

Response to Public Comments pertaining to the Fugitive Dust Risk Assessment – Draft (April 2005), Red Dog Mine, Alaska; Responses Compiled by the Alaska Department of Environmental Conservation; September 2005
 Consolidated Comments from Public Meetings, April 19 - 25, 2005

Comment	Response	Recommendation
<p>Topic: Caribou How many caribou were in the herd?</p> <p>Are you confident that 10 animals are adequate for this analysis and are you comfortable that they spent time in the area?</p> <p>You sampled every six years? Was there a difference between 1996 and 2002?</p> <p>The NPS requests that future monitoring/sampling be done in animals for lead in marrow and bone.</p> <p>Despite all those good questions, you may have sampled the wrong part – i.e., not including bone – so this raises a higher level of uncertainty.</p>	<p>About 750,000 animals are in that herd. The caribou are mostly migratory but the 10 that were harvested overwintered in the port, road or mine vicinity. [Additional Note: if metals from the DMTS affect metals concentrations in caribou, the animals used in the study would have a higher likelihood of showing those effects than other animals in the herd. Because they had overwintered at the site, they would have had a higher potential for exposure. Despite this, metals concentrations in the study caribou looked much like metals concentrations in caribou from other areas of Alaska and the rest of the world.]</p> <p>It is a small dataset, but sampling these animals is a significant undertaking. These caribou were harvested opportunistically because they apparently had overwintered there. Comparisons with other Arctic caribou databases show similar results. What has been discussed was the 2002 study. In 1996, there also was another caribou study performed at the Red Dog Mine and during that study, another 10 caribou were harvested and sampled the same way and showed results similar to the 2002 study.</p> <p>The data are consistent between the two sampling events, and are consistent with reference data from elsewhere in Alaska.</p> <p>Request noted.</p> <p>Studies show that local people eat mostly muscle so while there is some uncertainty, we are confident that the animals are safe to eat. [Additional Note: See note above regarding the proportion of marrow consumption relative to other foods, and the fact that lead is primarily stored in the mineralized portion of bone. Also, Exponent’s analysis shows little or no consistent difference between metals concentrations in caribou that overwintered near the DMTS and caribou from elsewhere. The lack of differences in comparison with reference data appears to be consistent regardless of the specific organ or metal. Thus, there is no reason to believe that metals would</p>	<p>Please provide details regarding the analysis conducted to support this response. What were the levels of Cd, Pb, and Zn in tissues from the two groups? Were statistical tests used to detect differences?</p> <p>Please provide more detail regarding COPC levels in caribou tissue and comparisons made between groups (site versus reference) and years (1996 versus 2002). Were statistical tests used to detect differences? If so, at what confidence level.</p> <p>Future studies should address this comment.</p> <p>Please provide details regarding the analysis conducted for over-wintering caribou near the site and those from elsewhere. What were the levels of Cd, Pb, and Zn in tissues from the two groups? Were statistical tests used to</p>

