Alaska Department of Environmental Conservation

Comments on the *Draft Final Baseline Risk Assessment, Red Devil Mine January 2013*

Commenter: (ADEC) **Comments Developed: May 19, 2013**

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1.	All background results	All background results	The table and calculation is misleading and incorrect currently the distribution of the data is presented; however the recommended column values are based only on the non-parametric distribution for all cases and not the data distribution. When using nonparametric UPL as presented in the table and data files every effort should be made to separate the outlying observation before computing nonparametric limits for BTV. An outlier test was initially performed with proUCL however it only represents the two tails and not the whole data set. Once the recommended outlier is removed the Dixon and Rosner test should have been rerun to determine if the new tails are outlier for example Hg = 6.6 is an outlier based on the test. If the test is run again with 6.6 removed then 6.4 is an outlier. The next step should have been to remove 6.4 and rerun the test, which suggest 1.86 is an outlier. Once 1.86 is removed there are no outliers at 5% significance level based on the ProUCL outlier test for Hg. Nonparametric upper percentiles are often represented by higher ordered statistics such as the largest value or the second largest value. In the case of extreme high observations, these higher order statistics may be outlying observations representing contaminated observations from the site under study. Decisions made based upon outliers or distorted statistics can be incorrect and misleading. Therefore, special attention should be given to such outlying observations. The procedures should have been performed for each background distribution.	*Q-Q Plots and classical outlier tests (Dixon Test and Rosner Test), as available through ProUCL, were used to identify potential outliers. For all compounds, Q-Q plots were used to identify potential outliers. The Dixon test was used to confirm the potential outliers. The Dixon test, and all outlier tests available through ProUCL, assumes normal distribution of the data set. Many of the compounds in the background data set for which statistics were used to determine a background threshold value did show normal distribution. In some instances, this assumption was not met. Although using the Dixon test to confirm the presence of outliers when the data set is not normally distributed adds a level of uncertainty, this most often occurred for compounds that are naturally occurring or not a risk-driver at the site.* *The Q-Q plot for mercury showed two potential outliers, 6.6 mg/kg and 6.4 mg/kg. If these two data points were removed, the data set would show non-parametric distribution. The applicable ProUCL outlier test assumes normal distribution. Although the data shows non-parameteric distribution, the Dixon test did support identification of these two data points as outliers. Although there is limitation to the outlier tests available through ProUCL, the Q-Q plots provide enough justification to eliminate these two samples from the background data set. This is a health protective approach, since both potential outliers were on the high end of the distributed data. These*

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				two samples were removed from the background dataset based on the Q-Q plots and distribution of the sample results. Further information on the use of Q-Q plots and the limitations of the outlier tests available in ProUCL will be provided in this section.
2.	All background results	All background results	While it is appropriate to use max concentration for EPC when data is insufficient for calculating 95% UCL. As it is a conservative approach. It is not appropriate to calculate background based on the max detection. Background should be based off lowest concentration if a 95%UTL is not calculated.	*Using the minimum detected background concentration guarantees an underestimation of background. The recommended value, UTL, is an estimate on the upper tolerance limit. When insufficient samples are not available to calculate the UTL, the maximum concentration better represents the upper limit. No change to report.*
3.	4-3	4.1.1	Please clarified in text that sample 10RD11SS and 10RD10SS was either removed from all background metals or just mercury and arsenic. Current table in D2 surface soil background has 10RD11SS and 10RD10SS removed for "as" but unlabeled table below still has 10RD11SS = 6.6 and 10RD10SS = 6.4 listed for Hg. Sample size on table 4-2 indicate that the 2 samples was removed from all metal analysis but excel file and appendix D has 20 samples listed in the table for the elements mn, hg, ni, k, se, ag, na, th, v and zn.	*Samples 10RD11SS and 10RD10SS were removed from the background data set for all analytes when calculating the background threshold value (BTV). When these two samples are removed and the duplicate samples are reconciled, 18 samples remain for calculating the BTV, as shown in Table 4-2 and Appendix D.*
4.	4-42	Table 4-10	Several recommended background levels (n=13> max) in the table exceeded the max concentration and was not highlighted as prior tables. Are background concentrations being overestimated? There are likely outliers in the calculation please see comment 1.	*If the background threshold values exceed the maximum concentration, the maximum concentration will be used. Table 4-10 will be revised.*
5.	6-3	6.1.4.1	"Of these, the following compounds had detection limits very close to the RBSC (within an order of magnitude): pchloroaniline, bis(2-chloro-1-methylethyl) ether, 2,4-dinitrotoluene, benzo(k)fluoranthene, 4,6-dinitro-o-cresol, hexachlorobutadiene, naphthalene, 3,3'-dichlorobenzidine, and nitrobenzene." The word "very close" could imply above or below RBSC. The word should be replaced with below.	*The text was changed to, "Of these, the following compounds had detection limits within an order of magnitude above the RBSC:…" The values were not below the RBSC, as indicated in the comment.*
6.	6-4	6.1.4.2	Thallium was reported as not detected in 133 of 135 surface soil samples from the RDM site and Selenium was reported as not detected in 133 of 135. Please include the	*The range of detection limits for selenium and thallium in soil were provided in the text of Section 6.1.4.2 in the draft final RI. No*

