Review Comments of Supplemental Draft Environmental Impact Statement (DEIS) Number 20200165 and the Stibnite Gold Project Draft Supplemental EIS - (SDEIS)

Stibnite Gold Project

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Reviewer Qualifications / Affiliation

Expertise: My name is Ian von Lindern and I have resided in Moscow, Idaho for 40 years. I am a licensed Professional Engineer in Chemical Engineering in Idaho and have practiced in the disciplines of Environmental Engineering and Risk Assessment in Idaho for the last 49 years. I hold a BS degree in Chemical Engineering from Carnegie-Mellon University in Pittsburgh, Pennsylvania, and MS and PhD degrees in Environmental Science and Engineering from Yale University in New Haven, Connecticut, specializing in air pollution and public health. I was the Regional Environmental Engineer for the Idaho Department of Environmental Quality (IDEQ) predecessor agency in both the Coeur d'Alene and Twin Falls offices and was responsible for air and water quality and hazardous waste regulatory programs for several years at the major mining and smelting operations in the State, including the last US operational antimony smelter at Big Creek, Idaho. I was President and Principal Scientist for TerraGraphics Environmental Engineering for 30 years and was Project Manager and lead risk assessor for the Bunker Hill Superfund Site as IDEQ's lead consultant. During that tenure, I directed more than 30 major environmental health investigations at mining and smelting sites, both nationally and internationally. I have served on the US Environmental Protection Agency's Science Advisory Board several times with regard to toxic metals assessments since 1975, with my last appointment ending in May 2020. Since retiring from the consulting business, I co-founded TerraGraphics International Foundation (TIFO) and continue to work in mining-related health and safety issues in low income countries. Most notably, I am currently working with the international humanitarian organization Médecins sans Frontières (MSF) (Doctors Without Borders) assisting the Kyrgyz Republic Ministry of Health (MOH) in developing health protective strategies to reopen both mercury and antimony smelters in Batken, Kyrgyzstan. These facilities were among the largest mercury and antimony producers in the former Soviet Union and are essential to the regional economy. Over the past seven years TIFO has collaborated with MOH and MSF in conducting human health risk assessments and biological monitoring investigations that have revealed excess absorption of arsenic and mercury in the majority of preschool children and reproductive-age women in local communities surrounding the mineral processing facilities. As such, I have considerable insight and experience with the issues associated with the proposed antimony-gold operations at Stibnite.

Affiliation: TIFO's mission is to assist mining and mineral processing communities to operate as safely as practicable while maintaining essential economic activities. TIFO supports scientifically sound and transparent analyses of the environmental and human health issues faced by mining communities; and the development of solutions implemented within local socio-economic and cultural capabilities. The Stibnite Gold Proposal (SGP) is of interest because both the industry and the US regulatory agencies have the capacity to implement best practices that are not available to low income communities throughout the world. In that regard, although the current effort has collected and assembled a large amount of credible scientific data, it has not been analyzed and presented in a transparent and cohesive manner, is not protective of health or the environment, nor reflective of the capabilities of the applicant or the regulatory agencies.

1.0 Forest Service Abuse of Public Review Process

Previous DEIS Comments: DEIS comments submitted by TIFO in 2020 focused on analyses regarding Contaminants of Concern (COC)s, specifically toxic metals. The comments emphasized the lack of transparency, material balances, and coherence in the document; and highlighted the resulting difficulties in determining the extent and disposition of toxic contaminants throughout the proposed alternatives. Because of these shortcomings it was not possible to develop comprehensive material balances and verify coherence. Rudimentary material balances were developed by TIFO, through reverse engineering of Midas Gold support documents. Tables supporting the detailed calculations and data sources were attached to TIFO's DEIS comments. The comments and Tables illustrated the lack of transparency that precluded objective analyses of potential health and environmental risks associated with the SGP.

Unfortunately, the Forest Service did not respond to public comments on the DEIS before substituting a new Preferred Alternative developed by Perpetua. Perpetua and the Forest Service characterize the new Alternative as refining the DEIS in response to public comments, without providing specific responses. As a result, the SDEIS Alternative comparison is limited to two site ingress/egress transportation routes and the status of previous comments is unknown. The Forest Service ignored public comments and *de facto* allowed Perpetua to determine which public comments are relevant and implied that responses are inherent in the SDEIS revisions. The Forest Service did little to address the lack of transparency and coherence in the SDEIS, and the documents remain fatally flawed. The introduction of a new Alternative in the SDEIS necessitated repeating the reverse engineering analyses to estimate material balance calculations with a different combination of Midas Gold and Perpetua support documents. SDEIS material balances are summarized in Tables attached below. TIFO's 2020 comments and DEIS material balance support Tables are provided as supplemental material.

Public Review Period / Quality of Document: With respect to both the Draft Environmental Impact Statement (DEIS) and the Supplemental DEIS (SDEIS), the Forest Service has imposed unreasonable time constraints for public review. The Stibnite Gold Project (SGP) is unique. No other co-located mine and antimony/gold mineral processing facility of this type operates in the U.S. Millions of tons of toxic metals will be removed from *in situ* containment and relocated in an already compromised local environment, at the headwaters of a pristine river ecosystem. The SGP has been the subject of tens of millions of dollars (and tens of thousands of hours of expert analyses) of numerous environmental, technical, cultural, and socio-economic investigations over the past several years.

The allocated SDEIS review period was not sufficient to responsibly submit comments for a project of this magnitude, complexity, and unique technical and environmental setting. The 75 day (50 workday) review period included four extended holidays: Veterans Day, Thanksgiving, Christmas, and the New Year. Availability of references for the SDEIS was not timely and documents were supplied by Forest Service agents on uncertain schedules.

The magnitude, complexity and non-transparency of the presentations, and unavailability of referenced support documents, have (once again, as with the DEIS) limited technical reviewers to identifying shortcomings within the respective disciplines. Due to the abbreviated review period, TIFO technical comments are limited to (i) analyses and presentation of Contaminants of Concern (COC) in both the industrial processes and environmental media and (ii) the failure of the Forest Service to consider Alternatives that would reduce contaminant production, volume and toxicity to better control and contain toxic releases.

With regard to concerns related to adverse effects of COCs determined through the material balances, these comments are limited to arsenic. The Forest Service did not allow sufficient review time to similarly address mercury and antimony. More time should have been allocated to refine these analyses and allow cross-discipline comparisons of the document's failures.

Extraordinary Reviewer Burden: The Forest Service has also imposed extraordinary burdens on Public Reviewers by i) allowing Perpetua to submit the new Alternative in the SDEIS without considering and replying to Public Comments on the DEIS, and ii) failing to conduct objective independent analyses for key health and air quality analyses, by deferring to analyses conducted by SGP for the Idaho Department of Environmental Quality (IDEQ) Permit to Construct (PTC). This has required reviewers to revisit analyses based on the DEIS Alternatives, repeat those analyses for the new SDEIS Preferred Alternative, compare the differences, and comment on both documents and the comparison. Similarly, reviewing the air quality analyses required obtaining and critiquing much of the support material from IDEQ. TIFO requested an extension detailing these challenges on December 15, 2022 and received no response from the Forest Service (letter attached).

2.0 Lack of Transparency and Coherence

Both the DEIS and SDEIS lack transparency and coherence. The USEPA defines transparency to "… *ensure that the regulatory science underlying its actions is publicly available in a manner sufficient for independent validation*." https://www.regulations.gov/document?D=EPA-HQ-OA-2018-0259-9322. Coherence is the quality of being logical and consistent, or presented in a manner in which all the parts fit together to form a united whole. Neither document meets these criteria. Key data and analyses are contained in obscure, and often unavailable, references. With regard to COCs, neither overall productions figures, nor any material balances are provided. Determining the contaminant quantities, potential chemical forms and toxicity through the proposed immense mining operations and complex metallurgical processes requires tedious reverse engineering.

Various support documents were used to develop rudimentary COC material balances for both the DEIS and SDEIS. These accountings are used below to demonstrate specific health and environmental concerns with DEIS and SDEIS, and the insufficiency of the Forest Service analyses.

It is not possible, in the time allotted with the available reference material, for an independent reviewer to assess the consistency and accuracy of the assertions made regarding COCs throughout DEIS or SDEIS.

TIFO comments include rudimentary material balances for the DEIS and SDEIS Alternatives. Table SD1a contains the Pit-specific and historic waste material COC distributions for Development Rock DR, Ores, and Historic Materials from the *SRK (2017) SGP Baseline Geochemical Characterization Report*. Tables SD1b and SD1c, combine the COC distributions with mining production estimates from *M3 (2014), (2019) and (2021) Stibnite Gold Project Feasibility Technical Study Reports* supporting the MoDPRO and MoDPRO2 Alternatives. These Tables contain probability distributions of COC production for mined materials for the DEIS and SDEIS, respectively. Table SD2 summarizes overall DEIS and SDEIS Pit-mined COC production. Table SD3 summarizes COC production and DR COC disposal for the SDEIS Alternative.

