EPA Comments on The
Baseline Risk Assessment, Red Devil Mine, AK

General Comments:

1. In the remedial investigation report, the proximity of Red Devil Mine to Red Devil Village should be better characterized.

   Response: A map, showing the proximity of Red Devil Mine to Red Devil Village will be added to Section 1.

2. The risk assessment is missing a discussion of suitability of data for the risk assessment. Questions such as the following: Are the data adequately representative of the site? Do the data adequately represent concentrations over exposure units? Were the detection and reporting limits for the data adequate for risk assessment? should be addressed in this discussion.

   Response: Data usability it provided in Section 6.1. Additional information on data quality will be included in the RI.

3. The description of exposure scenarios, exposure pathways, exposure parameters and their values is difficult to follow. Tables B3-15 and B3-16 in the Lower Duwamish Waterway Human Health Risk Assessment (SEE: http://www.ldwg.org/assets/hhra/final_hhra.pdf) are examples of a much clearer presentation of exposure characterization that should be utilized for the RDM HHRA.

   Response: The exposure tables from the Risk Assessment Work Plan will be used in the HHRA. These tables are similar to the Lower Duwamish Waterway HHRA format. These tables will replace Table 6-19.

4. Summary risk and HQ tables should be included in the main body of the text to allow the reader to quickly grasp risks.

   Response: Tables 6-30 and 6-31 will be moved from the Tables section to the main body of the report.

5. The term “conservative” should be replaced with the term “health protective.”

   Response: The term “conservative” will be replaced with “health protective”, as appropriate.

Specific Comments:

1. P. 6-4: There should be some discussion about frequency of detection and its relation to the COPC process. It is noted that this is not likely an issue.

Response: Although frequency of detection was shown in the screening tables, Tables 6-1 through 6-6, frequency of detection was not used in the COPC screening process. A statement about frequency of detection will be added to Section 6.2.2.

2. P. 6-8, Sect. 6.2.3.1. In the subsection "Future Onsite Adult and Child Resident", consumption of home grown produce should be included as an exposure pathway.

   Response: This exposure pathway will be added to Section 6.2.3.1. Evaluation of consumption of wild berries and plants is included in the risk assessment but evaluation of produce from local gardens will be added.

3. P. 6-13, Sect. 6.2.3.3. Children's exposure should be evaluated separately.

   Response: Exposure to non-carcinogenic compounds was evaluated for a child and an adult separately. Exposure to carcinogenic compounds was evaluated based on exposure to a combined child and adult receptor. This is consistent with Section 3.3.2.2 of the RAWP, which was revised based on comments from DEC (Marty Brewer, April 2011).

4. P. 6-14, Sect. 6.2.3.3. RAGS Part E does not appear to limit determining dermal exposure for bis(2-ethylhexyl)phthalate. Information limiting characterization of 1-methylnapthalene dermal exposure could not be found.

   Response: Exhibit 1-2 of RAGS Part E indicates, for the water pathway, organic compound not recommended for assessment in Table B3 require no further dermal evaluation. Neither bis(2-ethylhexyl)phthalate nor 1-methylnapthalene is included in Table B3. Impacts of not quantitatively evaluating these compounds for the dermal pathway will be discussed in the uncertainty section.

5. P. 6-18, Sect. 6.2.3.4. Note that the adult surface area comes from Appendix C, Exhibit C-1. The derivation of the children's surface area should be more clearly referenced. It was not possible to find the appropriate table or approach in the EPA Children's Exposure Factor Handbook.

   Response: Additional information will be provided.

6. P. 6-22, Sect. 6.2.3.5. The following description of development of 95th percentile harvest rates from the Wolfe and Utermohle 2000 paper should be used:

   a. Harvest rate for a resource class developed on a household basis.
   b. Households grouped into classes:
      i. Used the resource and did not share: Harvest per household / # in household
      ii. Used the resource and shared: Harvest for ***ALL*** households / # of individuals in ***ALL*** households
      iii. Did not use the resource
   c. Rank order individuals by consumption rate

d. Select individual at 95th percentile rank. That individual's rate is the 95th percentile consumption rate

Response: Additional text will be added.

7. P. 6-22, Sect. 6.2.3.5. A suppression effect may also occur if individuals believe that the environment has become contaminated so that individuals refrain from harvesting. The first paragraph should be revised to reflect this.

   Response: First paragraph will be revised to include additional description of suppression effect.

8. P. 6-23, Sect. 6.2.3.5. Rates should be compared for all villages in the Kuskokwim drainage. The highest rate of any village should be used to assess risks. The harvest data should be presented in tabular format to allow the reader to examine the figures upon which conclusions were based. In addition to a comparison of means, a comparison of 95th percentile harvest rates should be presented.

