Assessment of the adequacy and accuracy of the spill risks related to hazardous materials on the transportation corridor and overall in the Stibnite Gold Project Final Environmental Impact Statement

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Executive Summary

A draft environmental impact assessment (DEIS) (USFS 2020), a supplemental draft environmental impact assessment (SDEIS) (USFS 2022), and a final environmental impact assessment (FEIS) (USFS 2024) have been produced for the proposed Stibnite Gold Project (SGP). The possibility of spills of hazardous materials due to transportation and other causes have been underestimated at every phase from DEIS (USFS 2020) to FEIS (USFS 2024), even though substantive comments have pointed out flaws in the comments periods for the DEIS (USFS 2020) and SDEIS (USFS 2022).

1. Spill incidents are often modeled using the $N = RT$ model, where T is exposure variable, such as the number of truck-miles for trucks carrying hazardous materials, R is the spill rate per unit of exposure, such as spills per truck mile for trucks with hazardous materials, and N is the estimated number of incidents or spills involving trucks with hazardous materials. T and N were not explicitly shown in any version of the SGP EIS.
2. The FEIS (USFS 2024) incorrectly calculates an estimate of R that is roughly 100 times lower than used elsewhere.
3. The impact area for transportation corridor hazardous material spills is underrepresented. While Perpetua may only have direct control and responsibility over the mine site area, the impacts to the community extend along the full transportation corridor. Thus, T is often unstated and underestimated.
4. Estimation of the expected numbers of incidents is the first step in computing their probabilities and requires using the appropriate rates with the expected amount of exposure over time.
5. Hazardous material spills due to collision and rollovers along the transportation corridor have represented a small proportion of transportation-related releases at other mines.
6. Other mine EISs have dramatically underestimated the number of spill incidents that would occur during operations, with transportation-related releases (from all causes) being a small fraction of all accidental spills of hazardous materials associated with mining operations.

As previously stated (Lubetkin 2023, pp. 169-170), with some refinements to the third point (in *italics*):

The SGP spill impact assessment must

- Include an explicit, complete, and quantitative reagents list, as well as other chemicals for blasting, water treatment, spill mitigation, and materials associated with the mining machinery, such as hydraulic oil and antifreeze, and all hazardous wastes that would be considered hazardous materials being transported to or from the mine or used on-site.

- Include complete descriptions of the transportation methods (trucks, pipelines, etc.), load sizes, and frequency for the hazardous materials listed above, as well as tailings and other hazardous wastes.

- *When assessing hazardous material spill risk, the transportation corridor to model is not defined just by the length of newly built roads associated with the mine, the roads between the logistics facility and the rest of the mine, or even the area considered by the traffic impacts analysis, but instead extends from the mine to the origin(s) and destination(s) of the hazardous materials*.

- Include quantitative transportation spill risk estimates for the aggregated total of trips.

- The peer-revied literature for risk analysis of hazardous materials transportation is robust. Consider more detailed transportation spill risk models, with up-to-date risk rates and location-specific descriptions of the transportation corridor that allow for modification from national or regional average estimates of *R*.

- Acknowledge that accident modeling only describes one potential way hazardous materials are released from vehicles, and that transportation-related releases can have a multitude of causes, many of which are not modeled. Modeling transportation accidents is a necessary step, but not sufficient to model all transportation spills or all the unintentional releases that occur at mines.

- Be explicit about the numbers of expected spills. The two goals of the EIS production process are to clearly state potential consequences of projects and to inform stakeholders and decision makers of those impacts. The current treatment of spill risks in mining EISs does neither.

As they currently stand, the spill-risk predictions in the SGP FEIS (USFS 2024) only satisfy the first two bullet points listed; the remaining five are incomplete, inaccurate, or nonexistent. They do not measure up to the main objectives of an informed EIS, which are to: (1) estimate potential consequences of project impacts, and (2) inform stakeholders and decision makers how to mitigate those consequences.