The lack of material balances has been noted in several reviews including the DEIS and several IDEQ PTC submittals regarding the SGP. It is unusual that credible material balances are excluded in such complex environmental systems analyses. IDEQ has responded that material balances are "helpful but not required," and has been unwilling to request SGP to supply the accounting. The Nevada Department of Environmental Protection (NDEP), that regulates the only comparable gold refinery operations in the United States, does require material balances. Despite the *Forest Service Air Quality Expert Report* 2022 citing the NDEP requirements as exemplary, the Forest Service has not completed material balances for either the DEIS or SDEIS. As demonstrated below, COC sources, concentrations and distribution differ significantly for the DEIS and SDEIS.

The Forest Service should require material balances for toxic contaminants in future Supplemental analyses.

3.0 Lack of Meaningful Alternatives in the DEIS and SDEIS

The Preferred Alternative is New and Improperly Substituted in the SDEIS: The Forest Service has failed to evaluate appropriate Alternatives in both the DEIS and SDEIS. As noted, the Forest Service has abused the NEPA process, by extending extraordinary and inappropriate deference to Midas and Perpetua, and allowing new Alternatives to be substituted during the EIS period without Public Review. The SDEIS summarizes:

> *"This SDEIS was prepared in response to a modified Plan of Restoration and Operations (Plan) for the SGP. The Forest Service received the original SGP Plan in 2016, (Midas Gold Idaho, Inc. [Midas Gold] 2016a) for review and approval in accordance with regulations at 36 Code of Federal Regulations (CFR) 228 Subpart A. A revised Plan, also known as MoDPRO(1), was submitted to the Forest Service in 2019 (Brown and Caldwell 2019a). A further modified Plan, also known as ModPRO2(2), was initially submitted in December 2020 with a revised submittal in October of 2021 (Perpetua 2021a)."*

The evolution of these documents was also at issue in the IDEQ Permit to Construct (PTC). SGP has pursued and, although under Administrative Appeal, obtained a PTC for a facility capable of processing 180,000 tons/day of ore from the IDEQ. The initial PTC proposed by IDEQ did not address 99% of arsenic emissions from the proposed facility. Yielding to public scrutiny, IDEQ relented and required these emissions to be addressed in the PTC. The subsequent PTC application was also found to be insufficient. IDEQ accepted Perpetua's contention that there was no reasonably available control technology (RACT) addressing arsenic emissions from the proposed facility that could meet airborne carcinogenic risk criteria. IDEQ granted Perpetua TRACT relief from the carcinogenic criteria, allowing a ten-fold increase in cancer risk, and imposed production limits of 75% of capacity on operations. PTC Appellants argue these limitations are ineffective, as arsenic

<u>emissions and ambient concentrations are grossly under-predicted, the limits are not enforceable, and no monitoring is required to ensure compliance. (IDEQ 2022a,b).</u>

The Forest Service should recognize the initial configurations rejected by IDEQ are the Alternatives presented in the DEIS, and the alleged refinements are new Alternatives developed to comply with IDEQ requirements. The Forest Service SEIS Preferred Alternative (as noted in the *SGP 2021 Modified Mine Plan (MMP) Alternatives Report* (Forest Service 2022a)), is actually the 2021 MMP that includes the limits imposed by IDEQ. As a result, the Forest Service has selected a Preferred Alternative that differs significantly from the original scoping and the DEIS Alternatives.

The Preferred Alternative Does not Reflect the Capacity of the Permitted SGP: The Preferred Alternative evaluated by the Forest Service relies on SGP assertions that Perpetua, or subsequent operators, will adhere to the 2021 MMP. Perpetua has a PTC to construct a facility capable of operating at 180,000 tons/day capacity and an amendable permit condition limiting production to 135,000 ton/day (75% of capacity). The Forest Service relies on Perpetua's assertion in the 2021 MMP that the SGP will operate at 29% of capacity. There are no provisions in the PTC permit conditions to limit SGP to the Forest Service assumed production level. IDEQ permit conditions allow production up to the 75% of capacity TRACT limit, and is amendable without federal oversight.

The Forest Service only has Perpetua's unbound assurance that the SGP will operate according to the 2021 MMP. Table SD4 compares the Forest Service 2021 MMP, Maximum Design Capacity, and TRACT permitted emissions for Mining Fugitive Dust emissions. Table SD4 demonstrates the SGP is permitted by IDEQ to increase production, emissions and environmental releases by 2.5 times, and has the design capacity to increase emissions by 3 times. The Preferred Alternative is only constrained by amendable IDEQ Minor Source Permit conditions. Forest Service should consider the probability of SGP expansion, and evaluate potential impacts at the permitted and design capacity of the facility.

Alarmingly, Perpetua's 2021 Technical Feasibility Study disclosure to Investors indicates that substantial additional resources are available for exploitation, including expansion of the current Pits, and several other on-property and nearby reserves. Other mining companies are actively exploring similar ore bodies nearby that could utilize the SGP mineral processing excess capacity. The SDEIS does not address these nearby reserves, or the lack of constraints on the SGP to exploit the excess capacity,

The Forest Service should Accommodate Alternatives Suggested by Public Commenters: The Forest Service has never responded to public comments alleging the insufficiencies of the Alternatives in the DEIS. Those DEIS Alternatives were demonstrated to be fatally flawed by rejection from IDEQ. The Forest Service avoided making that determination by electing to provide no response, ignore the Public Comments, and narrowed the SDEIS analyses by substituting and selecting a new Preferred Alternative as suggested by Midas/Perpetua.

Perpetua and the Forest Service allege MoDPRO2 is a refinement of the earlier MoDPRO and PRO Alternatives, and addresses the insufficiencies identified in the DEIS. However, there are substantial and definitive differences with respect to the sources, toxicity, treatment, and disposition of COCs. In the Preferred Alternative, the SGP is not constrained to the production rates assumed by the Forest Service , but is permitted to increase production, emissions and environmental releases by 2.5 times, and could increase emissions by more than 3 times by amending a Minor Source Permit not subject to federal review. The Forest Service has neglected to consider there are adjacent resources available to SGP to substantially increase production.

Conversely, the Forest Service has refused to consider Alternatives suggested by Public Reviewers. Among the more protective Alternatives are process options considered by Midas in the same time period the serial MoDPRO Alternatives were developed to address arsenic instability and exposure problems. These potential Alternatives, as noted below, are both technically and economical viable, and could substantially reduce the environmental burden of COCs.

The Forest Service should reopen the Public Record and allow the same deference accorded the SGP to the Public. Appropriate alternatives should be identified in consultation with Public representatives, and addressed in a second, more objective, Supplemental DEIS. The Preferred Alternative should be re-evaluated on the basis of the design capacity of the facility, rather than on alleged production limitations.

4.0 Significant Differences in COC Considerations with the New SDEIS Alternative

Concurrent review of the serial Alternatives and support documents submitted to the Forest Service demonstrates that the Preferred Alternative is more than a refinement. As noted, it should be considered a new Alternative substituted for earlier DEIS Alternatives that were clearly insufficient.

In comparing MoDPRO and MoDPRO2, mined material is decreased by 44 MT in the SDEIS Alternative. This is achieved by decreasing Development Rock (DR) by 61 MT and increasing Ore production by 17MT. This significantly changes the production, sources, concentrations, and toxicity of COCs from mining operations, and the disposition of COCs downstream in metallurgical processes and environmental media (Tables SD1b and SD1c).

Most of the gold at SGP is refractory, i.e., chemically bound as small particles in arseno-pyrites. Massive amounts of these ores and Development Rock (DR) are mined to access this gold. The SDEIS Preferred Alternative mines nearly 400 million tons of material. Approximately 290 - 866 pounds of arsenic, 0.2 - 0.63 pounds of mercury, and 71 - 304 pounds of antimony will be disturbed for each ounce of gold produced (average - 95^{th}%tile) (Table SD2).

Overall, arsenic, mercury, and antimony mined are reduced by 15%, 25% and 40%, respectively, from totals estimated in the DEIS. The decreases are due to reduced DR from Hangar Flats Pit (HFP) offset by decreases in the DR/Ore strip ratio, and increasing Ore production in the West End Pit (WEP). About 17MT, or 18%, more Ore will be produced in the SDEIS Alternative than in the DEIS. COCs in ores decrease by 5% overall, with 20% and 224% <u>increases</u> in Yellow Pine Pit (YPP) and WEP Ore arsenic, respectively, and a 75% <u>decrease</u> in HFP Ore arsenic (Table SD1c).

Estimated gold recovery increased by 5% from 4040 - 4238 koz. Antimony product increased from 16% from 98.9M to 115M pounds, despite the 40% decrease in antimony ore production. This accomplished by a 32% increase in recovered YPP antimony offsetting a 31% decrease in antimony recovered from HFP. Antimony ores will be mined in years 1-6, and 64% of product will be recovered in years 1-4. There is no appreciable antimony ore in the WEP, and no antimony ores will be produced after Year 7. Table SD2 shows gold production and Table SD5 shows antimony production for the DEIS and SDEIS.

The purported remediation of historic wastes and tailings represents about 3% of total disturbed arsenic and 5% of disturbed mercury and antimony on site. All of the remediated arsenic, and >75% of remediated mercury and antimony will be redistributed on site. Undetermined percentages of mercury will leave the site as high-level waste, be disposed in DR or discharged to the TSF. About

22% of remediated antimony and 47% of ore antimony will be recovered as antimony concentrate for off-site sale. The remainder will be disposed on-site.