   Response: Table 3 of the *Proposed Approach to Evaluating Consumption of Wild Foods at the Red Devil Mine Site, Alaska, Version 2* was updated with 95th percentile harvest use rates from ADF&G for all eight communities, as requested by EPA. The revised table is included in this response to comments as Table 1 and will be included in Section 6.2.3.5 of the HHRA. Based on this comparison, for non-salmon fish, Red Devil households showed the highest harvest rate, on a per capita basis, compared to Sleetmute, Stony River, Crooked Creek, Aniak, Chuathbaluk, Lower Kalskag and Upper Kalskag. For small land mammals, the Red Devil harvest rates were low compared to Stony River and Sleetmute but comparable or higher than the other six communities. For birds, we looked at the three most commonly harvested birds in Red Devil Village - spruce grouse, ruffed grouse and ptarmigan. Red Devil Village harvest rates are consistent with the other communities and fall in the middle of harvest levels for the eight communities. This is similar for the commonly harvested berries (blueberries, lowbush cranberries, and crowberries/blackberries). For these resources – non-salmon fish, small land mammals, birds, and plants - no suppression effect is evident when compared to harvest rates in neighboring communities. Therefore, the harvest rates for Red Devil for these resources are appropriate estimates of consumption for use in the HHRA.

   Based on the rationale presented on page 6-23, large land mammals harvest rates from ADF&G 2003 are the most health-protective values and will continue to be used. The rationale on page 6-23 states, "For large land mammals, black bears contributed the largest harvest amount, followed by beavers and caribou. Reports from interviews conducted in 2010 concluded that severe declines in the availability of moose in the region have led to an increase in the harvest and use of black bears by village residents. While limited by the lack of historical data, a rise in black bear uses and harvests by Red Devil households may indicate an adaption to declines in the availability of other large game resources, such as moose and caribou. Several respondents reported during the harvest survey that, prior to the moose hunting closure in Game Management Unit 19A, moose were the primary subsistence resource for the village. While caribou were never heavily harvested by the Red Devil community, a reported decline in caribou harvests is, in part, explained by both a lack of hunting activity in traditional areas, where caribou have most

often been found, and the general migration of the Mulchatna caribou herd away from the region (Brown et al. 2012)."

9. P. 6-24, Sect. 6.2.3.5, 1st parg. It should be stated in this section whether harvests were adjusted by dividing the harvest by the number of individuals in that household.

   Response: The harvest for all households was divided by individuals in all households. The methodology is presented in page 6-22 and will be summarized here.

10. P. 6-24, Sect. 6.2.3.5, penultimate parg. See previous comment.

    Response: The harvest for all households was divided by individuals in all households. The methodology is presented in page 6-22 and will be summarized here.

11. P. 6-26, Sect. 6.2.3.5. The approach used to derive FIs for fish and birds needs to be discussed with and reviewed by EPA and ADEC.

    Response: The approach is presented on page 6-26. Additional information will be added to the description of how the FIs were calculated for all wild food sources.

12. P. 6-27 Sect. 6.2.3.6. Details on the methodology used for arsenic bioavailability testing should be included in this section.

    Response: Additional description of the methodology, as is provided in Section 5.3 of the RI, will be provided in this section.

13. P. 6-28. Sect. 6.2.3.6. The levels of methyl mercury in sculpin relative to other species at the site should be discussed since the concentration of mercury in the sculpin appears to be anomalously low.

    Response: Additional information on mercury results for Kuskokwim River fish, from the BLM's Mercury in Aquatic Biota from the Middle Kuskokwim River Region, Alaska, 2010-2011 (Draft), will be incorporated. Total mercury concentrations in slimy sculpin from Red Devil Creek (shown in Table 6-15 of the RI) is greater than other aquatic species in the Kuskokwim River region, as shown in Table 4 of the BLM report.

14. P. 6-29, Sect. 6.2.3.6. Inorganic arsenic data are essential for the HHRA and need to be incorporated.

    Response: Inorganic arsenic data was not available at the time of the draft risk assessment, and therefore was not included. The data will be incorporated in the Draft Final and will be provided to ADEC and EPA when available.

15. P. 6-29, Sect. 6.2.3.6. The HHRA needs to include a discussion of general mercury results for all Kuskokwim River fish. The data are available, and it is not onerous to prepare this analysis.

Additionally, the implications of fish movement telemetry results and contaminant uptake from the confluence of Red Devil Creek and the Kuskokwim should be discussed.

