Enclosure 1. The U.S. Fish and Wildlife Service Request for Spill Fate Analysis on the Kuskokwim River and Kuskokwim Bay

Spill Fate Request

The U.S. Fish and Wildlife Service (FWS) requests development of spill fate models that quantify the area impacted and the duration contaminants would be in the system were a chemical release to occur at the mine site or during the transportation of fuel, cyanide, or mercury. Although certain types of spills are described qualitatively in the spill risk chapter of the draft environmental impact statement (DEIS), the results lack details required to analyze the environmental impacts of a diesel, mercury, or cyanide spill or a larger tailings release.

This information is needed to analyze environmental hazards, compare the environmental risk of the different alternatives, and inform spill response planning. Fate and transport modeling will improve spill response plans, which will reduce the environmental hazard of a spill. This information is essential to analyze impacts on endangered species, aquatic and subsistence resources, and compare project alternatives (40 CFR 1502.22 (a)).

To assist with analyzing impacts and protecting wildlife and sensitive habitat, we recommend the results of all the models requested below be mapped in the DEIS, as was done for the tailings release scenarios. These maps should show gradients in concentrations of hazardous chemicals (including mercury, arsenic, cyanide, selenium, and diesel) and the spatial extent (volume of solids and water released at the mine site) of each release. The models should identify spill fate and ecological receptors, as well as quantify the duration of ecological effects from each type of spill (e.g., these are different for cyanide versus mercury).

The FWS is requesting quantitative fate and transport modeling for 1) a tailings dam breach, 2) a breach of a cyanide container, 3) a diesel barge grounding and spill, and 4) a mercury container breach, releasing these contaminants into the Kuskokwim River, Kuskokwim Bay, and Kuskokwim Shoals. Specific requests for each spill scenario are described below.

1. **Tailings Dam Breach Scenario** - The FWS requests that a realistic volume of tailings be modeled in a revised tailings dam breach scenario and included in a revised DEIS. The analysis that was conducted, even with the low relative volume of tailings modeled at 0.5 percent of the total tailings impoundment volume at year 27 and stopped within five hours of the breach, indicated that some of the 2.6 million cubic yards of tailings lost would reach the Kuskokwim River and bury sections at the confluence of Anaconda and Crooked Creeks in up to ten feet of tailings. A more realistic spill scenario would be 20 percent of total wet tailings storage facility volume, in five-year increments up to 30 years. This analysis should compare the risk of the proposed alternatives for the project. We recommend that the DEIS compare the risk of dam failure release from Alternative 2 to the risk of dam failure for the operating pond in Alternative 5A. This modeling should be conducted for high flow conditions in Crooked Creek and the Kuskokwim River; for example, the model could include a 50-year or 100-year flood event, incorporating the Scenarios Network for Alaska and Arctic Planning (SNAP) climate projections for the region.

2. **Cyanide Spill** - The FWS requests that the DEIS include a quantitative analysis of a cyanide tanktainer breach. Since cyanide will be transported over water in a chemical form that reacts in water to produce an acutely lethal compound, a quantitative analysis of this risk will inform response planning for a cyanide spill into the Kuskokwim River. The FWS recommends the DEIS incorporate a quantitative model of the resulting plume mapped on a time series and a description of the time required for total degradation of the cyanide in the aquatic environment. This type of analysis is critical to our understanding of the potential environmental consequences to fish and aquatic resources in the Kuskokwim River. This analysis should specify the volume of sodium cyanide spilled into the water and incorporate two hydrologic scenarios for the Kuskokwim River. The first is the lowest flow during which barge transport would occur. We request this analysis because low river flows might increase the probability of barge grounding and because low flow conditions will lead to less mixing and dilution of cyanide. The second hydrologic scenario requested is for the mean July flow under SNAP climate change scenarios. Analysis of average conditions will facilitate response planning efforts, including optimal placement of cleanup supplies in this remote area.

3. **Diesel Spill** - Although the DEIS does specify a volume of diesel hypothetically spilled from a barge into the Kuskokwim River, the analysis of plume movement and dissipation is only qualitative. The FWS requests that the same fate and transport modeling that was conducted for tailings at the mine site be conducted for diesel fuel spilled in two ways. The first is from a river barge into the Kuskokwim River, and the second is a larger volume from an ocean barge into the Kuskokwim Shoals. Please map the areal extent of the initial spill and include identification of ecologically sensitive areas in this analysis. The FWS can provide an example of this type of hazard assessment applied to ecologically sensitive areas in the Gulf of Mexico. The analysis should indicate how far diesel would travel (geographic extent) and how long it would remain in the environment (temporal extent) for both the river barge and the ocean barge spills. The analysis should account for currents and tidal flushing in the Kuskokwim Bay and the lower Kuskokwim River. As with cyanide, we request that the river barge spill analysis be conducted under two hydrologic scenarios for the Kuskokwim River. The first is the lowest river volume at which barges are projected to run. This will show the environmental consequences of diesel remaining at higher concentrations for longer, due to less mixing and dilution by river currents, and also contaminating near shore sediments when the river is low. The models should include a quantitative description of the time course for degradation of diesel in water and nearshore sediment, as these results are critical for biological assessment of spill impacts. The second requested river scenario is for July mean flow, which will facilitate response planning, including the optimal amount and placement of cleanup equipment.

4. **Mercury Spill** - Similar to the contaminants noted above, but perhaps more important due to its environmental persistence, high toxicity, and already elevated concentrations in this area, the FWS recommends that the USACE include a quantitative fate and transport model for a loss of a mercury container in the analysis of alternatives in the DEIS. According to the DEIS, Chapter 2, "Donlin Gold estimates the mine would remove approximately 34,600 pounds of mercury per year from the gaseous waste streams." This mercury would be shipped on the Kuskokwim under the proposed Alternative 2. Unlike the cyanide tanktainers, there is no plan to equip mercury containers with global positioning system (GPS) units, so it is unclear how a mercury container would be recovered if lost overboard. For this analysis, we request an evaluation of the loss and

subsequent breach of a one metric tonne "pig" of mercury into the Kuskokwim River. We request that this scenario include models that run at the highest river flow conditions that are realistic for barge transport. High flow conditions may increase the probability of a spill and an unrecovered loss overboard of mercury, which in turn would be expected to increase the spread of this persistent chemical and enhance mixing with riverbed sediments. The quantitative model should include an evaluation of where the mercury would go and how far it would spread, and this chemical fate should be mapped and the time course described in the revised DEIS. The model should also provide estimates of the mercury concentrations in water and sediment and their chemical forms through time, as well as estimate what proportion of mercury would be methylated if a flask ruptured and contaminated bottom sediments. This analysis will enable biological assessment of this risk and may lead to identification of additional mitigation measures necessary to reduce identified risks, such as incorporating the use of GPS units on the flasks, drums, and pigs employed for mercury transport to aid in their recovery if lost.

Moreover, we recommend that the DEIS state the ultimate disposal location of the mercury. Due to the risk to aquatic resources from a spill, we also request that the DEIS include an analysis for alternatives other than barging, such as onsite chemical immobilization, sealed or vitrified disposal, and using aircraft to move mercury offsite.