Approximately 36% of disturbed antimony will be recovered and 64% wasted. About 16% of disturbed antimony will be disposed of in DR repositories in about equal amounts above and below ground. About 47% of disturbed antimony will be discharged to the TSF, largely as flotation tailings. Table SD3 shows SDEIS COC production and disposal.

Regarding arsenic, an estimated 616,000 - 1,856,000 tons (average - 95^{tho}%tile) of arsenic is mined in the SDEIS configuration. Approximately 36% of site-wide arsenic (102,560 - 827,600 tons) is in Development Rock (DR) and historic overburden, and 64% (309,580 - 1,028,400 tons) in ore. Practically all of this arsenic will be disposed of on-site or released to the immediate environment. Three principal concerns are arsenic in air from mining dust, DR disposed in locations subject to groundwater and meteoric waters, and in ores disposed in the Tailings Storage Facility (TSF) after gold extraction. Over time, all three sources will release arsenic to the local environment (Table SD3).

The SDEIS Preferred Alternative effected large changes at the WEP, the fugitive dust source most affecting the compliance point for arsenic exposures. COC production in WEP Ores increases by more than 3.2 times, and WEP DR COCs increase 14%. The WEP is expected to yield 175,320 – 597,200 tons of arsenic (average - 95^{th} %tile), nearly doubling (1.97X) the estimate for the DEIS. The change in strip ratio increases weighted arsenic concentrations for mined material in the WEP by 1.5 times, from 569 - 2079 ppm to 887 - 3021ppm (average -95^{tho}%tile). Weighted concentrations remain similar to the DEIS, at 2240 – 6350 ppm in the YPP and 3436 – 10,170 ppm in the HFP (Tables SD1a, SD1b and SD6).

5.0 Arsenic in Dust and Air Concerns

Arsenic Emission Rates are Underestimated: Use of inappropriate Emission Factors (EF)s in the 2021 MMP combine to significantly underestimate arsenic emission rates in the SDEIS. The most critical EF selections are associated with Mining Fugitive Dust and include underestimated i) arsenic concentrations in Pit roadbeds, ii) silt content in on-site gravel roadbeds, and ii) percent control levels for application of dust suppressants. Each is discussed below.

Arsenic Dust Concentrations: Fugitive Mining Dusts in the three Pits will reflect the changing arsenic production and concentrations noted in Table SD6. The new 2021 MMP Preferred Alternative analyzed in the SDEIS does not include these changes. The DEIS characterized all Haul Roads using the median concentration of site-wide rock samples of 667 ppm As. The 2021 MMP uses 667 ppm to calculate mining fugitive dust arsenic emissions for Pit Haul Roads and substitutes 90 ppm for "*CR: clean rock - used to cap haul roads outside of the pits and DRSFs.*" The 2021 MMP modification should have included substituting the Pit-specific arsenic concentrations noted in Table SD6 for in-Pit Haul Roads. This oversight underestimates in-Pit arsenic emissions by 1.3 times for the WEP, 3.4 times for YPP, and 5.2 times for HFP. Table SD7 shows the calculation adjusting for the weighted in-Pit Arsenic concentrations from Table SD6.

Haul Road Silt Content: Pit Haul Road (HR) Fugitive Dusts are the largest source of total particulate (PM) and arsenic emissions, accounting for 83% of PM as calculated in the 2021 MMP Preferred Alternative. HR PM emissions are grossly under-estimated due to unrealistic assumptions regarding the silt content of the roadbeds and the level of control assumed for dust suppressants.

The Forest Service cites USEPA AP-42 guidance as the basis for HR Dust emission estimates. Table 13.2.2-1 from the cited guidance summarizes 272 gravel road samples from 53 sites at 18 different industries. Ten (10) sites and 58 samples were obtained specifically from Haul Roads. Haul Roads silt content ranged from 5.8% to 24%, averaging 11.6%. The minimum mean silt content from any one site was 4.3% for all gravel roads and 5.8% from Haul Roads. Table SD8 summarizes the USEPA AP-42 results for all roads. (USEPA 2022.)

The SDEIS uses a 4% silt content, lower than any value observed by the USEPA. The 4% value is referenced to *"Soil Resources Baseline Study, Stibnite Gold Project." Reid, Samuel B., Assistant Geology Supervisor, Midas Gold, Inc., April. (Midas Gold 2015).* The Appendix to this document notes <75 micron fractions for 28 on-site sieved soil samples, but it is unclear how the 4% value was selected.

Although the guidance indicates the importance of locally collected data, the 4% silt content cited by Midas are most relevant to "dirt roads" operating on native soils. The in-Pit Haul Roads at SGP will be constructed from Development Rock crushed gravels from within the Pits and with "*CR: clean rock - used to cap haul roads outside of the pits and DRSFs."* The silt content of industrial constructed gravel haul roads is generally designed and maintained at higher levels for stability reasons, as indicated in Table 13.2.2.1 of the AP-42 document (i.e., mean values ranging from 5.8% to 24%). Substitution of 8% and 24%, as a more appropriate range, for roadbed silt content into the Emission Calculations in the Appendices relied on for the SDEIS, increases uncontrolled PM emissions by 1.6 to 3.5 times, respectively. Table SD9 shows these calculations applied to the On-site Hauling fugitive dust Maximum production scenario in Table SD4 (i.e., 2901.3 tons/yr.).

Particulate Control: The SDEIS also relies on 93.3% particulate control achieved by a combination of chemical dust suppressants and watering. The AP-42 Guidance (AP-42) also discusses the effectiveness of both technologies. As Perpetua's control strategy relies largely on chemical dust suppressants, it is important to note the following excerpt from AP-42 that concludes: "*Past field testing of emissions from controlled unpaved roads has shown that chemical dust suppressants provide a PM-10 control efficiency of about 80 percent when applied at regular intervals of 2 weeks to 1 month"* (p 13.2.2-12). This suggests the proposed 93.3% control assumptions are suspect and will more likely range from 80% to 90%. Controlled emissions would be 1.5 - 3.0 times greater at 90% and 80% control, respectively. Table SD9 also shows that using 8% and 24% silt content increases the required PM control from 93.3% to 96.4% and 98.7%, respectively. These values are not achievable even for paved roads.

Table SD10 shows combined correction factors for the several emission factors underestimated by IDEQ and accepted by the Forest Service. In combination, correcting for the arsenic concentration and silt content in roadbeds and percent control for dust suppression underestimates indicate that arsenic emissions are likely 7.5 - 33 times greater from the YPP, 14 - 60 times greater for HFP, and 3 - 14 times greater for the WEP, than those estimated in the SDEIS. These changes alone would result in exceedance of cancer risk criteria. Unfortunately, specific calculations of the ambient estimates cannot be developed, as the link to the electronic support documents cited by the Forest Service cannot be accessed.

Airborne Arsenic Carcinogenic Risks Are Underestimated: Carcinogenic risk is determined by appropriately estimating emissions from SGP proposed activities, conducting air quality modeling to estimate ambient air arsenic concentrations and exposures, and comparing the exposures to carcinogenic risk criteria. The analyses the Forest Service relies on understates arsenic impacts in each of these steps. Objective correction of these dilutions results in cancer risks exceeding acceptable levels. These serial dilutions significantly underestimate carcinogenic risk for average conditions. Estimating risk at the average exposure implies half the receptor population has a greater cancer risk. Carcinogenic risk should be evaluated at both mean and reasonable maximum exposures (95^{th}%tile) to ensure protectiveness for the more vulnerable receptor population. Neither the Forest Service, nor IDEQ, has performed responsible risk assessment calculations. This is one basis for the current Administrative Appeal of the PTC. The serial dilutions are described in the following paragraphs.

The SDEIS cites a Perpetua consultant's report (Air Sciences 2021b) that alleges compliance with the 10^{-6} cancer risk criteria by comparing a calculated maximum equivalent 70-year exposure of 0.00015 ug/m^3 arsenic to the 0.00023 ug/m^3 standard. These calculations include a number of questionable dilution steps. Nevertheless, as calculated by the Forest Service, this evaluation implies that the 12 years of the 2021 MMP consumes 65% (0.00015/0.00023) of a receptor's acceptable 70-year lifetime exposure. Appropriate emission rate estimates are critical to estimating carcinogenic risk associated with the Preferred Alternative. Even by the Forest Service analysis, any correction of the EFs resulting in a > 50% (or 1.5 times) increase in arsenic emissions, would result in exceedance of the carcinogenic risk criteria.

Table SD10 summarizes the appropriate correction factors for Haul Road emissions and includes combination factors for As concentration, silt content, and % Particulate Control adjustments. Applying any combination of adjustments >1.5 in Table SD10 would result in excess cancer risk. For example, simply correcting for the minimum increases in arsenic emission rates for the WEP (3 – 14 times) results in airborne arsenic exposures arsenic levels exceeding the applicable carcinogenic risk criteria. That is, 3 x 0.00015 ug/m^3 = 0.00045 ug/m^3, corresponding to 2 x 10^{-6} cancer risk. Applying the 14 fold increase indicates a 9.3 x 10^{-6} cancer risk. Similarly, should either the silt content (1.6 - .3.5) or control level corrections (1.5 – 3.0) apply, excessive cancer risk will result. Correcting for silt content, percent control and pit-specific concentrations for all Pits, likely increases to concentrations >10^{-5} risk levels.