Response: Additional information on mercury results for Kuskokwim River fish, from the BLM's Mercury in Aquatic Biota from the Middle Kuskokwim River Region, Alaska, 2010-2011 (Draft), will be incorporated.

16. P. 6-30, Sect. 6.2.3.6. Provide information on the FCM approach for spruce needles and grouse in this section.

    Response: The food chain multiple (FCM) from the fish section will be reiterated in this section.

17. P. 6-40: Given that risks are in the 0.02 range, consideration should be given to using the one hit model. As noted in RAGS Part A:

    > "However, this linear equation is valid only at low risk levels (i.e., below estimated risks of 0.01). For sites where chemical intakes might be high (i.e., risk above 0.01), an alternate calculation equation should be used. The one-hit equation, which is consistent with the linear low-dose model given above and described in the box on page 8-11, should be used instead."

    Response: The risk characterization section will be updated to include a discussion of the results assessing carcinogenic risks using the one-hit model.

18. P. 6-36, Sect. 6.2.4.2. The first paragraph notes that the inorganic arsenic results from fish tissue from the BLM study are not yet available. A discussion should be scheduled with the Agencies to determine if this data should be included in the baseline risk assessment.

    Response: Inorganic arsenic data was not available at the time of the draft risk assessment, and therefore was not included. The data is planned to be incorporated in the Draft Final and will be provided to ADEC and EPA when available. Discussion on incorporation in the RA can be discussed during the comment resolution meeting.

19. P. 6-40, Sect. 6.2.5.3. Risks should be presented in tabular format. For example, for a soil exposure scenario, risks for should be presented separately for dermal and incidental soil ingestion and summed. If multiple exposure scenarios are considered, these should also be included in the same table.

    Response: Risks and hazards, by exposure pathway and media, are presented in Tables 6-30 and 6-31. These tables will be moved from the Tables section of the Chapter to within the main text of the Chapter.

20. P. 6.-41, Figure 6-2: The color coding for soil and air risks is similar and confusing.

    Response: Colors will be changed.

21. P. 6-42, Sect. 6.2.5.3. The document mixes risk characterization and uncertainty analysis. These functions should be discussed in separate sections.

    Response: Discussion of uncertainties will be included in Section 6.2.6 and only referenced in Section 6.2.5.

22. P. 6-43, Sect. 6.2.5.3. Contributions to HQ and HI should be presented as a function of exposure scenarios and routes.

    Response: Risks and hazards, by exposure pathway and media, are presented in Tables 6-30 and 6-31. These tables will be moved from the Tables section of the Chapter to within the main text of the Chapter. The text will be expanded to discuss routes of exposure by scenario.

23. P. 6-43, Sect. 6.2.5.3. Cancer risk exceeding 0.01 should be computed using the one hit model.

    Response: The risk characterization section will be updated to include a discussion of the results assessing carcinogenic risks using the one-hit model.

24. P. 6-43, Sect. 6.2.5.3. Outlier analysis requires knowledge of the underlying distribution. Groundwater samples results are frequently correlated. The assumptions of an outlier analysis need to be met before it can be viably used. In addition, groundwater sample 11MP25GW is also elevated in arsenic at 6650 ug/l. These three "outlier" samples are from monitoring wells, MW-14, -15, and -21, in the Red Devil Creek valley. MW-14 and MW-15 are adjacent to one another. Thus, these values may indeed represent some localize plume(s) and not outliers.

    Response: Agreed. As described on page 6-43, the inorganic arsenic EPC in groundwater is impacted significantly by two elevated sample results of 4,530 µg/L in 11MP29GW and 1,640 µg/L in 11MP39GW. Review of total arsenic concentration in groundwater in the MPA shows a number of wells with elevated total arsenic, indicating that these two elevated inorganic arsenic levels may not be true outliers. These samples were included in the EPC. The discussion will be reworded for clarify and will be moved to the Uncertainty Analysis section.

25. P. 6-45, Figure 6-5: The QQ plot is non-linear, indicating that the data are not normally distributed. Conclusions about outliers using an outlier test that assumes underlying normality of the data are not valid.

    Response: See response to comment #24.

26. P. 6-46, Sect. 6.2.5.3, Red Devil Creek Downstream Alluvial Area. See previous comments on risk magnitude and cancer risk model used.

    Response: The risk characterization section will be updated to include a discussion of the results assessing carcinogenic risks using the one-hit model.

27. P. 6-47: Assessment of Background Contribution to Risk: This comment relates to the background discussion in Chapter 4 of the RI. The discussion of the rationale for selection of background areas and numbers and location of samples is inadequate and needs to b enhanced.

