Comments on the Fugitive Dust Human Health Risk Assessment – Draft (April 2005), Red Dog Mine, Alaska; Comments Prepared by Alaska Department of Environmental Conservation (ADEC); June 2005

Comment No	Page	Section	Topic/ Importance	ADEC Comment
1	General	General Comment	General/High	We verbally requested that the implications of the findings of the Hasselbach et al. (2004) study be included in this risk assessment. Hasselbach et al. (2004) had evidence that dust from the transport system was traveling as far 25 km north of the road. Lead levels in moss were still elevated over background at this distance. It is important that this risk assessment integrate these findings. It should discuss whether animals eat the moss, especially during the winter or other times when food sources are scarce, and what the implications are for both human and ecological health. This study also has implications for the reference sample locations selected for the Phase II field sampling plan. It appears that the marine sediment samples taken during the Phase II field sampling event may possibly be impacted from fugitive dust based on the contaminant prediction maps presented in Hasselbach *et al.* (2004). The reference area for terrestrial assessment is located on the south side of the road. This reference location may still be appropriate but should be verified.
2	xx	Executive summary	General/ Moderate	In the executive summary it notes that NANA Regional Corporation (NANA) and Alaska Industrial Development and Export Authority (AIDEA) commented on the January 2003 workplan. DEC is unaware of comments by these two organizations. Please provide their comments on the workplan.
3	2-4 to 2-5	2.2	Policy/ Moderate	It should be clarified in this section that dust coming directly from trucks or port loading facilities has a larger percentage of particles smaller than 1 micron than does dirt sampled near the road. Air pollution that occurs as part of ongoing mine operations is not regulated by the Contaminated Sites program. However it would be useful to include a discussion of current levels of dust detected in air monitors to address public health concerns.
4	2-7	2.2.4	Policy/ Moderate	This section generally describes control implemented by Teck Cominco to reduce fugitive dust and thereby risk to human health and the environment. To assist the reader in understanding the specific controls implemented this should describe in greater detail the specific controls that have been implemented. Although this section refers the reader to the background

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				document, Teck Cominco has implemented more controls since the background document was written. DEC suggests detailed information about engineering and other controls be included as part of this section or as an appendix to the report.
5	2-12	2.3.2.3	Technical/ Moderate	The draft report states that surface water will be evaluated for streams that flow into the Wulik river that provide drinking water for the Kivalina residents. Please modify this section and other later sections in the report, such as Section 3.2.2. to address comments raised by resident in Kivalina during the April 20, 2005 meetings that other surface water bodies near the port, such as Umayutsiak Creek, are used for drinking water by humans or terrestrial animals. The report should also address other creeks that are potentially impacted by fugitive dust and could be used for drinking water by subsistence users or terrestrial animals that cross the DMTS such as those in Cape Krusenstren National Monument. Figures provided in the report generally detail the Wulik drainage and creeks immediately to the north of the port area. No detailed figure is provided that shows the creeks with names to the south of the port. This would give the reader a better perspective on the area that is potentially affected.
6	2-19	2.4.1	Technical/ Moderate	Please rephrase this section. It states that with the exception of Evaingiknuk Creek drainage basin, all the streams crossed by the DMTS road drain to the Wulik River. New Heart Creek and the Omikviorok River and its tributaries flow either directly into the Chukchi Sea or coastal lagoons. This section should include a discussion of river systems that discharge directly to the Chukchi Sea and may be impacted by fugitive dust.
7	5-1	5.1 and Figure 5-1	Technical/ Medium	The revised conceptual site model (CSM), Figure 5-1, is the same CSM provided in the RAWP prior to incorporating the comments on compounds of potential concern (COPC) screening protocol. Figure 5-1 should be updated to include quantitative evaluation of freshwater environments, as stated in Section 5.1. Specifically, surface water ingestion by residents and biota ingestion by subsistence users and the combined worker/subsistence user scenarios should be primary exposure pathways. These pathways were

