs to verify the mode of action or end point for each chemical in the mixture.

4. Uncertainty Associated with the toxicity information provided in other sources - During the comment resolution discussion with Ecology staff (conducted on 3/17/2016), Ecology staff provided an example of vanadium, stating that vanadium can also have effects on kidneys and could be combined with uranium for HI calculations. However, one of the ATSDR reports mentioned that while animals have shown minor effects on the kidneys following ingestion of vanadium, these effects have not been reported in humans exposed to vanadium (ATSDR, 1992). This illustrates the issues that could arise with attempting to follow lower tier toxicity information when IRIS RfD/RfC is available.

In some situations, where few contaminants are present at significantly elevated levels, it could be appropriate to research other adverse health effects to provide a more comprehensive understanding of risks. However, in situations such as those evaluated in this BRA where elevated concentrations are within a factor of two above the most sensitive values, such level of detail does not appear to be warranted. The above reasons show why IRIS assessments are the preferred source of toxicity information used for risk characterization. All IRIS assessments since 1996 have also undergone external scientific peer review. These assessments reflect the most recent available toxicity information and data analysis and were used in some cases to replace existing values on IRIS.