Project Title: Perpetua - Demonstration of an Idaho Based Antimony Trisulfide Domestic Supply Chain R2

Project Description and Purpose:

Revision 2:

The proposed project is a collaborative effort between Idaho National Laboratory (INL) and Perpetua Resources, a private industry partner, to conduct Verification & Validation (V&V) of Perpetua's pilot plant design for processing critical minerals. The project will test the plant's ability to produce antimony trisulfide concentrate and pyrite concentrate, two economically valuable materials, from Stibnite ore provided by Perpetua. This effort supports the U.S. goal of establishing a stable domestic supply chain for energy- and defense-critical materials.

This revision covers the final siting location for this project, as shown below in Map 1.

Map 1: Revision 2 Perpetua Siting Location Northwest of IF-663.

In addition to the siting location change, this revision also includes the following information:

- A dust mitigation system comes as a prefabricated component of the pilot plant and attaches to the first container where most dust is likely to occur. The system collects dust created in the container and reintroduces it into the process to prevent wasting of critical materials contained in the ore.
- No major dirt work will occur at the siting location, only minor leveling adjustments.
    - Above the dirt layer a plastic, heavy duty pond liner will be placed to prevent any material being left behind after the 6-month run. Above the pond liner, a geo texture mat will be placed to mitigate the effects of heavy rain on the plant. Underneath each container with wet processes (two total), a spill berm will be placed to act as secondary containment. These containers come with drain and sump systems to act as primary containment.
- All chemicals involved in the process fall below Acute Toxic Unit (TUA) thresholds.

The disposal of process byproducts will be handled by Perpetua per our SPP. BEA will not discard any byproducts as they may still be of some economic value to Perpetua. This includes concentrates, gangue, process water, waste water, etc. All of this will be shipped back to Perpetua in bi-weekly container shipments.

Revision 1:

The proposed project is a collaborative effort between Idaho National Laboratory (INL) and Perpetua Resources, a private industry partner, to conduct Verification & Validation (V&V) of Perpetua's pilot plant design for processing critical minerals. The project will test the plant's ability to produce antimony trisulfide concentrate and pyrite concentrate, two economically valuable materials, from Stibnite ore provided by Perpetua. This effort supports the U.S. goal of establishing a stable domestic supply chain for energy- and defense-critical materials.

The pilot plant, designed by Perpetua and WestPro Equipment, will be operated at INL's Idaho Research Center (IRC) under a temporary tent structure on a newly constructed gravel pad. INL will receive and install equipment provided by Perpetua, process the supplied material, and gather data on process efficiency and economic viability. These activities align with INL's Critical Minerals and Materials Initiative, which aims to advance technologies for domestic material sourcing and manufacturing.

This project is essential for ensuring the United States has access to critical materials while minimizing reliance on foreign sources. Antimony, one of the materials being processed, is vital for energy storage, electronics, and defense applications.

Finalized Location: The project will take place at the Idaho Research Center (IRC), west of IF-603, located within INL boundaries. Site Map 1, Site Map 2, and Figure 1 displays the screenshot of the placement highlighted in red. A new gravel pad, approximately 0.66 acres in size, will be installed to accommodate the pilot plant equipment, which will be housed under a temporary tent structure. The location has been selected to ensure safe and efficient operations while minimizing environmental impacts.

Site Map 1:

Site Map 2:

Figure 1:

Ground motion and acoustic monitoring:

Seismic and acoustic instruments will be installed at one distance from the proposed site location. These instruments will be used to measure induced ground motions and acoustic waves as part of plant operations. Both instruments are passive instruments and will collect data before, during and after the duration of the project. This data will be used to ensure the environmental impact of the plant is within specifications.

The seismic instrument to be installed will be the Kinemetrics Omni sensor. It will be installed directly into the ground and will require a hole dug 6 inches in diameter and 18 inches deep. The instrument will then be buried, and a cable will connect to the above ground digitizer. The digitizer, power supply and communication equipment will be housed next to the hole in a Knack Box. The box will protect the equipment from the elements and be locked to provide physical security for the equipment. The acoustic instruments will also be installed above ground and the sensors, digitizer and power supply will all be housed in a break out box.