Introduction

A draft environmental impact assessment (DEIS) (USFS 2020), a supplemental draft environmental impact assessment (SDEIS) (USFS 2022), and a final environmental impact assessment (FEIS) (USFS 2024) have been produced for the proposed Stibnite Gold Project (SGP). I have examined the adequacy and accuracy of the risks related to hazardous materials on the transportation corridor and for the project overall as presented in all three SGP EIS documents. The possibility of spills of hazardous materials due to transportation and other causes have been underestimated at every phase from DEIS (USFS 2020) to FEIS (USFS 2024), even though substantive comments have pointed out flaws in the comments periods for the DEIS (USFS 2020) and SDEIS (USFS 2022).

Appendix B of the SGP FEIS (USFS 2024) shows that spills, transportation, and hazardous materials were mentioned hundreds of times in in substantive comments about both the DEIS and SDEIS (Table 1). The responses to those substantive comments in the main body and Appendix B of the FEIS (USFS 2024) do little to nothing to address those concerns.

Table 1. Summary of hazardous materials spills and transportation corridor risks mentioned in Appendix B of the FEIS (USFS 2024).

Search term	Number of occurrences
Spill, spills, spilled	557
Transportation	404
Hazardous material(s)	298
Truck, trucks, trucking	152
Cyanide	146
Accident, accidental, accidents	96
Collision, collisions	29
Petroleum	17
Rollover	4

Section 1.11 of the FEIS listed 18 key changes from the SDEIS (USFS, p. 1-32). Two of those were related to transportation and hazardous materials:

- Expansion of the Access and Transportation analysis area to include SH 55 south to I-84 in Boise and north to US 95 in New Meadows (**Section 3.16**).
- Analysis of offsite transportation of hazardous materials added (**Section 4.16**).

Neither the expansion of the transportation analysis area nor the addition of the analysis of offsite transportation of hazardous materials was sufficient.

1. Spill incidents are often modeled using the $N = RT$ model, where T is exposure variable, such as the number of truck-miles for trucks carrying hazardous materials, R is the spill rate per unit of exposure, such as spills per truck mile for trucks with hazardous materials, and N is the estimated number of incidents or spills involving trucks with hazardous materials. T and N were not explicitly shown in any version of the SGP EIS.

The expected number of spills and their probability of occurrence have been modeled quantitatively for mines and other industries, particularly oil and gas extraction, in their EISs. The most prevalent mode is $N = RT$, where N is the number of spills due to some known exposure amount, R is the spill rate per unit of exposure, and T is the amount of exposure. Both Lubetkin (2020, pp. 10-19) and Lubetkin (2023, pp. 11-26) detail examples. More recently, BLM (2023, pp. 3-19 to 3-21) used the $N = RT$ model to estimate the number of spills for Ambler Road.

More sophisticated transportation risk models are available in peer reviewed literature, again as detailed in Lubetkin (2020, pp. 54-62) and Lubetkin (2023, pp. 127-138). No calculations of expected numbers of spills or their probabilities were made in the SGP DEIS, SDEIS, or FEIS, so it is impossible to evaluate the expected numbers of spills, the spill probability, or the spill risk (*risk = probability x consequences* (Lubetkin 2020, 2023)).

USFS (2024) had no additions or changes that added a quantitative risk assessment about spills related to the transportation corridor or any other spill mechanism related to the Stibnite Gold Project.

2. The FEIS (USFS 2024) incorrectly calculates an estimate of *R* that is roughly 100 times lower than used elsewhere.

The per truck mile accident and spill rates estimated have remained the same since the DEIS (DEIS, p. 4.7-3; SDEIS, p. 4-135; FSEIS, p. 4-148):

> To evaluate the potential impact of the transport of hazardous materials to and from the mine site, the risk of a transportation accident resulting in the release of hazardous materials was estimated. Accident and incident rates were derived from national statistics for truck accidents that involve hazardous materials as published by the Federal Motor Carrier Safety Administration (2018). Records show that the number of large trucks (gross vehicle weight of more than 10,000 pounds) on national highways from 2013 to 2016 ranged from over 10.59 million to 11.49 million; with large trucks traveling between 275.01 billion miles to 287.89 billion miles annually. Over that same time frame, large truck crashes involving hazardous materials cargo (with no release) ranged from 2,420 to 2,475, while large truck accidents with release of hazardous materials cargo ranged from 385 to 552. The statistical rate of large-truck accidents involving hazardous cargo for miles traveled ranged from approximately 1 accident for every 714 million miles traveled in 2013 to approximately 1 accident for every 522 million miles traveled in 2016. Therefore, statistically, the rate of accidents on the nation's highways involving crashes or spills of hazardous material cargo by large trucks is very low (Federal Motor Carrier Safety Administration 2018).