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<p>I am concerned that your comment that the food is safe may not be fully accurate.</p>	<p>be preferentially increased in bone marrow, which is not a significant lead storage organ.]</p> <p>The concern is noted. However, Exponent included many health-protective assumptions in the risk assessment, so that builds in many factors of safety. Despite uncertainties, the level of exposure of people in the villages is likely to be lower than the scenarios modeled in the risk assessment. Exponent believes that the risk assessment is protective, and that subsistence foods are safe to eat.</p>	<p>detect differences? If so, at what confidence level?</p> <p>Safe should be defined relative to site-related COPCs.</p>
<p>Is the assumption that the animal spends its life at the port or the mine?</p>	<p>For small mammals, Exponent assumed the animal lives next to the port, but for a larger animal that ranges over a larger area they evaluated several scenarios, for animals that might live near the mine, or near the road, or near the port, or range over the whole area. For caribou, Exponent evaluated both animals that would migrate through in a short time, as would most of the herd, and animals that overwinter near the port, road, or mine areas.</p>	<p>Indicate the over-wintering caribou were assumed to spend 150 days per year at the site and that the rest of the herd was assumed to spend only 7 to 9 days.</p>
<p>Which metals are issues?</p>	<p>Aluminum and barium were predicted by modeling to be an issue for small mammals, near to the mine boundary, and near the road and port. Aluminum is found everywhere, including on any gravel road in Alaska, because it is a major component of the earth's crust. [Additional Note: Although some effects were predicted for small mammals from aluminum, this is based on lab studies that use a more bioavailable form of aluminum, so it is possible that effects may not actually be occurring in the field.] Barium is found in higher concentrations around the mine and in the waste rock from the mine. When you travel further away from the mine, levels decrease. The modeling predicted potential for effects to small mammals from barium. However, this is based on forms of barium used in laboratory studies that may be more bioavailable than the forms found in the tundra. [Additional Note: For overwintering caribou, it was aluminum that was predicted by modeling to potentially cause reduced growth of overwintering animals.]</p>	<p>It should be noted that although aluminum is a common metal, concentrations were statistically elevated over background.</p>
<p>We eat all bone marrow and nothing is wasted. We also feed the marrow to our</p>	<p>The caribou studies at Red Dog were performed in 1996 and 2002. The data collected from those two studies were from muscle, liver,</p>	<p>Please specify what will be done with respect to</p>

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<p>children. I suggest that you test the marrow from the animals. What studies did you use before 1989 and what are those results?</p> <p>So there is no effect of eating caribou to humans? What were the Noatak and Kivalina responses to this question? Other studies showed similar findings that there is no risk to human health from eating caribou. These were compared with studies of caribou sampled in Nome and Canada near the Alaska border. This was true except for one caribou that was harvested at Red Dog Mine, but that caribou was a sick animal.</p> <p>I suggest talking more with locals before and after a study. I also suggest that you talk to hunters from the villages.</p>	<p>and kidney. [Additional Note: Pre-1989 data are not available for Red Dog, so Exponent compared 1996 and 2002 study results with reference data from other regional studies and other literature data. With regards to bone marrow consumption, as noted in response to previous comments, lead is stored in the body primarily in the hard mineralized portion of bones, not bone marrow, which is considered a different organ and does not preferentially store lead.] [Additional Note: Red Dog is committed to periodic continued caribou studies because of their importance to the people – TeckCominco we will attempt to include marrow sampling in future work].</p> <p>Additional Note: The caribou and all of the rest of the subsistence food diet were found to be safe. I believe that there was some general reluctance by both groups to accept that the risk assessment found that there was no such risk. For example, at Kivalina or at our meeting with the Subsistence Committee, someone noted that they observed caribou near the road were getting less fat along their backs. However, at that meeting, Roland Booth noted that perhaps the animals in the area of the road were more stressed because of hunting from both directions (Kivalina and Noatak) by hunters on snow machines.</p> <p>No response.</p>	<p>bone marrow studies.</p> <p>Meaning of “safe” should be defined. Critical assumption leading to this conclusion should be defined.</p> <p>Teck Cominco should indicate whether they intend to speak to more locals or hunters before conducting future work.</p>