This equipment will be installed before initial construction begins to establish background levels. It will remain in place for the duration of the project and will be removed during the decommission and remove stage of the project. The one location for the installation of the instruments can be found in the figure 2 below.

Figure 2:

Tasks:

The project involves the following key tasks:

- Site Preparation (INL Responsibilities):
  - Install a gravel pad on IRC grounds (~0.66 acres).
  - Set up a tent structure to house the pilot plant equipment.
  - Stage four CONEX containers and associated equipment in the designated area.
- Equipment Setup (Perpetua Responsibilities):
  - Supply pilot plant equipment, including crushing and processing units, generators, and other necessary tools.
  - Equip the crusher and processing units with dust suppression systems (e.g., active air ventilation and water spray).
- Operations (Joint INL and Perpetua Effort):
  - Process up to 1 metric ton of ore per day for six months.
  - Utilize equipment such as diesel generators, skid steers, telehandlers, and mobile light towers.
  - Conduct V&V of the pilot plant design by testing process efficiency, chemical performance, and other parameters.
  - Ensure emissions, including those from diesel-powered equipment, comply with regulatory requirements. An Air Pollutant Analysis Document (APAD) will be generated to track emissions.
  - Process water: Up to 3,400 kg. Recycle process water and will be returned to Perpetua.

Waste Generation:

- Industrial Waste: Incidental PPE and wipes (non-hazardous materials only) estimated at <150 lbs.
- Hazardous Waste: Potential chemical waste, estimated at <300 lbs. dry solids and <55 gallons liquids.
- PPE and Wipes: Non-hazardous PPE and wipes disposed of in non-hazardous trash.

All waste will be managed in accordance with INL's waste management procedures and applicable federal and state regulations.

Air Emissions:

The following measures will be implemented to ensure safe and compliant operations:

- Dust suppression systems (active air ventilation and water spray) will minimize airborne particulate emissions.
- Diesel-powered equipment will operate within regulatory limits, with emissions will be evaluated via an Air Permit Applicability Determination (APAD).

Note: This NEPA analysis remains valid assuming the antimony and pyrite process streams, processed ore material, and process water are shipped back to Perpetua as outlined in the original ECP scope.

Original ECP:

The Department of Defense (DoD) has initiated this project to establish a domestic supply chain for antimony trisulfide, which is crucial for defense applications. Advanced Technology International (ATI), managing the Defense Ordnance Technology Consortium (DOTC), issued a request for proposal to Perpetua Resources Idaho, Inc. (Perpetua Resources) to include the shipment, assembly, commissioning, and operation of a flexible, modular pilot plant. This pilot plant would validate the technology and ability to produce streams of concentrate such as antimony

trisulfide for antimony sulfide and pyrite concentrate that contains gold from stibnite ore. Stibnite ore is sourced domestically through Perpetua

Resources Idaho, Inc. Stibnite ore is the primary source of antimony trisulfide, a sulfide mineral containing a significant amount of antimony. Establishing a domestic supply chain for antimony trisulfide is important for national security. Additionally, a secondary pyrite concentrate stream containing gold for Department of Energy (DOE) National Laboratory partnership in supporting United States industry to establish stable domestic supplies of critical materials. This Idaho National Laboratory (INL) project will collaborate with Perpetua Resources (lead organization) to verify and validate the pilot plant and the technology to generate a pyrite concentrate and an antimony sulfide concentrate. The pilot plant consists of rock crushing/comminution equipment, a froth flotation circuit, and associated infrastructure such as Conex containers to process stibnite ore and produce concentrates of interest. There are no known radioactive components in the ore. Location: The project will require 0.5 - 1 acre of land to place the Conex containers that will hold the pilot plant operations. The project will find an existing pad/site that requires no disturbance of soil or vegetation. Potential locations within the INL site for the project include:

- Figure 1: CF-664 Storage Building.
- Figure 2: Location west of IF-663.
- Figure 3: Location north of IF-603 (IRC).
- Figure 4: IF-685 or Energy Systems Laboratory (ESL) Backyard