Inappropriate Serial Dilution of Exposure Indices: The preceding discussion applies only to underestimated emissions. In addition to diluting emissions, the 0.00015 ug/m^3 arsenic chronic exposure cited by the Forest Service was derived using three additional inappropriate dilutions of the air quality modelling results. In total, four levels of inappropriate dilution are: i) the underestimated arsenic emissions, noted above, due to unrealistic particulate arsenic concentrations, roadbed silt content, and control levels; ii) maximum emissions input to the air quality models are five-year averages (not maximums) diluted by different pit production ratios; iii) the predicted model results are diluted by averaging the results of two scenarios, one WEP and one non-WEP related. This averaging incorrectly reduces the WEP maximum annual average by 41%. The Forest Service relies on IDEQ's assertion that this technique is justified on the basis that maximum prediction for the WEP scenarios will not apply during the life of the mine. There are several problems with this reasoning. The five-year average already accommodates this effect. Several of the scenarios are no longer applicable, as the DR repository destinations no longer exist. The adjustments for Pit-specific dust concentrations are much greater for the non-WEP scenarios; and iv) adjusting for the ratio of the 16-year life of the mine to the 70-year lifetime of the receptor dilutes the ambient calculation by an additional 78%. The SGP is not entitled to consume the remaining 54 years of the receptor's 70 year lifetime acceptable exposure during the alleged 16-year life of the mine. (IDEQ 2022b).

These serial dilutions are another basis for the IDEQ PTC Administrative Appeal currently under consideration. Correction of these serial dilutions likely increase exposures and cancer risks by an order of magnitude exceeding 10^{-5} cancer risk criteria. However, as noted above, exposure estimates cannot be developed, as the link to the electronic support documents cited by the Forest Service cannot be accessed.

On-site Carcinogenic Air and Dust Exposures: All of the air quality analyses are limited to off-site ambient air. On-site air concentrations are likely an order of magnitude higher. In the interest of worker, site resident and visitor health, the Forest Service should estimate on-site airborne arsenic levels and assess the risk of on-site exposures. The high arsenic content of the dusts is also a health concern due to direct contact exposure, incidental ingestion, inhalation, and skin absorption. Arsenic levels in on-site dusts will range from 580 – 10,000 mg/kg. Total arsenic concentration for growth media range up to 3,000 ppm As, justified on the basis of observing vegetation survival on Hecla reclamation sites These metals concentrations substantially exceed (by 2 – 3 orders of magnitude) health risk screening and CERCLA cleanup levels for occupational, recreational and residential scenarios. On-site workers and visitors will be exposed to concentrations, potentially, orders of magnitude greater than these criteria. Neither Perpetua, nor the Forest Service or IDEQ have publicly disclosed estimated on-site airborne concentrations.

In the interest of Public Health protection, the Forest Service should not defer to the IDEQ PTC assertions under Administrative Appeal. The Forest Service should independently perform the emission calculations, air quality modeling, and risk assessment associated with COC releases from this facility. Resulting COC airborne and dust concentrations, both on-site and off-site estimates should be publicly disclosed. Human health risk assessments should be undertaken at mean and Reasonable Maximum Exposures (RME). Soil cleanup criteria should meet CERCLA guidelines.

6.0 Concerns Regarding Arsenic in Development Rock

Under the SDEIS, the TSF Embankment and Buttress will contain from 115,317 – 425,957 tons of arsenic, 117-378 tons of mercury, and 13,145 -17,566 tons of antimony. Compared to the DEIS Alternative, arsenic disposed in the TSF Dike /Buttress is increased by 210%, and decreased by 10% in the YPP and 66 % in the WEP. The HFP is backfilled with 14,618 - 53,995 tons of arsenic as opposed to water in the DEIS. Typical arsenic concentrations in DR backfill will range from 812 ppm to 3000 ppm, (average - 95th %tile), as compared to 656 ppm to 2422 ppm in the DEIS. Table SD11 summarized DR COC for the DEIS and Table SD3 summarized DR and Waste COC for the SEIS.

DR disposal SDEIS and DEIS are markedly different, and direct comparisons are difficult. Three of the DR surface repositories indicated in the DEIS have been eliminated and one subsurface pit has been added. Four (4) of the 10 DR haul road scenarios evaluated for both the DEIS and SDEIS air quality analyses are no longer applicable, and none estimate haulage to the TSF Dike/Buttress, the most utilized route under the new SDEIS Preferred Alternative. As a result, the relevancy of the air quality analyses supporting HR emissions calculations is suspect. However, these effects cannot be evaluated as the electronic links to the modeling files can no longer be accessed.

All SDEIS Alternative DR repositories will be under a geo-synthetic cover and largely protected from meteoric waters for the life of the cover. In total, approximately 54% of SDEIS DR arsenic will be disposed in surface repositories and 46% in Pits, as opposed to 68% surface and 32% sub-surface disposal in the DEIS. Pit-disposed COCs will be exposed to groundwater wet/dry and redox cycles, and will release COCs to groundwater. Although additional protections will be afforded from meteoric waters, YPP and HFP subsurface disposal of COCs likely increases groundwater contact, leaching and discharge.

The Forest Service should independently re-evaluate the air quality modeling and the relevance of the Haul Road characterizations, emission estimates, and carcinogenic risk assessments. Similarly, the release to groundwater and consequent downstream effects from YPP and new HFP should be re-evaluated.

7.0 Concerns Regarding Arsenic in Ore

Lack of Information Regarding Arsenic Behavior in Mineral Processing. The largest component of total on-site arsenic (64%) is in ore. Under the new SDEIS Alternative, a projected 112M tons of pit ore will be produced containing 396,246 to 1,028,406 tons of arsenic (average - 95th%-tile). About 55%, 12%, and 31% of arsenic in Pit ore will be produced from the YPP, HFP and WEP, respectively. This a marked change from the DEIS Alternative reflecting 44%, 46% and 9%, respectively. These are significant differences, as the concentrations and chemical form vary among ores and can have important effects on the distribution, chemical form, toxicity, and disposition of arsenic in downstream metallurgical processes, disposal and releases, and behavior in environmental media. About 3% of ore arsenic is in historic wastes.

Ores will be crushed and ground and subjected to flotation concentration. About 85% of arsenic in ore will go to concentrates and 15% to tailings. An estimated 9% of YPP arsenic, 30% of HFP arsenic, and 17% of WEP arsenic, or a total of 61,547 to 157,878 tons of arsenic will discharge with flotation tailings to the TSF. The chemical form of this arsenic is unclear, but likely varies by Pit source.

An estimated 85% of arsenic in ore (348,766 – 894,462 tons) will be captured in gold flotation concentrates (54% of Site-wide As). The arsenic in these concentrates is pressure oxidized in a high-temperature autoclave (POX) to liberate gold and will eventually go through cyanide (CN) leaching and detoxification (Detox) and be discharged to TSF. About 60% of total Site-wide As will be subjected to the POX/CN/Detox processes and undergo substantial chemical transformation.

Neither the DEIS nor SDEIS addresses the arsenic content, geochemistry or chemical constituency in relation to these proposed metallurgic processes or waste characteristics. This omission is of considerable concern, as arsenic chemistry and toxicity are complex and species (valence) dependent. Solubility, bioavailability and toxicity are highly variable among mineral processing applications depending on other metal concentrations, pH, and oxidation-reduction status, among other factors.

Only two, two-sentence statements in the entire SDEIS document address these issues: i) on page 2-51 *Oxidation and Neutralization* and ii) in Table 2.4-13 *Proponent Proposed Design Features.* Both allude to*: "Perpetua would monitor levels of soluble arsenic in the tailings. If soluble arsenic levels are higher than anticipated, Perpetua would treat the oxidized concentrate with HAC prior to neutralization."*

Soluble Arsenic in the TSF Discharge: Careful concurrent review of the evolution of the New MoDPRO2 Alternative using the 2014/2019/2021 M3 Feasibility Study documents and the subsequent MoDPRO and MoDPRO2 Alternative modifications, indicates that the Forest Service should be more diligent and forthcoming in the SDEIS, and in informing the public regarding difficulties with toxic soluble arsenic in the TSF discharge.

The brief mention of HAC (Hot Arsenic Cure) in the SDEIS apparently parrots a two paragraph statement in Section 2.2.5 Tailings Arsenic Management, in Perpetua, October 2021, STIBNITE GOLD PROJECT: REFINED PROPOSED ACTION – MoDPRO2. In short, Perpetua acknowledges that 2018 testing showed a substantial amount of amorphous (unstable) arsenic compounds formed in the POX would result in elevated soluble arsenic in POX waste and the tailings leachate. These levels may not meet water quality standards during post closure, necessitating long-term water treatment, even with the MoDPRO improvements.

Perpetua then asserts that, based on mid-2020 tests, the new Alternative MoDPRO2 will address the soluble arsenic detoxification problems as follows: *"During the initial years of operation, Perpetua Resources would monitor levels of soluble arsenic in the tailings. If soluble arsenic levels were higher than anticipated, Perpetua Resources would treat the oxidized concentrate with hot arsenic cure (HAC) prior to neutralization."*

Repetition of a single unsupported sentence in serial reports does not constitute reliability in the assertion that the HAC is a catch-all solution for the arsenic instability problems in the largest on-site discharge.