The rates listed above ranged from 1.4×10^{-9} hazardous material spills per large truck mile to 1.9×10^{-9} hazardous material spills per large truck mile. These values are two orders of magnitude smaller than $R = 1.87 \times 10^{-7}$ accidents/truck-mile (Harwood and Russell 1990) that had been used in previous mining EISs (Lubetkin 2020, 2023). The issues with the per truck-mile rate stated in the DEIS and SDEIS were raised in Lubetkin (2020, pp. 74-85) and Lubetkin (2023, pp. 95-107), respectively. Again, BLM (2023, pp. 3-19 to 3-21) recently used the $N = RT$ model to estimate the number of spills for Ambler Road. BLM (2023) used a value of $R = 4.95 \times 10^{-6}$ ore concentrate spills per truck-mile based on the number of spills observed along the transportation corridors of five large hardrock mines in Alaska.

There was no response in Appendix B or the main body of the FEIS (USFS 2024).

The logic in the FEIS remains flawed. Not all large trucks carry hazardous materials. Therefore, dividing the number of accidents or spills involving large trucks carrying hazardous materials by the number of miles traveled by all large trucks (both those carrying and those not carrying hazardous materials) results in underestimated rates.

Mathematically, the incident rate per truck-mile can be represented as

$$R_{all} = \frac{N_{all}}{T_{all}}$$

where R_{all} is the incident rate for all heavy trucks, N_{all} is the number of incidents from all heavy trucks, and T_{all} is the number miles traveled by all heavy truck. Similarly

$$R_{nonHM} = \frac{N_{nonHM}}{T_{nonHM}}$$

is the rate for incidents just for heavy trucks not carrying hazardous materials and

$$R_{HM} = \frac{N_{HM}}{T_{HM}}$$

is the rate for incidents for from heavy trucks carrying hazardous materials.

Note that $N_{all} = N_{nonHM} + N_{HM}$ and $T_{all} = T_{nonHM} + T_{HM}$, so

$$R_{all} = \frac{N_{all}}{T_{all}} = \frac{N_{nonHM} + N_{HM}}{T_{nonHM} + T_{HM}}$$

The incident rates that are cited in all three versions of the EIS incorrectly compute

$$R_{HM} = \frac{N_{HM}}{T_{nonHM} + T_{HM}}$$

Figure 1 illustrates the error in the approach used in all versions of the EIS. There are 500 cells in the figure. Each cell represents a large truck, with 450 white cells indicating the truck is carrying non-hazardous cargo and 50 orange cells representing large trucks carrying hazardous materials. Cells with x's indicate that a crash has occurred. With 500 large trucks carrying both hazardous and non-hazardous loads and 20 large truck crashes, the overall crash rate is 20 crashes/500 large trucks = 0.04 crashes per large truck regardless of the truck contents (hazardous or not).

The correct measure of the crash rate for hazardous materials-laden trucks (simplified in this example such that all trucks are traveling the same distance) is the number of crashes involving hazardous materials per number of trucks carrying hazardous materials, which is the number of x's in orange cells as a fraction of the number of orange cells. In the case of the figure below, where the trucks with hazardous cargo have the same crash rate as trucks without hazardous cargo, there are 2 hazardous material crashes/50 trucks with hazardous materials = 0.04 hazardous material crashes per hazardous material truck. In contrast the EIS measured the hazardous material crash rate as 2 hazardous material crashes/500 trucks carrying any type of load = 0.004 hazardous material crashes per truck carrying any kind of load. This method calculates the proportion of x's in orange cells out of all the cells in the grid, which wrongly underestimates *R* for mine traffic.