Figure 1. CF-664 Storage Building

Figure 2. Location west of IF-663

Figure 3. Location north of IF-603

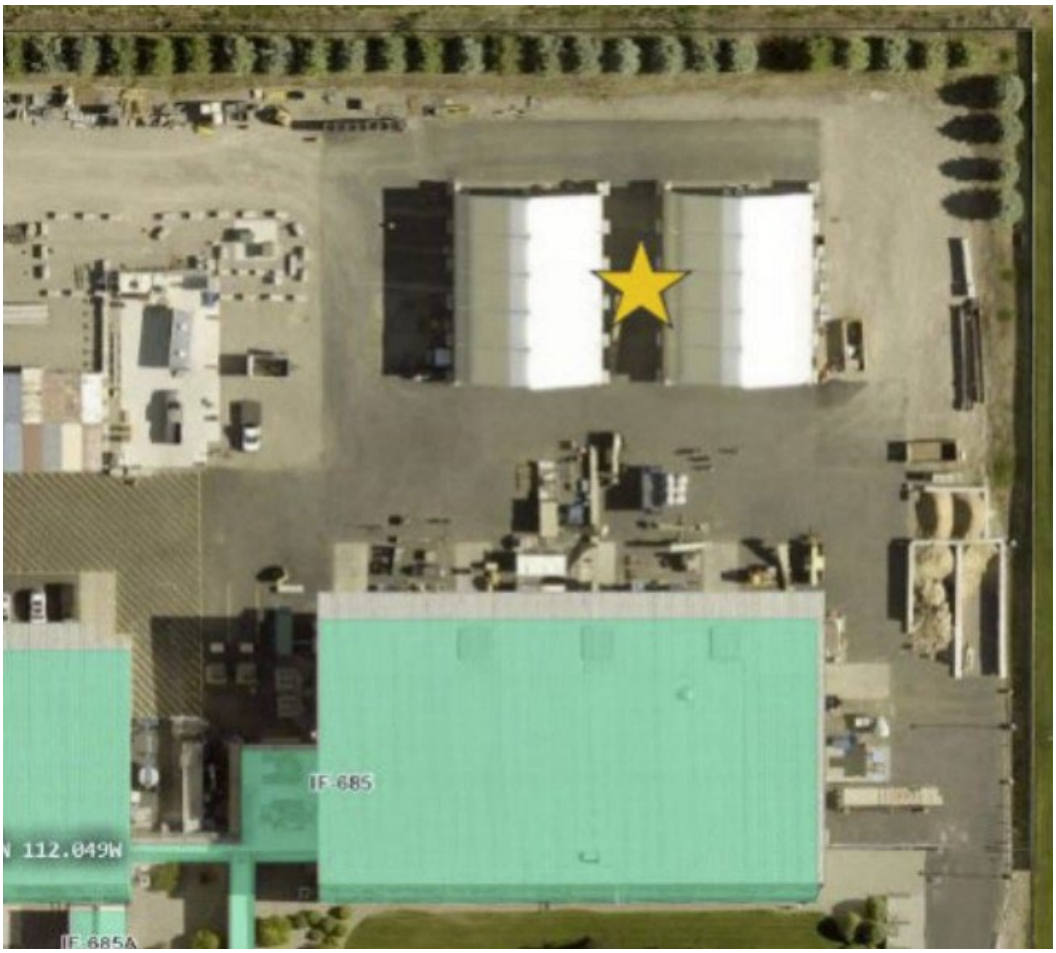

Figure 4. IF-685 Backyard

The final location will be determined based on project requirements and site suitability. Equipment Purchases: INL will purchase one 10-yard container and sufficient supersacks and containers to package all byproducts for shipment back to Perpetua Resources. A fabric tent structure may also be purchase depending on the final location. A diesel generator will be rented for power.