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			detection limit for the two compounds in the text.	*change to report.*
7.	6-4	6.1.4.2	"For thallium, 16 of 73 samples were U-qualified and the MDL was greater than the screening level for thallium in sediment (0.24 mg/kg, MacDonald et al. 1999)." Please include the MDL for thallium in "(" for the sentence. "However, in all other sediment samples analyzed for thallium, thallium was detected, or reported as not detected with an MDL less than the screening level." Please include the MDL for thallium in "("for the sentence and number of samples that fell into this category.	*The requested information will be provided.*
8.	6-4	6.1.4.2	Please explain how the MDL > SL for the chemicals in surface water was handle.	*There is no simple explanation that can be applied to all chemicals in question. Major contaminants of concern at the site have MDLs > SLs. No change to report.*
9.	6-5	6.1.5	"All the criteria listed above were met for data used to prepare the BRA with the minor exceptions noted in the previous section." Please note (provide location) where in the previous section were data criteria was not met.	*The section reference will be provided.*
10.	6-6	6.2.2.1	Was migration to groundwater cleanup values in Alaska method 2 soil cleanup for under 40in zone (18 AAC 75.341) also considered in the screening process and being addressed? ADEC migration to groundwater cleanup values in soil are based on the excepted risk base or MCL limits in groundwater expected from modeling.	*Migration to groundwater cleanup levels were not used for screening consistent with RAWP, "Soil and tailings RBSCs will include EPA Regional Screening Levels (RSLs) for residential soils (EPA 2010f, or most recent), one-tenth of the direct contact and inhalation Alaska Method 2 soil cleanup level for the Under 40 inch zone (18 AAC 75.341; values provided in Appendix B of the Cumulative Risk Guidance [2008b])…" No change to report.*
11.	6-7	6.2.2.1	In the 3rd paragraph please state that the sediment screening was based on dry weight in the text for comparison to soil SL.	*"All sediment samples were measured on dry weight basis." Will be added to this section.*
12.	Table 53-54	6-183	Gray et al. 2000 data from fish samples showed that 90% of total mercury detected comprised of methylmercury in fish sample from the Red Devil mining site. Other studies in fish have concurred that the majority of total mercury detected in fish is methylmercury in some cases	*There are several reasons why the ratio of methyl to total Hg in fish collected by Gray et al. (2000) was greater than the ratio*