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<p>Topic: Berry Sampling What about berries outside of the ambient air boundary?</p> <p>You state that it is safe to pick berries and we pick berries by the port.</p>	<p>The risk assessment only used the berry data close to the port and road because it was the most conservative.</p> <p>Exponent used data from the berry studies within the port and along the road to be conservative [health protective] in their evaluation, although those areas within the ambient air boundaries are off limits to berry pickers because of safety issues associated with the mine's activities. Exponent also used data from another location just north of the ambient air boundary (from the south end of Ipiavik lagoon). They harvested ptarmigan along the DMTS, and caribou near the road and port. Using all of the subsistence foods data collected near the road and port in the risk assessment, TeckCominco found that the subsistence foods diet is safe, and it is safe to eat the berries whether inside or outside of the port boundary (although again, harvesting inside the boundary is off-limits).</p>	<p>Please address this issue. It appears some berry data at the port was not included in the risk assessment.</p> <p>Same as above.</p>
<p>Topic: Marine Sediments and Ocean Currents Which way does the ocean current flow? Did you evaluate ocean currents between different years?</p> <p>I understand then that there are two reasons why metal concentrations have decreased in the marine environment which are because of 1) ocean currents and, 2) source reductions.</p>	<p>The port area is a highly dynamic area. Exponent looked at the currents, which are seasonal as well. Therefore, between the high impact of currents and the increased effort that has been performed to reduce sources of fugitive dust, the metal concentrations have been decreasing in the sediment. [Additional Note: There are ocean current surveys, which have been conducted by the government that were examined.]</p> <p>The commenter is correct. The ocean is a very dynamic environment with the wind, waves, currents, and icepack working the sediments and dissipating metals, as the dust inputs have decreased over time through improved source controls.</p>	<p>Please clarify ;</p> <p>(1) whether seasonal currents are likely to move sediment in a discernable pattern.</p> <p>(2) If sediment accumulation is occurring along shoreline within a couple kilometers from the ship loader</p>
<p>Topic: Human Health Risk Assessment</p>	<p>The risk assessment looked at three different groups: children</p>	<p>Please note that Elders</p>

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<p>(Receptors, Exposure, and other issues) Is there a study for elders versus other age groups? Are children included in the risk assessment? Were pregnant women evaluated?</p> <p>Are subsistence users a different category than the ‘normal’ person?</p> <p>Did you factor into the risk assessment that we have been exposed already for 10-14 years to contamination from the mine? Also, was your sampling done after Teck Cominco performed a lot of their improvements to minimize the dust?</p> <p>You need to take in data over some periods. I bet that the risk assessment document does not look at it over time.</p> <p>What model did you use?</p> <p>What standards did you use to ensure that the children are safe?</p>	<p>subsistence users, adult subsistence users, and adults who work at the mine <u>and</u> engage in subsistence activities. Pregnant women were evaluated, specifically for exposure to lead</p> <p>To be protective, the risk assessment assumed that each person only eats subsistence foods, no grocery store or other outside foods. Also, it was assumed that each worker eats 25% subsistence food in his/her diet when they are at the mine working.</p> <p>Most of the sampling data was gathered between 2001 and 2004, and many dust control improvements have been made during that time. However, in the sense that metals accumulate in soil over the period of operation, soil incorporates the deposition over that period. The biggest intake people have of metals is from soil, as compared with food. Exponent used soil concentrations from road and port facilities areas, to be most conservative about the soil concentrations people might be exposed to. Also, with regard to subsistence foods, we assume that subsistence eating has been, and will be on-going for life. The State did the blood testing and that is another way to look at it.</p> <p>The risk assessment provides results that are like a snapshot in time, based on lifetime exposure to conditions as they are at present. There are uncertainties in the risk assessment evaluation, but the risk assessors look at all of those uncertainties and variables and consider what issues need to be evaluated in the future. [Additional Note: There will need to be some level of ongoing monitoring to assess changes relative to current conditions.]</p> <p>Several models were used to evaluate risk. For example, we used the EPA child and adult models for lead.</p> <p>The risk assessors looked at how much and what types of food are used, and the toxicity of the metals. For lead, the Risk Assessment</p>	<p>were not addressed as a separate group in the RA</p> <p>Please explain how and why Fractional intake was used in risk assessment.</p> <p>Provide an explanation that although the risk assessment assumes long term exposure to current concentrations, it does not factor in previous metal contaminant levels, which may or may not have been higher than current concentrations.</p> <p>List models used and/or refer to RA report sections where they are described.</p>

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	used that information in an EPA child lead model. As with adults, it was assumed that children eat a 100-percent subsistence foods diet.	