Project Tasks:

Task 1. INL Perform Site Preparation and Permitting

- Obtain and maintain all necessary permits (local, state, federal) for on-site work.
- Rearrange existing equipment to create space for the pilot plant and ancillary equipment at the chosen site.
- IF ESL is selected for location, INL will use the existing asphalt pad and shelter at the ESL site for winter operations. If ESL is not a viable location, INL will perform at the CFA site locations and operate with a fabric structure for winter.
- Power will be supplied via a diesel-powered generator. Task 2. Prototype Pilot Plant Assembly and Commissioning
- INL will receive purchased CONEX containers and rent heavy equipment and a diesel-powered generator.
- INL staff and subcontracted services will be responsible for unloading both the components of the pilot plant and the raw stibnite ore that will be processed in the modular plant.
- INL will receive 110-120 cubic yards of stibnite ore solids from Perpetua Resources in the form of drill cores to be comminuted (ground and processed) in the pilot plant (grinded). Drill cores are intact, cylindrical solids that result from drilling into an ore body. The assay data from the drill cores determined that there were no Uranium (U) and Thorium (Th) reported.
- INL will not receive Mine tailings or any Resource Conservation Recovery Act (RCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) materials for the project.
- INL will commission the modular pilot plant to produce four concentrate byproduct streams from Stibnite ore:
    - Antimony-rich stream that contains 90-95% antimony sulfide for Perpetua Resources to further process via liquation to produce antimony sulfide product for DOD United States Army. The process stream will be shipped back to Perpetua.

- Pyrite stream containing the pyrite fraction which includes the critical material gold. This stream will be shipped back to Perpetua Resources.
- Processed ore material (gangue) will be filter pressed, stored in supersacks or other suitable containers and shipped back to Perpetua.
- Process water which will be captured and shipped back to Perpetua.

The Stibnite Ore bench composite analysis is shown in Figure 6 below. There was no reported mercury. Soluble arsenic was present but it is tied up in the crystalline structure of the ore. Further process materials include the following:

- Lime (25 kg)
- Sodium Cyanide (20 kg)
- Methyl Isobutyl Carbinol (MIBC) (5 kg)
- Copper Sulfate (30 kg)
- Potassium Amyl Xanthate (PAX) (20 kg)

Figure 6. Pilot Composite Head Assays of Stibnite Ore.

13183 Bench Composite Head Analysis

HRI	Sample ID	Analysis								
		Sb		Fe	Pb	S	As	Au		
		%						mg/kg		
56238-1	Pilot Composite	2.8	2.7	1.28	<0.005	2.05	0.164	2.67	2.69	2.69

Note: Au assayed in triplicate, Sb duplicate

Task 3. Prototype Pilot Plant Validation

- INL will perform continuous runs to concentrate, analyze samples using X-ray Fluorescence (XRF), and process the ore. The modular pilot plant will use chemicals (e.g., sodium hydroxide, frothing agent, sodium cyanide at ~2 mM to 200 mM concentrations, etc.). Primary chemical containers will be stored in secondary containment. Reagents will be pumped from primary containers to the modular pilot-plant using in-line chemical pumps integral to the modular pilot-plant.
- INL will manage byproduct streams and process water according to regulations.
- Most byproducts/samples will be shipped to Perpetua Resources to study, analyze, and then be dispositioned for off-site evaluation.

INL will use the rest of the samples to be re-used in the modular pilot plant.

Task 4. Prototype Pilot Plant Decommissioning and Removal

- INL will decommission and remove the pilot plant after successful runs.

Waste Generation:

INL:

- Industrial Waste: Incidental PPE and wipes (non-hazardous materials only) estimated at <150 lbs.
- Hazardous Waste: Potential chemical waste, estimated at <300 lbs. dry solids and <55 gallons liquids.
- PPE and Wipes: Non-hazardous PPE and wipes disposed of in non-hazardous trash.
- Radioactive Waste: None anticipated.
- Other Waste: No low-level, mixed, or TRU waste expected.

Emissions:

- The project will emit exhaust from the diesel-powered generator and heavy equipment (skid steer and telehandler). The diesel-powered generator will operate for 6 months, 5 days a week and 24 hours.
- The rock comminution will operate daily with 1 ton/24 hours. The stibnite ore will be ground to approximately 50 microns on average in the crusher unit. WestPro Mining providing the Conex containers will need to include dust suppression technology for dust emissions. The process of dust mitigation is unknown currently.