Failure to Disclose Arsenic Stabilization Uncertainties: Although the documents show Midas was aware of, and actively investigated these problems in 2018, the Forest Service was either unaware of, or chose to ignore, these concerns in the DEIS and, subsequently, in the SDEIS. The only public disclosures regarding arsenic detoxification difficulties prior to the DEIS were the two brief references to arsenic behavior in wastes in the 2019 Feasibility Study noted and copied in full in the original DEIS comments.

The 2021 Technical Feasibility Study disclosure to Investors provided the details of the tests that indicated conditions necessary to capture precious metals in the POX/CN/Detox circuit, resulted in arsenic instability downstream of the autoclaves; and largely labile, pentavalent As being discharged to the TSF.

The following are the first and last paragraphs of Section 13.9.4 Arsenic Stability Investigation (2020) of the 2021 Technical Feasibility Study summarizing the problem, investigations and conclusions: *The stability of arsenic was a concern flowing out of the 2018 metallurgical product environmental geochemical results. A test work program was initiated at SGS commencing April 2020 to examine where arsenic destabilization occurred.*

Section 13.9.4.7 Arsenic Deportment Across Metallurgical Circuit concludes: *Arsenic destabilization appears to be an inevitable outcome of raising the pH of the POX residues for the recovery of gold employing the cyanide carbon-in-leach step. The destabilization of arsenic does not seem to be reversible at pH values above neutral and only appears to be arrested when the pH is reduced to approximately 8.5 in Cyanide Detox. Arsenic is expected to leach from POX residues and report to the process liquors. The only sink for aqueous arsenic is in the pore water within the tailings facility and in the autoclave and neutralization circuits where arsenic containing process water is employed in the feed repulp, reagent make up and quench water* (emphasis added).

Lack of Reliability in Arsenic Stabilization Processes: The Arsenic Stability Investigation (2020) was the genesis of the HAC assurances provided in the SDEIS. The 2021 Feasibility Study, MoDPRO2 and SDEIS documents confuse the HAC acronym, with the Feasibility Study distinguishing Hot Acid Cure (HAC) and Hot Arsenic Cure as (HC), in contrast to the MoDPRO2 and SDEIS documents using only Hot Arsenic Cure (HAC). Regardless of the confusion, it is most important to note that the supposed process indicated in the MoDPRO2 refinements, and the four SDEIS sentences, are based on 3 tests of a single concentrate, representing *"years 1-4 production consisting of 85% Yellow Pine and 15% Hangar Flats (Con 10)."* The 2021 Feasibility Study also indicates the HAC system would be installed in Year 6 to be operational in Year 7, when arsenic levels in the mill feed are expected to increase. This corresponds with the completion of YPP and HFP ores and the introduction of WEP ores for which there were no reported HAC tests. This indicates the HAC will not be installed in time to treat the majority of concentrates that were tested, and was never tested on the concentrates it is intended to treat.

It is also important to note that the amorphous arsenic concern is with the final discharge in a six step detoxification flowchart. This occurs after the supposed HAC stabilization of thermally treated arsenic in the POX in an earlier step. The supposed stabilized CN/Detox slurry was then blended with concentrator tailings thickener underflow, and the blend was examined for arsenic stability. The blend ratio was 75.2% rougher tailings, 12.0% cleaner tailings, and 12.8% cyanide detox residue. As a result, it is unclear if the alleged stabilization in the final discharge is due to dilution from rougher and cleaner tailings, or from the alleged effectiveness of the HAC.

Considering the complex arsenical geochemical differences in ores processed, and the shift in the 2021 MMP toward WEP Ores (that demonstrated significantly different arsenic recovery chemistry due to unique combinations of sulfide, oxidized and transitional ores), the Forest Service should have little confidence in Perpetua's ability to manage arsenic stability through the Life of the Mine (LOM).

Reliance on Inappropriate Leachate Tests: Finally, the stabilization results referenced in the Feasibility Study are based on Synthetic Precipitation Leachate Procedure (SPLP) test results. SPLP is commonly used to simulate the effect of acid rain on land-disposed waste (e.g., land application or unlined landfills) where leaching to groundwater is a concern. The SPLP test is not a regulatory test, and concentrations are generally compared to drinking water standards (i.e., 0.01 mg/l for As). The 2021 Technical FS leachate studies refer *to "acceptably low SPLP concentrations of As (<2 mg/L)."* The justification for this SPLP "cut off" level is unknown as it is 200 times the drinking water standard.

Because these wastes are to be disposed in a lined and covered TSF landfill, the Toxic Characteristic Leachate Procedure (TCLP) is a more appropriate test, and that most often cited in reviews of arsenic stabilization (Nazari, et al (2017). TCLP is a regulatory test and the standards are generally 100 times the drinking water standard. The TCLP procedure generally shows considerably greater concentrations of arsenic than the SPLP. The use of SPLP in the earlier studies suggest that Midas was concerned with disposal of the arsenic subject to meteoric waters. MoDPRO2 changed the TSF configuration to a geo-synthetic cover. As a result, the Forest Service should not rely on SPLP test results in evaluating arsenic stability, and should consider the Perpetua's alleged capacity to stabilize amorphous arsenic in the POX/CN/Detox is unproven.

TSF Leak Detection and Treatment: The concern with appropriate leachate testing was exacerbated with the Idaho mining industry's successful lobbying effort to modify the IDEQ CN waste disposal rules. At the time Midas was conducting arsenic stabilization investigations, the Idaho CN rules required double-lining, and leachate collection and treatment for the TSF. These rules were amended by the Idaho State legislature and as noted in the SDEIS, the TSF will not require double lining. Leak detection will be commenced in groundwater monitoring as opposed to between the liners, and feasibility of timely seepage collection/treatment is unlikely. This rule change increases the urgency for reliable arsenic stabilization alternatives.

Summary of Arsenic Tailings Concerns: Numerous tests conducted prior to the DEIS indicated significant arsenic instability associated with POX/CN/Detox proposed discharges to the TSF. These instabilities were not disclosed to, or were ignored by, the Forest Service in the DEIS. Midas Gold performed an assessment of arsenic stability in 2020 and alleged that the HAC had been developed to address this problem in the new 2021 MoDPRO2 Alternative. Examination of the studies, however, show these were based on three tests of a single ore concentrate, were significantly diluted with pre-

POX flotation tailings, and relied on an inappropriate leachate procedure. The DEIS and SDEIS failed to mention or consider these uncertainties and shortcomings. Simultaneously, IDEQ cyanide disposal rules were amended, relieving the SGP of double lining the TSF. Leakage from the TSF will likely be undetectable in any way that supports corrective actions.

The Forest Service should not accept Perpetua's assertions that arsenic in the TSF discharges can be stabilized, and consider an Alternative that does not require on-site treatment and disposal of thermally treated arsenic.

8.0 Alternatives that Reduce COC Production, Toxicity, and Disposal

Off-Site Processing of Gold Concentrates: The issues associated with disposal of massive amounts of potentially unstable arsenic were repeatedly pointed out in the DEIS public comments. The Forest Service did not respond to these comments, but inserted vague references to a supposed HAC treatment system. Midas and the Forest Service did not disclose these problems and neglected to inform the public of an Alternative that could reduce toxic metals burdens to the environment by 50% - 80%. The 2021 Technical Feasibility Study also reveals that, at the same time Midas was conducting the HAC treatment tests, off site gold processing was being evaluated. This option would eliminate the POX/CL/Detox circuit and the arsenic stability challenges and would reduce the arsenic disposal burden at the site by more than 50%.

The Forest Service evaluated and rejected Off-Site Gold Processing in Section 2.6.2.1 of the SDEIS that states:

"Under this alternative, raw ore would be processed off-site and would reduce the amount of reagents transported and used at the SGP, and the number of employees traveling to the site. It would also eliminate the need to store mill tailings at the SGP site. Transporting approximately 22,000 tons per day by trucks to an offsite mill would require <u>approximately 550 round trips daily during the 15 years of mine operations</u>. This would greatly increase the air emissions and transportation impacts of the SGP and dramatically increase operational costs. The main problem with this alternative is that there currently is no commercial milling operation in the U.S. West that could economically process the SGP ore. So, a new mill, with all the same associated environmental impacts <u>as the proposed SGP on-site mill would need to be constructed.</u>" (Emphasis added)

It is uncertain whether this statement is naïve, facetious, or intentionally misdirecting. Raw ores were first, and perhaps last, shipped from Central Idaho Territory to Utah from Bayhorse in 1864 by pack train. For the last century, ores have been concentrated before shipping, usually at flotation mills built near the mine. In fact, simultaneous with addressing the arsenic stabilization problem, the 2021 Technical Feasibility Study states: *"The potential for cleaner flotation to produce a concentrate suitable for shipment off-site, as an alternative to on-site sulfide oxidation and gold leaching, was investigated during the FS."*

The 2021 Technical Feasibility Study also disclosed that pilot tests indicated that the processes were potentially technically and economically feasible, developed process flowsheets, and made recommendations for additional testing, should the alternative be pursued. As opposed to the one concentrate tested for HAC, variability testing was conducted on 13 different samples from all Pits, representing some of the *"best and worst acting samples from the feasibility study."* Gold grades in concentrates were 40-50 g/t. "*Average estimated supplemental loss in gold recovery was 3.3%, compared with the flotation of an on-site POX-ready concentrate.*" This indicates a 25-30 fold concentration of Life-of-Mine (LOM) gold grades, reducing trucking to 20 loads/day at concentrate metals values comparable to the antimony concentrate Perpetua intends to ship to Asia or the Middle East.