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			100%. The "sculpin proucl input" data for methylmercury as presented in excel worksheet provided Hg MeHg %MeHg 2-RD-9~~1~~-SC 0.68~~2.26~~0.16 23 ~~7.08~~ RD 5,6 14~~/Slimey Sculpin0.09~~ 0.31 ~~346.67~~ composite(methyl Hg only measured in this sample) RDSS1-1 0.27 0.11 41.76 RDSS1-2 0.27 0.16 60.97 RDSS1-3 0.16 0.05 31.12 RDSS2-1 0.22 0.14 61.64 RDSS2-2 0.10 0.08 82.87 The one high sample at 346.6% can be explain since it is a composite of 3 fish and not representative of the corresponding Hg The RDSS2-2 sample at 83% of methyl Hg from total falls more in line with what has been documented in literature from RDM. However the remaining samples ranging from 7.1%-61% seem underestimated and makes up a majority of the data set. In addition a sample size of 'n' = 7 is not adequate enough to compute meaningful and reliable EPC.	*observed in sculpin from Red Devil Creek.* *1. Gray et al. (2000) collected Arctic grayling, dolly varden, chum salmon, coho salmon, chinook salmon, and northern pike. These species are much more mobile than sculpin. If the fish collected by Gray et al. (2000) were present near mercury mine sites for only a limited time, they would not be expected to contain a high fraction of inorganic mercury. The sculpin collected from Red Devil Creek in 2010 and 2011 by BLM likely were present in the creek for much of their lives and, therefore, experienced prolonged exposure to high levels of inorganic mercury. In such situations, it is not unexpected for a large fraction of total mercury in fish to be present in an inorganic form.* *2. Gray et al. (2000) analyzed muscle tissue (fillet). The sculpin samples from Red Devil creek were analyzed as whole-body samples. Fillet samples typically contain a greater percentage of methyl Hg than whole-body samples.* *3. Gray et al. (2000) collected most of their fish from Cinnabar Creek, which is considerably longer and larger than Red Devil Creek.* *The total Hg and methyl Hg data presented in this comment appear to have been taken from Appendix H (Human Health ProUCL Inputs and Outputs). Please note that the methyl Hg results for two samples appear on incorrect rows. Corrections are shown in the table at left. Six individual sculpin samples from Red Devil Creek were analyzed for methyl and total Hg. The ratio of methyl to total Hg in these six samples ranged from 23% to 83% with an average ratio of 50%. One composite sculpin sample from Red Devil Creek (RD 5, 6, 14) was analyzed for methyl Hg only. Hence there are a total of seven analyses for methyl Hg in sculpin from Red Devil Creek. Seven detected*

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				results is sufficient for calculating the 95% UCL. EPA (2010a) suggests avoiding the use of statistical methods to estimate the background values on data sets with fewer than four to six detected values. We agree that a larger sample size is preferable, but only seven methyl Hg results are available for sculpin from Red Devil Creek. *The following discussion of uncertainty of using a small sample size for methyl mercury in fish will be added to Section 6.2.6.2., "Methylmercury concentrations in sculpin from Red Devil Creek were used to determined potential hazards of ingesting game fish from the Kuskokwim River. The methylmercury concentration in sculpin was multiplied by three to account for the bioaccumulation properties of methylmercury into game fish. There are seven sculpin samples that were analyzed for methylmercury, six of which were whole body samples that also had total mercury results. Of these six samples, the methylmercury percentage compared to total mercury ranged from 23% to 83%. The total mercury concentrations in these six samples ranged from 0.10 mg/kg-wet weight to 0.68 mg/kg-wet weight. Forty-five whole fish sculpin samples were analyzed for total mercury. The total mercury results from this data set ranged from 0.05 mg/kg-wet weight to 3.7009 mg/kg-wet weight. The small data set for methylmercury could potentially under-estimate methylmercury in sculpin from Red Devil Creek. Although there is uncertainty in the methylmercury concentration in sculpin based on the small sample size, the actual methylmercury concentration in fish is preferable than estimating methylmercury concentrations and percentages based off of total mercury concentrations and literature values. In addition, the health protective assumptions used to model the methylmercury*