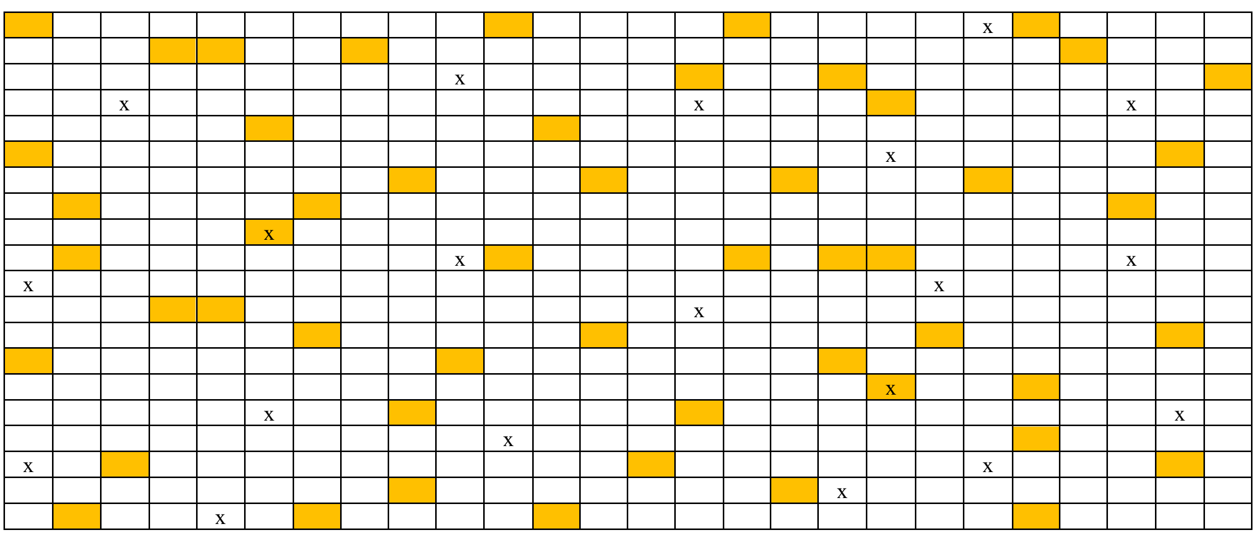

Figure 1. A 25 x 20 grid representing 500 large trucks. The 50 orange cells represent trucks carrying hazardous materials. The 450 white cells represent trucks that are not carrying hazardous materials. The 20 cells with x marks are those that have been involved in a crash with the same frequency of crash occurrence for the orange and white cells (two in orange cells and 18 in white cells).

3. The impact area for transportation corridor hazardous material spills is underrepresented. While Perpetua may only have direct control and responsibility over the mine site area, the impacts to the community extend along the full transportation corridor. Thus, *T* is often unstated and underestimated.

The transportation corridor associated with the proposed SGP will have both direct and indirect effects that extend well beyond the area considered in the access and transportation studies cited in SGP DEIS (USFS 2020), SDEIS (USFS 2022), and FEIS (USFS 2024). Both Lubetkin (2020, pp. 63-68) and Lubetkin (2023, pp. 85-90) examine the road lengths that hazardous materials will have to travel beyond the area considered in the traffic baseline and impact studies (HDR, Inc, 2017 a, b).

The FEIS (USFS 2024, p. 3-415) stated that (text in italics differs from the corresponding section of USFS 2022):

> **3.16.2 Access and Transportation Area of Analysis**
>
> The analysis area for access and transportation encompasses the overall road system, which is dominated by unpaved roads, one state highway (SH 55), and county roads. *Although **Figure 3.16-1** displays the majority of the analysis area, it does not show the portion of SH 55 that continues both north and south, intersecting with I-84 in Boise to the south and US 95 at New Meadows to the north. The extent of the analysis area was confirmed by the results of the Traffic Impact Analysis on SH 55 (HDR 2017l).*

and in the FEIS (USFS 2024, p. 3-418)

> **3.16.4.1 Existing Road Transportation Network**
>
> The transportation network in the analysis area includes SH 55 *(between Cascade to the south and McCall to the north)*, Valley County roads, and NFS roads.

Additionally, USFS (2024, Appendix B, p. B-867) states

> The SDEIS includes a revised analysis of hazardous material spill risk and the Final EIS expanded the area of that analysis to include State Highway 55 between Boise and Grangeville.