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				quantitatively evaluated in the risk assessment.
8	5-3	5.2.1.1	Technical/ High	ADEC would prefer to also see the soil EPC presented without weighting, because it assumes that the time spent near the port is determined by surface area relative to the area along the road. There is no known evidence to support this assumption. Concern over berry harvesting in the port area remains an important issue to the residents of Kivalina. It is feasible that the time they spend near the port is comparable to the time they spend near the haul road. To allow comparison, a simpler non-weighted EPC should also be presented in the main text.
9	5-4	5.2.1.2.3	Technical/ Medium	Please explain why the data from ptarmigan collected in the reference area is not used in the risk assessment. This data appears to be used when determining COPCs in ptarmigan and caribou. Specifically, thallium in ptarmigan and caribou were eliminated as COPCs based on comparison of ptarmigan site samples to reference samples.
10	5-4	5.2.1.2.4	Policy/ High	The executive summary states that the area within the port is included in the risk assessment. This is not consistent with eliminating berry samples taken at the port facility. Additional rational should be provided in the risk assessment for eliminating some berry samples. The statement in section 8.1.3 that "…risks are not elevated even when data from restricted areas are included…" is an overstatement if data from the port area is excluded. Moreover the restriction of berry gathering in this area does not mean it never occurs. Since the intention of the risk assessment is to include the port area, all samples taken near the port should be included in the assessment.
11	5-5	5.2.1.2.6.1 and Table 5-3	Technical/ High	Because data on thallium in fish was not available, it was agreed upon in the response to the RAWP comments that thallium will be estimated in fish based on the relationship between thallium and lead concentrations in surface water. This assumes uptake and bioaccumulation of both compounds occurs at the same rate. Data supporting this assumption should be provided in the main text of the risk assessment. Some supporting data is provided in the uncertainty section.

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				Please provide a rationale for why the ratio of thallium to lead was determined based on the mean concentrations versus the upper confidence limit (UCL) or the maximum concentration. If the ratio were determined based on the UCL the thallium concentration in fish would be estimated as 0.004 mg/kg-wet versus 0.0027 mg/kg-wet based on the mean comparison.
12	5-5	5.2.1.2.6.2 and Table 5-4	Technical/ High	Barium concentrations in caribou tissue were estimated similar to the method described in the comment above. This general approach was agreed upon in the response to the RAWP comments. Please address the comments above regarding bioaccumulation, uptake, and mean comparisons for the estimation of caribou tissue concentrations. These issues are especially of concern since tissue concentrations are being estimated between species. Some discussion is provided in the uncertainty section but this should be expanded and provided in the main text of the risk assessment. Section 5.2.1.2.3 indicates that the ptarmigan samples taken from the reference area are not used in this risk assessment. Therefore, the comparison of ptarmigan thallium tissue concentrations at the site to reference concentrations should not be conducted and thallium should be included as a COPC in both ptarmigan and caribou. Please include thallium as a COPC or show why the ptarmigan site-samples should be compared to the reference samples in the risk assessment.
13	5-6	5.2.1.2.7	Technical/ Moderate	Weighting of edible tissue introduces the following concerns: -It assumes that eating habits reflect weight proportions. This may not always be the case for at least certain segments of the population. The goal of any risk assessment should be to protect those with higher than average exposure. -It is unclear if the weight percentages are the percent of the edible tissue of the caribou or the total weight -A grouse can reach a weigh of up to 31/2 pounds, whereas a ptarmigan's upper weight limit is 11/2 (ADF&G). Combining these two birds to estimate weight percentages of certain organs is going to result in inaccuracies.

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				Please verify that the kidney and liver weight percentages used in the risk assessment are based on edible tissue and not an overall caribou weight.
14	5-6 to 5-7	5.2.2.1 and Table 5-6	Technical/ High	Provide a reference for the lead diet intake value. The source is listed as "update to EPA default". This should be referenced and supported. The Environmental Protection Agency (EPA) does not recommend a quantitative adjustment of the soil/dust ingested daily variable unless significant data is available to support the adjustment (see excerpt from EPA 1999, below). Please use the EPA default values for this variable. Please confirm that the alternate source, subsistence food variable is set at 1.6 μg/day for all age groups. EPA, December 1999, *Short Sheet: IEUBK Model Soil/Dust Ingestion Rates*, OSWER, Washington, D.C., OSWER 9285.7-33; EPA 540-F-00-007.