The 2021 Technical Feasibility Report continues. "*A preliminary market study for gold concentrate sales was completed by an independent leading industry participant. The participant's name has been withheld for confidentiality. In the study, the assumption was that the gold flotation concentrate would be shipped offsite to a regional processing facility located in Nevada where several autoclave and roaster plants are located…On <u>May 9, 2018</u>, Barrick Gold, which owns and operates (through the Nevada Gold Mines joint venture with Newmont) several roasters and autoclaves in Nevada, was granted a right of first refusal regarding purchase of gold concentrates as part of a financing arrangement were such concentrates to be shipped off-site.*"

Midas Consultants noted this Alternative was, potentially, technically and economically feasible with a substantial reduction in capital costs. This alternative would minimize, or eliminate, the highly toxic POX/CN leaching processes at Stibnite. This would reduce the total TSF arsenic disposal burden by >85% or by >350,000 tons, that would be disposed of in Class 1 facilities in Nevada. <u>This would result in a 55% decrease in on-site disposal of arsenic, and elimination of labile As downstream of the flotation circuits.</u>

These undisclosed findings certainly suggest that Off-site Sale of Gold Concentrates meet the Alternatives criteria noted by the SDEIS: i) does the alternative, including a combination of component options, meet the purpose and need of the SGP? ii) does the alternative or component option potentially reduce environmental effects to at least one resource? iii) is the alternative or component option technically feasible? iv) is the alternative or component option economically feasible?

No Action alternative should consider CERCLA: This site is also subject to CERCLA, although it has not risen to priority status by the State of Idaho at this time. CERCLA-related actions are ongoing and are more likely to proceed, based on the outcome of the DEIS, and USFS, State of Idaho and Nez Perce Tribe considerations. Based on preliminary investigations undertaken, and other sites involving PRPs for this site in adjacent States, it is probable this site will achieve active status in the foreseeable future. Imposition of CERCLA, would be among the first steps require a conceptual site model that includes an accurate and transparent material and contaminant balance for the site. Evaluation of such a model would be incumbent on the State, Tribal and federal trustees to resolve remedial requirements and CERCLA liabilities in, either Consent Decrees or implementation of voluntary cleanups, as part of mine development, reclamation, and closure.

The Forest Service should include Off-site Processing of Gold <u>Concentrates</u> and CERCLA Cleanup as Alternatives in a more objective Supplemental DEIS.

9.0 Closing Observation with Respect to Other Toxic Contaminants

It seems clear the Forest Service has failed to undertake due diligence with respect to evaluating the reliability of the metallurgical processes, for the potential effectiveness of treatment alternatives, and potential adverse health and environmental effects of releases. Unfortunately, the unreasonable time and logistical constraints imposed on Reviewers by the Forest Service have precluded similar evaluations for other COCs, particularly mercury and antimony. However, the absence of any significant mention of these toxins in the DEIS and SDEIS evaluation of metallurgical processes, suggests the Forest Service was equally negligent in this regard. Even were there more time to develop similar analyses for mercury and antimony, the Agency should not rely on, nor expect Public Reviewers to undertake the Forest Service duties and responsibilities.

10.0 Material Reviewed

Air Sciences. 2018a. Stibnite Gold Project. Air Quality Analysis. Prepared for Midas Gold Idaho, Inc., Air Sciences, Inc. Project No. 335-1-2, October 10, 2018.

Air Sciences. 2018b. Stibnite Gold Project. Unpaved Road Dust Control Efficiency from Chemical Suppressants. Prepared for Midas Gold Idaho, Inc., Air Sciences, Inc. Project No. 335-1-2, January 12, 2018.

Air Sciences. 2020. Stibnite Gold Project. State of Idaho Permit to Construct Application. Prepared for Midas Gold Idaho, Inc., Air Sciences, Inc. Project No. 335-1, June 23, 2020.

Air Sciences. 2021a. Stibnite Gold Project. Air Quality Analysis Addendum ModPro2. Prepared for Perpetua Resources, Air Sciences, Inc. Project No 335-21-402, July 13, 2021.

Air Sciences. 2021b. Stibnite Gold Project. Supplemental HAP Air Quality Analysis Addendum ModPro2. Prepared for Perpetua Resources, Air Sciences, Inc. Project No 335-21-402, October 5, 2021.

Brown and Caldwell 2019a. SGP Environmental Impact Statement (DEIS) Modified Proposed Action. May 3, 2019.

Brown and Caldwell 2019b. *SGP Modified Proposed Action (ModPRO*) September 2019.

Forest Service 2022a. Stibnite Gold Project 2021 MMP Alternatives Report. Payette National Forest.

Forest Service 2022b. Stibnite Gold Project, Air Quality Air Quality Specialist Report Specialist Report, Payette National Forest, August 2022.

Idaho Department of Environmental Quality 2022. Permit to Construct, Stibnite Gold Project. 2020-2022, Regulatory Record Files.

Idaho Department of Environmental Quality (IDEQ). 2022a. Permit to Construct for Perpetua Resources. Idaho Department of Environmental Quality.

Idaho Department of Environmental Quality (IDEQ). 2022b. CASE DOCKET NO. 0101-22-01. FIRST AMENDED PETITION TO INITIATE CONTESTED CASE: AIR QUALITY PERMIT TO CONSTRUCT P-2019.0047 (JUN. 17, 2022).

Idaho Department of Environmental Quality 2022c. Permit to Construct, Stibnite Gold Project. 2020-2022, Regulatory Record Files.

M3 Engineering & Technology 2014. Stibnite Gold Project Prefeasibility Study Technical Report, prepared for Midas Gold, December 8.

M3 Engineering & Technology 2018. Stibnite Gold Project Prefeasibility Study Technical Report, prepared for Midas Gold, December 8, 2014, amended March 28, 2019.

M3 Engineering & Technology 2021. Stibnite Gold Project Feasibility Study Technical Report effective January 27, 2021.

Midas Gold 2016 Stibnite Gold Project, Valley County, Idaho. Plan of Restoration and Operations. September 2016.

Midas Gold 2020. Preliminary ModPRO2 December 2020.

Nazari, et al. 2017. Review of arsenic metallurgy: Treatment of arsenical minerals and the immobilization of arsenic. Hydrometallurgy 174 (2017) 258–281.

Perpetua 2021. Stibnite Gold Project: Refined Proposed Action ModPRO2. October 2021.

SRK Consulting 2017. Stibnite Gold Project Baseline Geochemical Characterization Report, Stibnite Project, Midas Gold, Inc. May 2017

TIFO, von Lindern. 2020. Review Comments of Draft Environmental Impact Statement (DEIS) Number 20200165. Stibnite Gold Project. Submitted to US. Forest Service October 2020.

USEPA 2022 , AP-42 Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. Chapter 13: Miscellaneous Sources, AP 42, Fifth Edition, Volume I | Clearinghouse for Emission Inventories and Emissions Factors | Technology Transfer Network | US EPA. Section 13.2.2.1 Unpaved Roads.

Table SD1 Support Calculations for COC Production Material Balance					
Table SD1a Pit-specific COC Concentrations					
Data Source	**SRK_2017_SGP Baseline Geochemical Characterization Report.pdf**				
Table 3-1. Statistical Summary of Key Multi-Element Results from the Exploration Database					
Location		**Statistic**			
Constituent			Arsenic (ppm)	Mercury (ppm)	Antimony (ppm)
Average crustal abundance			1.8	0.08	0.2
Yellow Pine					
Development Rock	(n=19,268)				
		P5	7	0.11	5
		Average	1,300	0.48	62
		P50	650	0.35	18
		P95	4,600	1.2	76
Ore	(n=4,889)				
		P5	570	0.2	16
		Average	4,200	1.2	1,600
		P50	3,500	0.64	45
		P95	10,000	3.3	7,800
Hangar Flats					
Development Rock	(n=12,147)				
		P5	7	0.1	5
		Average	1,200	1.6	260
		P50	470	0.9	21
		P95	5,200	5.3	110
Ore	(n=3,594)				
		P5	840	0.1	31
		Average	5,400	4.4	3,900
		P50	4,900	3.4	2,110
		P95	12,000	11	20,000
West End					
Development Rock	(n=4,853)	P5	10	0.1	5
		Average	340	0.9	84
		P50	140	0.5	20
		P95	1,400	3.3	150
Ore	(n=1,236)				
		P5	310	0.2	15
		Average	2,500	1.8	130
		P50	1,600	0.9	52
		P95	7,800	6.3	370
Spent Ore	Table 3.28				
		P5	990	1.4	92
		Average	1600	2.4	160
		P50			
		P95	2600	3.8	280
Bradley Dumps	Table 3.39				
		P5	545	0.65	426
		Average	1614	0.8	1474
		P50			
		P95	3440	2.17	16380
Bradley Tailings	Table 3.42				
		P5	769	0.62	637
		Average	1296	0.96	1573
		P50			
		P95	2082	1.26	2720
Historic Waste Overburden					
		P5	545	0.62	92
		Average	1296	0.8	160
		P50			
		P95	2082	1.26	280