    Response: Additional discussion on background risk and uncertainties will be added to Section 6.2.5.4.

28. P. 6-49, Sect. 6.2.6.1, last parg. Statements that contaminants in water with detection limits exceeding risk based concentrations were not an issue because they were not identified in soil or sediment needs further elaboration.

    Response: Additional discussion will be provided.

29. P. 6-50, Section 6.2.6.2. The second paragraph notes that a single sample of spruce needles was anomalously high in arsenic. Thus the modeled concentration overestimates the risk. What would be the modeled calculation if the outlier was not used?

    Response: Impacts to the risk and hazard estimates not including this sample will be added to the uncertainty analysis discussion.

30. P. 6-51, Sect. 6.2.6.3, last parg. Household harvest was computed on a per capita basis based on household harvest and household size.

    Response: Agreed. The harvest rates were adjusted to estimate ingestion on an individual Basis but was derived from household data. Additional text will be added to clarify the issue.

31. P. 6-51, Sect. 6.2.6.3, last par. Editorial: harvested

    Response: Noted. Text will be changed.

32. P. 6-53, Sect. 6.2.6.5. The following text should be incorporated into the first paragraph:
    "However, use of central tendency estimates of risk would underestimate risk for a substantial fraction of individuals and would result in remedial actions that would not be protective of a substantial fraction of the population."

    Response: Central tendency estimates of risk were not used in this assessment. All estimates were based on the reasonable maximum exposed receptor. Discussion of the health protective approach taken in the HHRA will be added to the risk characterization uncertainties section may be confusing in this assessment.

33. P. 6-53, Sect. 6.2.6.5. The text describing the stream volume of Red Devil Creek and movement of fish do not appear to be linked to conclusions about site risks.

    Response: Fifth paragraph on page 6-53 will be deleted.

<u>Tables Appendix:</u>

34. Table 6-1: Field duplicates should not be included as independent samples in computation of 95% UCLs.

    Response: Field duplicates were not used as independent samples in the 95% calculations. Consistent with ADEC requirements (ADEC 2008), the highest concentrations between duplicate and original samples were used in the risk assessment.

35. Table 6-15: It is not clear whether the mercury results for slimy sculpin are for total or methyl mercury.

    Response: The mercury results for slimy sculpin are total mercury. A footnote will be added to the tables explaining that the fish tissue result from the BLM study (Matz 2011), total mercury results were measured in the tissue. For this assessment, mercury in fish was assumed to be 100 percent in the methylmercury form.

36. Table 6-19: The receptors associated with each medium and exposure route should be identified and the exposure routes should be grouped by exposure scenario.

    Response: See response to general comment #3.

37. Table 6-22: This table needs to be updated to include 95th percentile consumption rates.

    Response: The table will be relabeled to indicate the ingestion rates provided in Table 6-22 are 95th percentiles. We have not yet received the 95th percentile value for large land mammal from EPA or ADF&G.

38. Table 6-26: Please reference that GI absorption values are taken from Exhibit 4-1 of RAGS Part E.

    Response: Exhibit 4-1 will be added to footnote 1.

39. Table D-1: Risk should be subgrouped by exposure scenario. Children's risks should be computed separately.

    Response: See response to specific comment #3.

Table 1. Comparison of Harvest Rates for ADF&G Surveyed Communities

		Red Devil	Sleetmute	Stony River	Crooked Creek	Aniak	Chuathbaluk	Lower Kalskag	Upper Kalskag
Category	**Type**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**	**ADF&G 2012 - Use 95th percentile (grams/day)**
Fish	Non-Salmon	271.81	118.06	230.28	86.68	36.63	48.35	84.69	111.15
Lg. Land Mammal		27.36	335.3	161.44	124.19	74.51	63.17	223.54	74.51
Sm. Land Mammal		37.26	60.29	91.28	15.97	21.75	29.18	7.76	9.31
Birds	Spruce Grouse	8.69	8.69	9.78	2.17	2.9	2.17	1.74	2.61
	Ruffed Grouse	2.17	4.89	4.35	1.74	2.53	2.61	1.79	1.74
	Ptarmigan	0	4.97	1.24	1.24	6.31	1.24	2.48	3.1
Plants	Blueberry	4.3	5.21	9.93	8.28	6.21	12.42	12.42	33.32
	Lowbush Cranberry	9.03	13.91	8.28	2.48	4.97	9.93	2.84	11.69
	Crowberry	12.42	8.94	16.56	14.9	3.73	16.73	14.9	24.84

Notes:

Highlight = highest of 95th percentile use values