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				Substitution of Default Values of Ingestion Rates: Technical Considerations The IEUBK model default values for the rate of soil/dust ingestion do not reflect differences associated with variables that may affect ingestion rates at different sites. Examples of such variables include ground cover, climate, activity patterns, and behavior. While inclusion of such information in a risk assessment is desirable, often such data are not available to support quantitative adjustment of ingestion rates in the IEUBK model. Recognizing the technical difficulties of interpreting soil and dust ingestion studies, the *Administrative Reform for Lead Risk Assessment* specified that adjustments to the IEUBK model default ingestion rates be performed only after OERR recommends such a change. The process for obtaining a recommendation is to submit all information pertaining to the ingestion study to OERR for review by the TRW. The results of the TRW review will be sent to the requestor, and, if any improvement in the soil and dust ingestion estimate is warranted, will be incorporated into guidance and shared among other EPA Regions. This process promotes the sharing of data and consistency in lead risk assessments.
15	5-9	5.2.2.2 and Table 5-10	Editorial/Low	Section 5.2.2.2 indicates that, "Because adults could potentially have a greater exposure to COPCs in subsistence foods than children, adults were also evaluated for exposure to non-lead COPCs." Table 5-10 and 5.2.2.2.3 show that exposure to non-lead chemicals in subsistence foods were evaluated for both adults and children, which is appropriate. Please clarify the text in Section 5.2.2.2.
16	5-11	5.2.2.2.2	Editorial/Low	The chemical concentration in water should be expressed in µg/L, not mg/kg as stated in the text. The units shown in Table 5-1 and the water intake

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				equation are in μg/L.
17	5-12	5.2.2.2.3	Technical & Editorial/ Moderate	It seems appropriate to apply the same 5 km downwind and 2 km upwind boundary around the port, please clarify if this was done. (Figure 5-3 makes it appear as though this is not the case)
18	5-12	5.2.2.2.3	Technical/ High	ADEC has some concerns about the data used to derive the FI. By using a ratio of the area of the site within the subsistence use area compared to the total Kivalina subsistence use area assumes that harvesting and hunting occur equally throughout the area. The information provided does not support the FI used for caribou and fish. Site-specific information should be provided to support the use of 0.09 as the FI for these species.
19	5-16	5.2.2.3 (also Table 5-11, Table 5-8)	Technical/ Moderate	Table 5-11 incorrectly highlights caribou mean per capita consumption, which causes confusion regarding what consumption rate is used in the risk calculations
20	5-16	5.2.3.1 and Table 5-13	Technical/ Medium	The equation presented on page 5-17 to calculate the geometric mean blood lead level for adults does not incorporate the soil ingestion rate or fractional intake from soil that is specific to subsistence activities and activities while working. The equation should be adjusted to account for IR_{S_W}, IR_{S_S}, FI_{S_W}, and FI_{S_S}. Currently these variables are not incorporated into the equation. It is unclear if the equation on page 5-18, accounting for ingestion of lead from additional sources (i.e. subsistence foods), is correct. Daily lead intake from subsistence foods IR_f is presented in g/day units. This variable takes into account both ingestion rate and tissue concentration. This variable should be expressed in μg/d to ensure the units for the equation are correct. In addition, using the variable IR for both ingestion rate and daily intake is confusing. The ingestion rate does not incorporate the media concentration yet the daily intake variable does. These issues should be checked and the equation verified. The units in both the text and the table need to be adjusted. Please note that the daily lead intake from subsistence food for the adult lead

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				model should be the value calculated in Table 5-14 for adults, not Table 5-8 which calculates intake for children. The value presented in Table 5-13 is the correct value for adults but the units are incorrect. The value for IR_f is 3.2 μg/day not 3.2 g/day, as shown in Table 5-13. The equations and input parameters should be checked and the results recalculated. The reviewer calculated the geometric blood lead level for the fetus and the probability of exceeding the EPA goal of 10 μg/dL for the 12% lead bioavailability scenario using equations incorporating the changes above and replicated the results shown in Section 5.4.2.1. Therefore, it appears the correct parameters and equations were used. This should be verified and the text of the risk assessment and Table 5-13 should be corrected.
21	5-19 to 5-20	5.2.3.1.4 (see also Table 5-7)	Technical & Policy/ Moderate	In our comments on the 2004 work plan, ADEC requested that a discussion of the uncertainties associated with using the lead bioavailability derived from the Arnold and Middaugh studies be included in the risk assessment. We were unable to locate this discussion. The uncertainty associated with the Arnold and Middaugh value should be noted in the main text (Section 5.2.3.1.4) with a more thorough discussion included in the uncertainty section.
22	5-22	5.2.3.2 and Table 5-15	Editorial/ Medium	The equations presented for soil intake in Section 5.2.3.2.1 and Table 5-15 are not consistent. Intake should be a cumulative intake from intake during work and intake during the time engaging in subsistence activities. The equation in the table is correct; the text should be changed to match the table. Please define all variables, especially the IR and FI with S_W and S_S subscripts. The FI in the water ingestion equation in Table 5-15 should be FI_{WW} not FI_{WF}, as shown.
23	5-33	5.4.3	Technical/ High	It appears that some major areas of uncertainty were not addressed in the uncertainty section. For example, some discussion is needed regarding the limited data set used to derive site-specific lead bioavailability values. In addition, the uncertainty associated with weighted EPCs should be discussed,