P5 = 5th percentile; P50 = 50th percentile; P95 = 95th percentile; Source: SRK, Lith Representivity Analysis 200900.060 ld Rev06; ** anomaly or error in SRK 2017, Table 3.1

Table SD1 Support Calculations for COC Production DEIS Material Balance									
Table SD1b DEIS COC Production by Pit									
	Source:	M3_2019_SGP Prefeasibility Study Technical Report							
		SRK_2017_SGP Baseline Geochemical Characterization Report							
Location		**Statistic**	**Production ktons**	**Arsenic tons**	**%**	**Mercury tons**	**%**	**Antimony tons**	**%**
Yellow Pine			Yrs 2-7						
Development Rock	(n=19,268)		124,304						
		P5		870		14		622	
		Average		161595	51%	60	18%	7707	18%
		P50		80798		44		2237	
		P95		571798		149		9447	
Ore	(n=4,889)		43985						
		P5		25071		9		704	
		Average		184737	43%	53	21%	70376	32%
		P50		153948		28		1979	
		P95	SR 2.8	439850		145		343083	
Hangar Flats			Yrs 6-10						
Development Rock	(n=12,147)		86696						
		P5		607		10		433	
		Average		104035	33%	139	43%	22541	54%
		P50		40747		79		1821	
		P95		450819		459		9537	
Ore	(n=3,594)		35650						
		P5		29946		4		1105	
		Average		192510	45%	157	62%	139035	64%
		P50		174685		121		75222	
		P95	SR 2.4	427800		392		713000	
West End			Yrs 6-12						
Development Rock	(n=4,853)	P5	129995	1300		13		650	
		Average		44198	14%	121	37%	10920	26%
		P50		18199		65		2600	
		P95		181993		429		19499	
Ore	(n=1,236)		15430						
		P5		4783		3		231	
		Average		38575	9%	28	11%	2006	1%
		P50		24688		14		802	
		P95	SR 8.4	120354		97		5709	
Spent Ore	Table 3.28		5915						
		P5		5856		8		544	
		Average		9464		14		946	
		P50							
		P95		15379		22		1656	
Bradley Dumps	Table 3.39		1501						
		P5		862		1		674	
		Average		2553		1		2332	
		P50		0		0		0	
		P95		5442		3		25913	
Bradley Tailings	Table 3.42		1501						
		P5		6718		1		1008	
		Average		2050		2		2488	
		P50		0		0		0	
		P95		3294		2		4303	
Hist. Tails TOTAL			8916						
		P5		13436		10		2226	
		Average		14068	3%	17	7%	5518	3%
		P50		0					
		P95		24115		28		30316	
Historic Waste Overburden			5915						
		P5		3224		4		544	
		Average		7666	2%	5	1%	946	2%
		P50							
		P95		12315		7		1656	

Table SD1 Support Calculations for COC Production Supplemental SDEIS Material Balance

Table SD1c SDEIS COC Production by Pit

Source:		M3 2021.Stibnite Gold Project FEASIBILITY STUDY TECHNICAL REPORT SRK_2017_SGP Baseline Geochemical Characterization Report								
Location		**Statistic**	**Prod. ktons**	**Arsenic tons**	**%**	**Mercury tons**	**%**	**Antimony tons**	**%**	**% DEIS COC**
Yellow Pine			Yrs 2-7							
Development Rock	(n=19,268)		110,000							
		P5		770		12				
		Average		143000	63%	53	23%	6820	26%	88%
		P50		71500		39				
		P95		506000		132				
Ore	(n=4,889)		52,742							
		P5		30063		11				
		Average		221516	54%	63	30%	84387	64%	120%
		P50		184597		34				
		P95	SR 2.1	527420		174				
Hangar Flats			Yrs 6-10							
Development Rock	(n=12,147)		22,000							
		P5		154		3				
		Average		26400	12%	35	15%	5720	22%	25%
		P50		10340		20				
		P95		114400		117				
Ore	(n=3,594)		9,111							
		P5		7653		1				
		Average		49199	12%	40	19%	35533	27%	26%
		P50		44644		31				
		P95	SR 2.4	109332		100				
West End			Yrs 6-12							
Development Rock	(n=4,853)	P5	148,000	1480		15				
		Average		50320	22%	138	60%	12432	48%	114%
		P50		20720		74				
		P95		207200		488				
Ore	(n=1,236)		50,212							
		P5		15566		9				
		Average		125530	31%	90	43%	6528	5%	325%
		P50		80339		45				
		P95	SR 2.9	391654		316				
Spent Ore	Table 3.28		5915							
		P5		5856		8				
		Average		9464		14		946		100%
		P50								
		P95		15379		22				
Bradley Dumps	Table 3.39		1501							
		P5		862		1				
		Average		2553		1		2332		100%
		P50		0		0				
		P95		5442		3				
Bradley Tailings	Table 3.42		1501							
		P5		6718		1				
		Average		2050		2		2488		100%
		P50		0		0				
		P95		3294		2				
Hist. Tails TOTAL			**8916**							
		P5		13436		10				
		Average		14068	3%	17	8%	5767	4%	100%
		P50		0		0				
		P95		24115		28				
Historic Waste Overburden			**5915**							
		P5		3224		4				
		Average		7666	3%	5	2%	946	4%	100%
		P50								
		P95		12315		7				

Table SD2 Contaminants of Concern (COC) Pit Production for DEIS and SDEIS

DEIS	SDEIS	Statistic	DEIS			SDEIS		
Production	Production		As	Hg	Sb	As	Hg	Sb
ktons	ktons		tons	tons	tons	tons	tons	tons
DR Total		**P5**	2,777	37	1,705	2,404	30	1,400
340,995	**280,000**	**Average**	309,829	319	41,167	219,720	226	24,972
		P50	139,744	187	6,658	102,560	133	5,402
		P95	1,204,611	1,038	38,483	827,600	737	32,980
Ore Total		**P5**	59,801	16	2,040	53,282	-	1,879
95,065	**112,065**	**Average**	415,822	237	211,417	396,246	194	126,448
		P50	353,321	163	78,003	309,580	110	24,209
		P95	988,004	635	1,061,792	1,028,406	591	612,186
Total Mined		**P5**	62,578	53	3,745	55,686	30	3,279
436,060	**392,065**	**Average**	725,651	557	252,584	615,966	419	151,420
		P50	493,065	351	84,661	412,140	242	29,611
		P95	2,192,615	1,672	1,100,275	1,856,006	1,328	645,166
Gold Produced (oz)			**Lbs COC/oz Gold**					
4,040,000	**4,238,000**	**Average**	359	0.28	125	291	0.20	71
		P95	1085	0.83	545	876	0.63	304

Tabl4e SD3 SDEIS Total Contaminants of Concern (COCs) Production and Disposal By Source (tons)									
	Arsenic			**Mercury**			**Antimony**		
	Average	**95th%tile**	**%of Total**	**Average**	**95th%tile**	**%of Total**	**Average**	**95th%tile**	**%of Total**
Total COC Disturbed	637,699	1,892,435		441	1363		158133	678695	
Source									
Pit Ore	396,246	1,028,406	62%	194	591	44%	126,448	612,186	80%
Hist Tails	14,068	24,115	2%	17	28	4%	5,767	31,872	4%
DR	219,720	827,600	34%	226	737	51%	24,972	32,980	16%
Hist Overburden	7,666	12,315	1%	5	7	1%	946	1,656	1%
DR and Waste Disposition									
TSF Embankment3	49,538	182,981	8%	50	162	11%	5,647	7,546	4%
TSF Buttress1	65,779	242,975	10%	67	215	15%	7,498	10,020	5%
Midnight Backfill	5,685	20,998	1%	6	19	1%	648	866	0%
Yellow Pine Backfill	91,766	338,966	14%	93	300	21%	10,460	13,978	7%
Hangar Flats Backfill1	14,618	53,995	2%	15	48	3%	1,666	2,227	1%
Subtotal COC	227,386	839,915	36%	230	744	52%	25,918	34,636	16%
Mineral Process Waste									
Flotation Tails to TSF	61,547	157,878	10%				74,544		47%
POX/CN/DeTox Tails to TSF	348,766	894,642	55%						
Subtotal	410,313	1,052,520	64%						
Total COC Disposal	637,699	1,892,435	100%				100,642		64%
Antimony Product							57,671		36%
DR Mean Concentration (mg/kg)	812	3000		.82	2.66		93	124	