Thus, the FEIS (USFS 2024) acknowledges that the length of the full transportation corridor where mine-related impacts may be felt extends past the area delineated by the traffic studies. However, at no point were explicit transportation corridor lengths specified for the various hazardous materials, nor the cumulative number of truck-miles with hazardous materials loads calculated for the proposed projects' lifetime.

Measuring traffic and safety impacts by estimating where the proportional increase due to mine transportation falls below a certain threshold is not sufficient to state that there will be no impacts due to transportation or to define the length of the transportation corridor where safety is a concern. The geographic area over which there may be significantly increased traffic due the potential addition of mining-related transport is a subset of the overall transportation corridor for the mine. While the transportation baseline and impact studies (HDR 2017a, b) may have extended from "SH 55 at Cascade south to I-84 and SH 55 to New Meadows and US 95 from New Meadows north to Grangeville", "the long-distance transport of minerals, namely antimony concentrate, from the mine site to locations for processing" were not identified or analyzed in the FEIS as stated in Appendix B (p. B-54). It is not sufficient that the "transportation of hazardous materials should be taken in context of the existing traffic pattern in the analysis area" (USFS 2024 Appendix B, p. B-205) because that ignores that the transport of hazardous materials poses a risk over the entire length those materials are moved. The addition of two inquiries to the Idaho Department of Transportation (Grange 2023 and Rich 2023) that confirm the 2020 traffic projections made in the 2017 Traffic Impact Study (HDR Inc. 2017) (USFS 2024, Table 4.16-3 on p. 4-521) does not address the fundamental issue of how safe it is to move thousands of loads of hazardous materials over hundreds of miles through Idaho's (and neighboring states') communities every year.

The addition of the new text *Crash Projections and Offsite Transportation of Hazardous Materials* (pp. 4-527 and 4-528 of USFS 2024) acknowledges that 23 trips per day would travel north toward McCall, Idaho, and that 45 trips per day would travel south. However, the ASHTO Highway Safety Manual predictive method was for characterizing "intersections, traffic volumes, controls and lane configurations". This only focuses on incidents that occur at intersections, not the long stretches of narrow, steep, winding highway that are typical of SH 55. A transportation risk study must include the lengths of the roads used, not just the intersections. That is, the $N = RT$ model (or other road length-based model) should also be applied, and the T must be accurate and complete. Note that although the per truck mile accident and spill rates were estimated in Section 4.7.2.2 (USFS 2024, p. 4-148), they were never used to find quantitative estimates. While Appendix B claims that

“A discussion of quantitative risk of spills has been added to Section 4.7.2 of the Final EIS” (USFS 2024, Appendix B, p. B-213 and B-214), no quantitative risks are presented in Section 4.7.2 and the language changes in that section between the SDEIS (USFS 2022) and the FEIS (USFS 2024) are scattered and minimal.

4. Estimation of the expected numbers of incidents is the first step in computing their probabilities and requires using the appropriate rates with the expected amount of exposure over time.

Based on the information in the 2021 MMP and EIS versions, we can estimate the number of miles traveled by trucks carrying hazardous materials. Since the number of truck miles with hazardous materials can be estimated, the accident rate per truck mile with hazardous materials is the appropriate rate to use for estimating the expected number of incidents and their probabilities of occurrence over the life of the proposed mine.

The amount of exposure was estimated in Lubetkin (2020, pp. 69-74) and Lubetkin (2023, pp. 91-94) based on the list of hazardous materials given in the 2021 MMP. That list was modified in the FEIS by removing activated carbon and grinding metals from the list of hazardous materials, which would reduce the number trips by 23 and 337 per year, respectively (USFS 2022, p. 4-123), which would bring the total number of hazardous materials loads coming to and through the mine site from an estimate ranging from 4,641 to 5,006 down to 4,281 to 4,646 loads per year.