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				not just in relation to lead modeling. The limitations of the Alaska Division of Public Health (ADPH) 2005 report are under represented in Section 5.4.3.3. The sample size for this study was extremely small and therefore the reviewer is not comfortable with the general conclusions made on page 5-37. The statement made in Section 5.4.3.2.1 regarding children not being present at the site should be substantiated.
24	5-39	5.4.3.5	Technical/ Low	The text states that none of the COPCs have the same target organ. This is inconsistent with the data provided in Table 5-16. Both barium and cadmium target the kidney. Although no adverse effects were determined in the study presented in IRIS for barium, additional investigation and supporting documentation would be needed to eliminate the kidney as a potential target organ for barium.
25	5-40	5.4.3.7	Technical/ Medium	Not all references indicated in this section are provided in Appendix H. Garry et al, 2004 is not provided and there is no corresponding reference in Section 9 for Exponent 2004e. The reviewer assumed Exponent 2004e is the technical memo provided in Appendix H dated April 7, 2005. This should be verified. The comment that muscle lead concentration in area caribou do not appear to differ from those found in the U.S. meat supply (Section 5.4.3.7.1) should be referenced and supported or eliminated from the uncertainty discussion. This information is not provided in the report provided in Appendix H. When discussing general conclusions from the studies in Appendix H in relation to the risk assessment uncertainty, some discussion should also be provided regarding the limitations of each study. For instance, discussion should be provided regarding the small samples sizes and adequacy of reference locations.

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26	7-2	7.3	Technical/ Medium	Action levels were not calculated at this time. The text states that this is because risks are not significantly elevated. Hazard indices above 1 were calculated for some ecological receptors. Please indicate why action levels were not calculated in these instances.
27	8-2	8.1.3	Editorial/Low	The text states that, "The results of the risk assessment, along with the results from the subsistence foods evaluations (Appendix H), support continued harvesting of subsistence foods without limitations." A similar statement is made in Section 5.4.3.7.3. This is a risk management statement and should not be included in the risk assessment.
28		Table 5-8	Technical/ Low	For clarity, please provide the equation for calculating the daily food intake for use in the Integrated Exposure Uptake Biokinetic (IEUBK) model. It is not entirely clear based on the footnote or chronic daily intake algorithm. It is assumed the equation used is the following: $$DailyFoodIntake = \frac{10^{-3} \times CR \times ED \times ED \times FI}{AT}$$ All variables are defined in Section 5.2.2.2.3.
29		Tables 5-9 and 5-10	Editorial/Low	Footnote 'a' references Section 5.2.1.1 for calculation of the fraction of the assumed subsistence use area. This discussion is found in Section 5.2.2.2.3. The footnote should be adjusted accordingly.
30	Table 5-13		Technical/ Moderate	The exposure frequency of 200 days per year was intended for site with contaminate soil that would be frozen or covered in snow for a large portion of the year. At Red Dog transport of ore along the DTMS occurs year round and dust control is a greater challenge in the winter since water can not be used. 200 days per year may not be adequate for the particular conditions at this site.
31		Table 5-20	Technical/ Medium	The intake rate for adult ingestion of surface water for the subsistence receptor, using the equation presented Section 5.2.2.2.2 and Table 5-9, is 3.6E-7 mg/kg-day resulting in a HQ of 0.0045. The intake rate presented in Table 5-20 appears to be incorrect.

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32	Appendix G	Table G-1	Technical/ High	There are only three tundra soil samples in vicinity of the mine. This may not be adequate to fully characterize this portion of the site. Was the sample taken 10 m from the road included in the risk assessment? Why were no samples included between 10 m and 1000 m? The data submitted to ADEC early in 2005 showed lead concentrations outside the ambient air boundary southwest of the mine ranging between 665 and 7,308 ppm. The average of the seven values near TT7 outside the ambient air boundary is 2475 ppm. Based on the available information, transect samples do not seem to provide a conservative estimate of the pollution in the vicinity of the mine.

Key:

ADEC –	Alaska Department of Environmental Conservation
ADPH –	Alaska Division of Public Health
COPC –	Compound of Potential Concern
CSM –	Conceptual Site Model
E & E –	Ecology and Environment, Inc.
EPA –	Environmental Protection Agency
EPC –	Exposure Point Concentration
FI –	Fractional Intake
IEUBK –	Integrated Exposure Uptake Biokinetic Model
RAWP –	Risk Assessment Work Plan
UCL –	Upper Confidence Limit