Table SD4 Mining Fugitive Dust Sources Particulate Matter (PM) Emissions					
* Adapted from Appendix A p 41 of 99 SGP Air Quality Specialist Report					
		SDEIS(1)		Maximum	TRACT
Activity	Description	PM tons/yr	% of Total	PM tons/yr	
O/DR(1)	Open Pit Drilling	1.97	0.2%	284.7	61.71
O/DR(1)	Open Pit Blasting	14.08	1.3%	117.4	117.4
O/DR(1)	Material Load / Unload	4.62	0.4%	8.06	
O/DR(1)	Dozing	39.92	3.8%	103.6	27.8
O/DR(1)	Wind Erosion	2.78	0.3%	0.02	
O/DR(1)	Surface Exploration	1.31	0.1%	1.12	
HR(4)	Onsite Hauling	819.13	78.5%	2901.3	2322.0
HR(4)	Grading	21.33	2.0%	36.8	
HR(4)	Water Truck Travel	21.24	2.0%	109.3	
AR(2)	Access Roads	113.18	10.8%	6.95	6.95
	Mobile Tailpipes	4.3	0.4%		
	Total	1043.9	100.00%	3569.1	2535.8
% CAPACITY		29%		100%	75%
O/DR(1)	Ore/DevRock	65	6%	515	207
HR(4)	Haul Roads	862	83%	3047	2322
AR(2)	Access Roads	117	11%	7	7
Material Mined (ktons)		392,065		1,340,524	952,429
Potential As Production (tons)					
	Average	615,966		2,106,072	1,496,343
	95th %tile	1,856,006		6,345,938	4,508,726
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Table SD5. Comparison of SDEIS and DEIS Antimony Ore and Concentrates Production by Source

			DEIS			SDEIS		
			YPP	**HFP**	**Hist**	**YPP**	**HFP**	**Hist**
DEIS	**SDEIS**	**SDEIS/DEIS**						
Antimony Ores (tons)		**Ore**	70,376	139,035	5,518	84,387	35,533	5,518
214,929	**125,439**	**58%**				120%	26%	100%
Concentrates (klbs)								
98,852	**115,000**	**Rec. klbs**	69,822	30,030	2,454	92,065	20,822	2,454
SDEIS/DEIS		**116%**				132%	69%	100%

Table SD6 Pit Mined Material Weighted Arsenic Concentration (ppm)

	Total Material Mined			DEIS COCs Mined			SDEIS COCs Mined		
Pit	**DEIS**	**SDEIS**		**As**	**Hg**	**Sb**	**As**	**Hg**	**Sb**
	ktons	**Ktons**		**tons**	**tons**	**tons**	**tons**	**tons**	**tons**
YPP	168,289	162,742	**Average**	346,332	112	78,083	364,516	116	91,207
			P95	1,011,648	294	352,530	1,033,420	306	419,748
HFP	86,696	22,000	**Average**	296,545	296	161,576	75,599	75	41,253
			P95	878,619	852	722,537	223,732	217	184,640
WEP	145,425	198,212	**Average**	82,773	149	12,925	175,850	228	6,528
			P95	302,347	526	25,208	598,854	805	18,578
				Concentration					
Pit				**As**	**Hg**	**Sb**	**As**	**Hg**	**Sb**
				ppm	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
YPP			**Average**	2,058	0.7	464	2,240	0.7	560
			P95	6,011	1.7	2,095	6,350	1.9	2,579
HFP			**Average**	3,421	3.4	1,864	3,436	3.4	1,875
			P95	10,134	9.8	8,334	10,170	9.9	8,393
WEP			**Average**	569	1.0	89	887	1.2	33
			P95	2,079	3.6	173	3,021	4.1	94

Table SD7 SDEIS Mining Fugitive Dust Emissions Corrected for Pi-Specific Arsenic Concentrations *								
SDEIS Emission Calculation	* Adapted from Appendix A p 73 of 99 SGP Air Quality Specialist Report							
Ore, Waste, and Limestone Dust HAP Concentrations (1) and Emissions								
	O/DR(1)	AR(2)	CR(3)	O/DR	AR	HR(4)	Emissions	
Pollutant	ppm	ppm	ppm	ton/yr	ton/yr	ton/yr	ton/yr	
Arsenic	667	2.5	90	0.043	2.80E-04	0.331	0.374	
Mercury	0.6	0.009	0.07	3.90E-05	1.00E-06	2.90E-04	3.30E-04	
Antimony	23	3.75	6	1.50E-03	4.20E-04	0.013	0.015	
Emission Calculation Corrected for Pi-specific Arsenic Concentrations								
Ore, Waste, and Limestone Dust Arsenic Concentrations (1) and Emissions								
	O/DR(1)	AR(2)	CR(3)	O/DR	AR	HR(4)	Emissions	Adjustment
Pollutant	ppm	ppm	ppm	ton/yr	ton/yr	ton/yr	ton/yr	Factor
WEP Perpetua	667	2.5	90	0.043	0.00028	0.331	0.374	
WEP Adj	887	2.5	90	0.057	0.000	0.428	0.485	1.3
YPP Perpetua	667	2.5	90	0.038	0.000	0.288	0.326	
YPP Adj	2240	2.5	90	0.126	0.00025	0.890	1.016	3.1
HFP Perpetua	667	2.5	90	0.031	0.00020	0.237	0.268	
HFP Adj	3436	2.5	90	0.193	0.00025	1.347	1.541	5.7
(1) O/DR: ore and development rock; Perpetua (Midas Gold 2017c); Corrected for Pit-Specific Concentrations								
(2) AR: Burntlog access route roadbed material analyses - 1/2 detection limit used for non-detect analyses (ALS 2018)								
(3) CR: clean rock - used to cap haul roads outside of the pits and DRSFs - 1/2 detection limit used (Perpetua 2021g)								
(4) HR: haul road - emissions calculated based on 49% of the total VMT occurring on CR for LOM Year 10								

Table SD8 Summary of Roadbed Silt Content In Cited USEPA AP-42 Guidance

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE

AP-42	MATERIAL ON INDUSTRIAL UNPAVED ROADS		
		All Gravel Road	Haul Roads
	Industry Types	18	4
	No. Sites	53	10
	No. Samples	272	58
	Minimum	4.3%	5.8%
	Maximum	24.0%	24.0%
	Average	10.1%	11.6%
	Median	8.4%	8.4%
	Geomean	8.8%	9.9%

Table SD9 Summary of USEPA AP-42 Emissions Calculation using Alternate Roadbed Silt Content

Emissions by Area				PM_TPY	PM10_PPD	PM10_TPY	PM2.5_PPD	PM2.5_TPY		
				PM	PM10		PM2.5		Control Used	
Area ID	Activity			ton/yr	lb/day	ton/yr	lb/day	ton/yr	Annual	Daily
HR	Onsite Hauling			2,901.30	3,899.40	712.9	389.9	71.3	90.00%	93.30%
CONTROLLED		4	% silt	2,901.30	3,899.40	712.9	389.9	71.3		
		8	% silt	4,713.10	7,276.50	1,330.40	727.7	133		
		24	% silt	10,169.40	19,558.40	3,576.00	1,955.80	357.6		
Increase from 4%		8	% silt	**162%**	187%	187%	187%	187%		
		24	% silt	**351%**	502%	502%	502%	502%		
UNCONTROLLED		4	% silt	29013	58200	7129	5820	713		
		8	% silt	47131	108605	13304	10860	1330		
		24	% silt	101694	291916	35760	29192	3576		
Compliance Point									Control Req.	
Controlled		4	% silt		3,899					93.3%
Uncontrolled					58200					
Controlled		8	% silt		3,899					**96.4%**
Uncontrolled					108605					
Controlled		24	% silt		3,899					**98.7%**
Uncontrolled					291916					

Table SD10 Pit-Specific Emission Correction Factors for Arsenic Content, Silt and % Particulate Control												
Scenario[1,2]	8% Silt 90% Control			8% Silt 80% Control			24% Silt 90% Control			24% Silt 80% Control		
Pit	**YPP**	**HFP**	**WEP**	**YPP**	**HFP**	**WEP**	**YPP**	**HFP**	**WEP**	**YPP**	**HFP**	**WEP**
As Content	3.1	5.7	1.3	3.1	5.7	1.3	3.1	5.7	1.3	3.1	5.7	1.3
Silt Content[3]	1.6	1.6	1.6	1.6	1.6	1.6	3.5	3.5	3.5	3.5	3.5	3.5
% Particulate Control [4]	1.5	1.5	1.5	3	3	3	1.5	1.5	1.5	3	3	3
Combined[5]	7.5	14	3.1	15	28	6.2	16	30	6.8	33	60	14

[1] Forest Service Analysis uses 4% silt content, 93.3% Control and 667ppm Roadbed As content

[2] All Correction Scenarios adjust for Pit Specific Roadbed As content from Table 7

[3] Silt Content for Scenarios #1 and #3 is 8% silt and for Scenarios #2 and 4 is 24% silt

[4] % Particulate Control for Scenarios #1 and #3 is 90% and for Scenarios #2 and #4 is 80%

[5] Combined is the product of the As Content, Silt Content and % Part. Control Correction Factors

Table SD11 DEIS Development Rock and Overburden COC Disposal by Repository						
DEIS Waste Rock COC Disposal Summary		**Arsenic**		**Mercury**		**Antimony**
		tons		tons		tons
Total Excavated	average	317,495		324		42,114
	95th%tile	1,216,926		1,045		40,139
Disposition						
Tailings Embankment	average	55,603		57		7,375
	95th%tile	213,121		183		7,030
Main WRSF	average	136,840		140		18,151
	95th%tile	524,495		450		17,300
West End WRSF	average	23,050		24		3,057
	95th%tile	88,349		76		2,914
YP Backfill	average	102,001		104		13,530
	95th%tile	390,960		336		12,895
*error in SRK 2017 95th %tile Sb estimate						