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				concentration in game fish reduces the potential impacts of this uncertainty. "
13.	6-13	6.2.3.2	Please provide approximate size of the 3 exposure units.	*Approximate size estimates will be included.*
14.	Table 6-15	6-128	Why aren't the total mercury results also present? 7 samples for EPC on methyl mercury are not enough for proUCL. In addition the % mercury vs total would provide info on how well the fish data is represented.	*See response to Comment 12. No change to report.*
15.	Table 6-27		It is not understood why methylmercury is in the cancer toxicity data table when it doesn't have an oral cancer slop factor.	*Those rows should have been hidden in the file since methylmercury is not a carcinogen. Those fields have now been hidden and will not appear in the .pdf or printed files.*
16.	6-34	6.2.3.7.4	The one blueberry sample value could not be located in Appendix E as stated. In addition one blueberry value that is in a potentially impacted is not sufficient for the HHRA. Were elevated corresponding soil concentration noted in the same area? Based on Figure 4-46 corresponding surface soil sample levels were below background proposed.	*This is the only on-site berry data that was available after multiple rounds of attempts for collection. Because the on-site data is limited, modeled concentrations in berries will be used to estimate risk and hazards from ingestion of metals in berries. Specifically, chemical concentrations in blueberry fruit is modeled based on the following uptake equations from Baes et al. (1984):* $Cv = Cs \times Br$ *Where,* *Cv = Concentration in non-vegetative (reproductive) portion of food* *Cs = Concentration in soil (mg/kg)* *Br = Soil-to-plant elemental transfer coefficient for non-vegetative (reproductive) portions of food crops* *The transfer coefficient for reproductive portions of plants is obtained from Figure 2-2 of Baes et al. (1984) and will be presented in a table.*

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				The uncertainty of estimating blueberry fruit concentrations based off of the modeling approach is described in the Uncertainty Analysis, Section 6.2.6.2.
17.	6-40	6.2.4.2	The inorganic arsenic 95-percent UCL is 19.23 milligrams per kilogram wet weight (mg/kg-wet), which is greater than the total arsenic 95-percent UCL of 12.98 mg/kg-wet. Please cite table where the data is presented. The data is contradictive of the prior information and is there a plausible explanation?	*This information is correct. This is primarily a function of the calculation of the 95% UCL. There are 45 results for total arsenic that went into the calculation and only 12 results for inorganic arsenic. When looking at samples which had both total and inorganic arsenic, the percent inorganic arsenic ranges from 24% to 115%, with two paired results greater than 100%. Inorganic arsenic was used in the risk and hazard calculations. A table of paired total and inorganic arsenic data will be added.*
18.	6-42	6.2.5.5.	The statement is bias and should be replaced with more factual statements, "most likely in the trivalent form," The overestimation of risk is more appropriate in the uncertainty section.	*This is in reference to Section 6.2.4.5. The last sentence will be deleted and a reference to the Uncertainty Section, 6.2.6.2, will be added. Section 6.2.6.2 states,* *"Total chromium was identified as a COPC in soil, sediment, surface water, groundwater, and biota based on comparison of site concentrations to health-protective screening levels for hexavalent chromium. There are no known sources of release of hexavalent chromium. Since only total chromium concentration data are available, the ADEC requires that total chromium results be assessed assuming 100 percent of the total chromium is in the hexavalent form. This assumption will over-estimate the true risk of exposure to chromium."*
19.	6-45	Table 6-29	Column medium has "HI by Target organ" listed and seems to be out of place when table is referring to cancer risk.	*Row will be deleted.*
20.	6-45	Table 6-29	Fist column in table under medium doesn't list HI by target organ as indicated.	*The row referenced in Comment #19 will be deleted.*
21.	6-46	Table 6-30	Foot note is incorrect stating HI greater than 1.0 is shaded as berries and plants are shaded but	*The shading will be eliminated where the HI was equal to 1.*