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<p>Topic: Site Area Did the risk assessment go beyond the road to investigate? Are there any studies outside of the ambient air boundary perimeter along the corridor between the port and the mine? What about studies further away?</p>	<p>The risk assessment studied areas surrounding the mine, the road, and the port, including the marine environment. A large part of the risk assessment was outside of the ambient air boundary to see what contaminant concentrations are and what effects are to the plants and animals there.</p> <p>The sampling occurred using a sampling scheme, with the transects oriented perpendicular to the road, and had several stations per transect with increasing distance from the road. The transects were placed on the north side of the road, because concentrations on the north side of the DMTS road have been found to be higher than those levels found on the south side of the road because that is where more deposition has occurred with the prevailing wind patters.</p>	<p>Response acceptable. (Figures 3-1 through 3-4 provide the sampling locations)</p>
<p>Topic: Samples of Animal Tissue Did you study the marrow from animals? Separate samples on each of the organism's body, such as the liver, should be taken.</p>	<p>For the ecological evaluation, whole small animals were analyzed (including bones); therefore the marrow was included. This is because animals would eat the whole small animal. Because small animals are food for some larger animals, the results from whole small animal samples were used to estimate concentrations in larger animals.</p> <p>For the human health evaluation, organs that are a subsistence food item were analyzed separately. For instance, caribou liver, kidney, and muscle tissue were analyzed separately for use in the human health evaluation.</p>	<p>Response acceptable.</p> <p>Future studies of lead in bone marrow are recommended.</p>
<p>Topic: Fraction Ingested of Subsistence Food What would happen if a person got everything they eat from around the port and the road? Was that accounted for in the risk assessment?</p>	<p>In the risk assessment, it was assumed all of the foods consumed are subsistence foods, and the samples of subsistence foods used in the risk assessment were only collected from areas around the road and port, to be most protective.</p>	<p>The response should explain that the risk assessment use a fractional intake adjustment and what the risk estimate would be without that adjustment.</p>
<p>Topic: Metal Accumulation Do metals accumulate also in human bones?</p>	<p>For lead, Exponent used EPA models for children and adults, which simulates the blood lead concentrations, and we use that to assess the potential effects. [Additional Note: Some metals, for example lead, may accumulate in human bones. EPA's child lead model accounts</p>	<p>Please indicate whether any other COPCs accumulate in bones.</p>

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	<p>for the amount of lead in various parts of the body, including bone. EPA’s lead models use exposure information and what is known about how lead moves through the body to predict blood lead levels. The predicted blood lead level can then be compared to blood lead levels at which there may be a health effect. Currently, the best information available about the health effects of lead is related to blood lead levels. The relationship between bone lead levels and health effects is not well characterized. So even if bone lead levels were available for people residing near the DMTS, it would not be possible to draw any conclusions about the potential for health effects.]</p> <p>TeckComino stated that they can include bone marrow analysis in the next study.</p>	<p>Please provide more information about this sampling.</p>
<p>Topic: Metals Bioavailability I have heard that metals are basically not bioavailable. However, for long-term I believe that they can be oxidized and take another form which can be bioavailable. Therefore, I suggest that long-term monitoring occur. [Additional Note: The commenter may be referring to the concentrate study that found the bioavailability of the lead in concentrate from Red Dog to be low.]</p> <p>The NPS and DEC had some previous comment that the metals were not totally unbioavailable.</p>	<p>These compounds start in one form and over time change to another form such as zinc sulfite to zinc sulfate, and as sulfate is not necessarily any more bioavailable.</p> <p>[Additional Note: To be protective, in the ecological risk assessment, all metals were assumed to be 100-percent bioavailable. Also, in the human health risk assessment, all metals other than lead were assumed to be 100-percent bioavailable. For lead, both the site-specific bioavailability from the Red Dog ore-concentrate studies and the EPA default bioavailability were used, so results can be evaluated both ways.]</p> <p>[Additional Note: The definitions of bioavailability and bioaccumulation are the following: Bioavailability - The propensity of the chemical to be absorbed into the bloodstream across the gastrointestinal tract, skin, or lungs. For metals, different physical or chemical states of the metals can affect bioavailability. Bioaccumulation -The tendency of the chemical to accumulate in biota (plants animals or humans.)</p>	<p>Please provide a response to the question of bioavailability of metals from the concentrate and what long-term monitoring will be conducted, or refer to the sections of the RA that discusses these issues.</p> <p>There is evidence that metals are bioavailable to some extent – such as elevated metal concentration in ptarmigan compared to background.</p>

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The commenter would like to see some more studies occur on this issue.	No response.	Please provide a response to the question of bioavailability of metals from the concentrate and what long-term monitoring will be conducted.