Once the expected numbers of spills on the roadways are known, those quantities can be used to calculate the probability of at least one occurrence and the spill risk. As spills would be expected to occur at random intervals and independently of one another, a Poisson distribution would be a reasonable choice for modeling spill probability. See Lubetkin (2020, pp. 97-105) and Lubetkin (2023, pp. 121-126) for calculating spill probabilities along the full transportation corridor and Lubetkin (2023, pp. 127-138) for an overview of various risk models specific to transportation of hazardous materials.

There was no response in Appendix B or the main body of the FEIS (USFS 2024).

5. Hazardous material spills due to collision and rollovers along the transportation corridor have represented a small proportion of transportation-related releases at other mines.

Lubetkin (2023, p. 147-166) details that other large mines have a long history of spills related to transportation that are attributable to causes other than rollovers and collisions on roadways. See also Lubetkin (2022) and Hughes et al. (2024). The SGP DEIS (USFS 2020) and SDEIS (USFS 2022) did not estimate the number of spills that may be expected from any transportation-related incident except crashes at the intersections defined in the traffic impact analysis (HDR 2017).

There was no response in Appendix B or the main body of the FEIS (USFS 2024).

6. Other mine EISs have dramatically underestimated the number of spill incidents that would occur during operations, with transportation-related releases (from all causes) being a small fraction of all accidental spills of hazardous materials associated with mining operations.

Lubetkin (2023, p. 147-166) details that other large mines have a long history of spills due to many other processes at mines that are not related to transportation. See also Lubetkin (2022) and Hughes et al. (2024). The scale of the proposed SGP is comparable to the five large hardrock mines analyzed in Lubetkin (2022). As pointed out in Lubetkin (2023), the EISs for those mines downplayed the spill risks, and yet the five mines considered in the retrospective report had a combined total of more than 8,150 spill incidents, releasing >2,360,000 gallons and >1,930,000 pounds of *hazardous substances* since July 1995.

Appendix B (USFS 2024, p. 206) discounts the possibility of multiple spills and their cumulative effects:

> Assuming there would be cumulative and additive effects of multiple spills within the SGP area is an unrealistic condition. Section 4.7.2.2 describes the potential sources of any spills of hazardous materials and the EDFs that are planned to largely contain these spills so they are not released to the environment. Spills that might occur outside of secondary containment would be immediately cleaned up and the contamination properly disposed so the environmental effects would not be cumulative or additive.

There was no response in the main body of the FEIS (USFS 2024).

Conclusion

The $N = RT$ model could easily have been applied to the full transportation corridor for hazardous material loads associated with the proposed SGP but was not. The FEIS (USFS 2024) included a value for R that was estimated at 100 times smaller than it should have been and there was no estimate of T. No other spill mechanisms were addressed, even though experience at other mines shows with to be necessary.

As previously stated (Lubetkin 2023, pp. 169-170), with some refinements to the third point (in *italics*):

The SGP spill impact assessment must

- Include an explicit, complete, and quantitative reagents list, as well as other chemicals for blasting, water treatment, spill mitigation, and materials associated with the mining machinery, such as hydraulic oil and antifreeze, and all hazardous wastes that would be considered hazardous materials being transported to or from the mine or used on-site.

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- The peer-revied literature for risk analysis of hazardous materials transportation is robust. Consider more detailed transportation spill risk models, with up-to-date risk rates and location-specific descriptions of the transportation corridor that allow for modification from national or regional average estimates of R.

- Acknowledge that accident modeling only describes one potential way hazardous materials are released from vehicles, and that transportation-related releases can have a multitude of causes, many of which are not modeled. Modeling transportation accidents is a necessary step, but not sufficient to model all transportation spills or all the unintentional releases that occur at mines.

- Be explicit about the numbers of expected spills. The two goals of the EIS production process are to clearly state potential consequences of projects and to inform stakeholders and decision makers of those impacts. The current treatment of spill risks in mining EISs does neither.

As they currently stand, the spill-risk predictions in the SGP FEIS (USFS 2024) only satisfy the first two bullet points listed; the remaining five are incomplete, inaccurate, or nonexistent. They do not measure up to the main objectives of an informed EIS, which are to: (1) estimate potential consequences of project impacts, and (2) inform stakeholders and decision makers how to mitigate those consequences.

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* Indicates a reference that is not already part of the administrative record and has been included with this comment.