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22.	6-46	Table 6-30	An adjusted total HI should also be provided that is base off the combine adult/ child future residential scenario. By just presenting the risk to only child or adult it doesn't represent a future resident that incorporates but receptors for a residential exposure of 30years.	*The proposed approach is not consistent with the RAWP, DEC's Risk Assessment Procedures Manual (Table 1), or EPA's Regional Screening Level development. For non-carcinogens, adult and child exposure are evaluated separately. Please note adult exposure is evaluated at 30 years of exposure. The proposed approach would result in "averaging out" the adult and child hazards instead of showing the higher child hazard versus lower adult hazard. Please note, the proposed ACLs coincide with the higher child exposure. HIs or ACLs for a combined receptor would be between the ones calculated for adults and children. No change to report.*
23.	6-47	Figure 6-2	Please display the total cancer risk for each site on the figure as 5% on a high risk area could be much higher than 20% on a lower risk area. Without knowing the total the figure could be misleading?	*The intent of these figures is to show media contribution to risk, not compare overall risk between areas. Total cancer risk will be added to the figure.*
24.	6-50	Figure 6-3	Same comment as 23, but for the HI.	*The total HI will be added to the figure.*
25.	6-55	6.2.6.1	How much underestimation of risk from these compounds exceeding RBSC is actually expected (quantified) from the MDL achieved from the lab reports. pchloroaniline, bis(2-chloro-1-methylethyl) ether, 2,4-dinitrotoluene, benzo(k)fluoranthene, 4,6-dinitro-o-cresol, hexachlorobutadiene, naphthalene, 3,3'- dichlorobenzidine, and nitrobenzene. The magnitude to which the MDL and RBSL differs should also be presented in the text of the uncertainty section. The greater the difference the more uncertainty is associated with the result and vice versa for the individual compound.	*A discussion of the magnitude of which the MDL exceeds screening levels and potential impact of not including these compounds as COPCs will be added to the uncertainty discussion.*
26.	6-78	6.3.7.4	Are there any chemical data to suggest the 6 reference creeks are appropriate? The map Figure 6-6 displays cinnabar deposits in close proximity to Vreeland and Fuller creek.	*Yes. Metals data for sediment and water are available for the reference creeks to verify their reference status (BLM 2012). The data will be briefly summarized and included in the BERA.* ***References***

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				BLM. 2012. Quantification of Fish and Aquatic Insect Tissue Contaminants in the Middle Kuskokwim River, Alaska: Supplemental Information on Study Design, Watershed Characteristics, Benthic Macroinvertebrate Analysis, and Sediment/Water Sampling Within the Project Area. Prepared by BLM, AK State Office, Anchorage, AK.
27.	6-172	Table 6-44	Please provide spreadsheet calculation for the HQ for oversight. Footnote "e" for chromium is incorrect (2008c). The current citation listed is for child exposure factor in the reference section.	*The spreadsheet will be provided. EPA (2008c) will be changed to EPA (2008f) in foot note e.*
28.	6-72	6.3.4.2	Benzoic acid and bis(2-ethylhexyl)phthalate may be introduced into environmental samples from other sources is the reasoning for not including in the COPC list. Please provide discussion on the concentrations detected in relation to expected contribution form these sources other sources discussed.	*See response to EPA comment #66. No change to report.*
29.	6-96	6.4.1	Non-cancer based off just 6 years as is child is not the typical residential time of 30 years. Residential risk based cleanup should also included 24 years as an adult. A combine scenario is required for future residential receptor..	*See response to comment #22.*
30.	6-215	Table 6-83	Please list if cancer or noncancerous is driving the risk. Is cumulative risk being considered in the calculation? See comment 31 for future resident from noncancerous risk. Do these risk based cleanup values address the migration to ground water?	*Arsenic is the only carcinogenic COC. The RBCLs shown in this table for arsenic are driven by carcinogenic risk. For the rest of the COCs, the RBSCLs are set based on noncarcinogenic hazards. A footnote will be added to the table. As stated in 6.4.1, final RAOs will be adjusted to ensure that the cumulative risk and hazard at the site do not exceed a target excess cancer risk of 1 in 100,000 (10-5) or an HI of 1.0. As many of the final RAOs will potentially be set at background level at the FS stage, it would be inappropriate to present any adjustments here.* *Migration to groundwater cleanup levels are part of the ARAR analysis and are not included in the risk assessment.*