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<p>Topic: Use of Surface Water for Drinking/Drink Water in General We use freshwater from Umayutsiak Creek which is located about 2 miles south from the port and we also use freshwater from another creek next to it. Is that safe?</p> <p>There is a yellow discoloration in a stream just past the village of Kelly and usually this has been a creek that has had good spring water.</p> <p>What about the water?</p>	<p>Water samples were taken from some creeks that cross the road. All freshwater samples taken were found to be safe. The creeks that cross the road would be expected to have higher concentrations of metals those creeks further away from the road if those metals come from the fugitive dust. Since water in creeks crossing the road is safe, creeks further away should also be safe.</p> <p>Teck Cominco indicated they were willing to address the concerns regarding water quality in the area.</p> <p>Jim Kulas of Teck Cominco indicated he would look into this issue.</p> <p>TeckCominco performs monitoring on Kivalina’s drinking water and so does EPA and DEC. All the results show that the water that you use for drinking is safe.</p>	<p>Please define what safe means.</p> <p>Teck Cominco should indicate what actions were taken.</p> <p>Please specify standards used to determine that drinking water is safe and/or refer to the applicable sections of the RA report.</p>
<p>Topic: Risk Management Plan The National Park Service, DEC, and others were invited to come back to talk with the communities prior to making a decision at the site. A comment was received that those agencies are talking for the community members but they would like to know what the decision makers are thinking before determining the risk management decision.</p>	<p>Jim Kulas of Teck Cominco said they would involve those who wanted to be involved in the management plan and he will be getting back to those individuals regarding this issue.</p>	<p>Teck Cominco should provide further details about how they will involve the community in the risk management plan.</p>
<p>Topic: Historical Data Availability Besides historical data, is there other information available that has been compiled in the 1980s used in the risk assessment?</p>	<p>There were environmental baseline studies conducted in the early 1980’s, however, they did not have data for all of the media or metals that Exponent needed data for in the risk assessment. That is why Exponent collected similar samples from reference areas for comparison.</p>	<p>Please describe if and how data collected in the 1980s was used in the Risk Assessment.</p>
<p>Topic: Barge Loading and Offloading</p>	<p>The State will be looking into that issue of loading barges. The COE</p>	<p>TeckCominco should</p>

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<p>Have you ever monitored when you off load the barges to the ships?</p> <p>How far offshore are the ships?</p> <p>The dust – risk assessment – can it be done from the barge to the ships and studies on the ships to where they came from? Also, does the dust from the Concentrate Storage Building go blowing to the ocean during winter season? Can there be studies done on that?</p>	<p>has done some sampling in this area, which is about three (3) miles off shore. Recently, Foss Marine made improvements, such as to the snorkel system for the barges by making the snorkels longer, which reduces the fugitive dust.</p> <p>Barge offloading occurs approximately three miles offshore because the water is too shallow at less than that distance. One ship is able to load a bit closer to shore. [Additional Response – all ships stay beyond the three mile limit due to regulatory restrictions]</p> <p>No response.</p>	<p>indicate which State agency he is referring to in this response.</p> <p>Please clarify which is the correct answer?</p> <p>Please address this comment.</p>