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31.	6-217	Table 6-85 to 6-87	Do the currently proposed cleanup values for the COC in ecological risk account for cumulative risk? A calculated cleanup HQ =1 for Arsenic and HQ= 1 for mercury will exceed cumulative risk.	*The cleanup levels for protection of ecological receptors do not account for cumulative risk. A statement to this effect will be added to the BERA in Section 6.4.2.*
32.	Appendix J	All tables	All groundwater risk calculations should be base max concentration for the area and not an EPC calculation. Please provide results with max groundwater calculation for risk. The EPC results can be included in the uncertainty section.	*All site risks and hazards were calculated using the maximum groundwater concentrations for the EPC, as discussed in Section 6.2.3.2. and presented in Table 6-14. Section 6.2.6.2. of the uncertainty section discusses the potential over-estimation of risk based on this approach and calculates risk using the 95% UCL for the EPC. Note for the SMA exposure unit, the groundwater EPCs were based on the results from the single monitoring well located within the SMA (MW29). No change to report.*
33.	Appendix J-6		Please place 95% UCL in the column for medium EPC. The calculation for mercury seems incorrect for soil concentration at SMA residential with an EPC of 39.4 mg/kg a HQ for child ingestion = 2.4 as opposed to 1.3 with recheck on RAIS calculator using EF of 270. The other routes were also lower for child and adults. Please recheck calculation and provide spreadsheet for oversight for all tables in appendix J. The maximum detected concentration in groundwater shall be used as the EPC for the assessment of risk posed due to exposure to groundwater (i.e., **ingestion, dermal contact, inhalation** of volatiles from water). Considering the dynamic nature of groundwater, it is not deemed appropriate to average concentrations over an aquifer. This is recognized in 18AAC75.345 (e) regarding the point of compliance where groundwater cleanup levels must be met throughout the aquifer. Is 0.247 ug/L the max groundwater dermal concentration for the site? Why is **groundwater ingestion HQ** not presented for the residential site SMA or the other sites.	*Please see response to Comment #32. The 95% UCL was used for all medium except for groundwater which used the maximum concentration.* *RAIS calculator for mercury (inorganic salts) returns a results of an HQ=1.3, consistent with Appendix Table J-6. If elemental mercury is chosen in the RAIS calculator, that results in the reference HQ of 2.4. The reference dose or mercury, inorganic salts, is the most appropriate and health protective choice for this site. Appendix J Excel files will be provided.* *Please see response to Comment #32.* *The maximum groundwater concentration for mercury in the SMA is 0.247 ug/L based on the result of sample MW29.* *The groundwater ingestion HQ is shown. The row headers were*

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			A combine adult/child residential scenario calculated for the noncancerous risk of 30years should be presented.	*inadvertently left off this row but will be added.* *See response to Comment #22.*
34.	Appendix J-12		Groundwater should be based off max concentration see comment (29). The concentration for mercury at 14.8 µg/L is not the max concentration presented in the Excel spreadsheet which has GW input sample **11MW01GW max listed at 56.5 µg/L**. HQ for mercury at 14.8 µg/L child ingestion from groundwater using RAIS calculator resulted in 5.9. What is presented in the table is 3.2. Please recheck calculation and provide spreadsheet for oversight for all tables in appendix J.	*This table is used in the uncertainty discussion to show the impacts of using the maximum groundwater concentration in the risk characterization section versus use of a 95% UCL in the uncertainty discussion. The value presented in this table is the 95% UCL, as is correct for this demonstration.* *RAIS calculator for mercury (inorganic salts) returns a results of an HQ=5.9, consistent with Appendix Table J-12. If elemental mercury is chosen in the RAIS calculator, that results in the reference HQ of 3.2. The reference dose or mercury, inorganic salts, is the most appropriate and health protective choice for this site. Appendix J Excel files will be provided.*