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<p>Topic: Animal Deformities Skinny foxes without tails have been observed in the plume area. Teck Cominco should consider collecting and analyzing tissues from such animals.</p>	<p>No response provided about foxes.</p>	<p>Please provide a response to this comment.</p>
<p>Topic: Haul Road What is the distance of the haul road that is shown on the figure that is colored in purple?</p>	<p>The purple area is approximately 3 miles on either side of the road. This figure is simply a schematic showing the general areas evaluated in the risk assessment. The ambient air boundary for the road is not shown on this map. [Additional Note: The ambient air boundary is 300 feet on either side of the road centerline. The length of the road is approximately 52 miles from mine to port.]</p>	<p>Please provide a figure number for a similar figure in the RA report.</p>
<p>Topic: Truck Spills What about the truck spills, were they part of the risk assessment?</p> <p>On the truck spill that you discussed, did you do something to address it?</p>	<p>Teck Cominco had a program that systematically evaluated truck spills and did additional cleanup where necessary. TeckCominco did look at patterns of deposition, but the individual spills did not affect the overall pattern. [Note: ADEC has monitored this cleanup effort.]</p> <p>The NPS gave TeckCominco some requirements that were used as the criteria to clean-up those truck rollovers and performed revegetation. [Additional Response – All spill sites were sampled to confirm there was adequate original clean-up. Those that required more work were excavated and confirmed clean with follow-up sampling. Sites outside the park will be hydroseeded. Those within the park will be left to naturally re-vegetate as per NPS request.]</p>	<p>Page 2-3 of the Risk Assessment report provides further information about the Settlement Agreement between Teck Cominco and DEC that guides spill recovery.</p>
<p>Topic: Chemicals of Potential Concern Were there other metals that you looked at?</p> <p>What about silica?</p>	<p>Besides lead and zinc, the whole list of other metals that are present in the ore concentrate were evaluated.</p> <p>Silica is found at the mine. It does pose a problem with the lungs, so we require a half-mask respirator be used by all workers who are exposed to silica.</p> <p>Lead is found in the sulfide form at the mine and it is not as toxic in</p>	<p>Please refer to appropriate tables in the risk assessment report.</p> <p>Response acceptable.</p> <p>Please provide references</p>

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<p>What is the composition of the dust?</p> <p>What about other impacts such as asbestos from truck brake linings?</p>	<p>that form. It passes through the body as well. For example, at lead smelters, lead is a bigger problem since that form of lead can be much more available to the human body than the sulfide form found at the mine.</p> <p>Teck Cominco ships five times more zinc than lead so there is a concentration in the soils or in the tundra that is proportional to this ratio.</p> <p>The trucks' use their gears to assist slowing down so less wear is placed on the brakes. [Additional Note: Research has shown that most of the chrysotile asbestos in brakes is transformed by heat into non-asbestos compounds during the braking process.] It is expected that asbestos release and exposure to asbestos would be insignificant.</p>	<p>to support the lead bioavailability statements.</p> <p>Refer to appropriate tables in the risk assessment report.</p> <p>Provide references for the statements about asbestos release and exposure?</p>
<p>Topic: Reclamation and Closure When I was at Sitka, they talked about long-term negative effects of a mine and I am concerned for my children.</p>	<p>TeckCominco is developing a closure plan to ensure things like that do not happen. [Additional Response – the closure plan is required by state regulations and it will include a financial assurance agreement that sets aside money for the State to use for further cleanup or reclamation activities if necessary.]</p>	<p>Please describe key components of the closure plan.</p>

- Key:
- ACAT = Alaska Community Action on Toxins
 - AIDEA = Alaska Industrial Development and Export Authority
 - COPC = Chemical of Potential Concern
 - DEC = Department of Environmental Conservation (Alaska)
 - DMTS = DeLong Mountain Regional Transportation System
 - DOI = Department of Interior
 - EPA = Environmental Protection Agency
 - IGAP EPA = Indian General Assistance Program of the Environmental Protection Agency
 - Kivalina IRA = Kivalina Indian Reorganization Act
 - NANA = Northwest Arctic Native Association
 - Noatak IRA = Noatak Indian Reorganization Act
 - NPS = National Park Service
 - RP = Responsible Party

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