Power/Energy Usage:

- For power, using the diesel generator is preferred to avoid complications with the Idaho Fall's, ID city's North Loop energy usage that is maxed-out and the challenges of extending power to ESL. If another location is chosen at the INL site, power needs will be sourced to CONEX containers or the generator will be utilized.
- For water, poly tanks will store water with a projected usage of 10 GPD, sufficient for a few weeks before refilling via a water tender. The plan is to recycle process water using a catch tank and solids settler. If recycling is not feasible, 1,500 to 1,800 gallons of water will be captured and returned to Perpetua.

Discharge of Water:

- Once the ore is ground, it is mixed with water and chemicals to create a 35% slurry. During the froth flotation process, chemicals cause certain minerals to float to the top as "soap suds," which are then collected. The leftover ore, called gangue, and the concentrated minerals are dewatered using a filter press. The water used in the process is recycled, but some is lost to evaporation and within the solids. After the final processing, the remaining water and solids are collected, with the water being containerized and stabilized for shipment back to Perpetua. There will be no discharges at ESL as plant solids/liquids will be captured, and staff will use existing ESL facilities. If project is operated at the INL site locations, staff trailers will necessitate addressing sanitary sewage and infrastructure.

INL waste will be managed by Waste Generator Services in accordance with laboratory procedures

Perpetua Resources:

- No waste expected besides shipping waste.

Activities at Perpetua Resources are performed according to the facilities compliance management and environmental protection requirements (https://perpetuaresources.com/wp-content/uploads/ESG-Policy.pdf). All off-site partners will comply with their local procedures and state/federal regulations as identified in contract agreements.

Environmental Aspects or Potential Sources of Impact:

Air Emissions

The project is expected to have fugitive emissions, emissions from crushing ore material, and emissions from equipment operations (generators). An APAD is required prior to the start of the project.

Discharging to Surface-, Storm-, or Ground Water

NA

Disturbing Cultural or Biological Resources

There is the potential for this work to impact vegetation and for project personnel to interact with various wildlife species. A Biological Resource Review will be arranged within two weeks prior to the initiation of any activities that might disturb soil or vegetation and again following completion of project activities. A nesting bird survey is included with the Biological Resource Review for actions occurring between April 1 - October 1 per compliance with the Migratory Bird Treaty Act. Bat surveys are also included with the Biological Resource Review in accordance with the INL Bat Protection Plan.

CULTURAL: Pursuant to 2023 Programmatic Agreement, this federal undertaking is excluded from project-specific Section 106 consultation. The proposed activity results in no historic properties affected. Please see Hold Points and Project Specific Instructions.

Generating and Managing Waste

When wastes are generated, how they are disposed can adversely affect the environment. Managing wastes appropriately and responsibly and implementing recycling or reuse practices, where feasible, during project activities can reduce the potential impact on the environment.

Incidental PPE and wipes (non-hazardous materials only) estimated at <150 lbs.

Potential chemical waste, estimated at <300 lbs. dry solids and <55 gallons liquids. PPE and Wipes: Non-hazardous PPE and wipes disposed of in non-hazardous trash.

Releasing Contaminants

When chemicals are used during the project there is the potential for spills that could impact the environment (air, water, soil).

Using, Reusing, and Conserving Natural Resources

Project description indicates materials will need to be purchased or used that require sourcing materials from the environment. Being conscientious about the types of materials used could reduce the impact to our natural resources.

Determination:

References: B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

Justification:

B3.6 Small-scale research and development, laboratory operations, and pilot projects. Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

The proposal fits within the classes of actions listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE's NEPA Implementing Procedures and satisfies the conditions that are integral elements of the classes of actions therein. The proposal does not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Appendix B.

There is no extraordinary circumstance related to the proposal that is likely to cause a reasonably foreseeable significant adverse effect or for which DOE does not know the environmental effect. Extraordinary circumstances are unique situations presented by specific proposals, including, but not limited to, scientific controversy about the environmental effects of the proposal; uncertain effects or effects involving unique or unknown risks; and unresolved conflicts concerning alternative uses of available resources.

The proposal has not been segmented to meet the definition of a categorical exclusion. Segmentation can occur when a proposal is broken down into small parts in order to avoid the appearance of significance of the total action. However, segmentation does not include proposals that are developed and potentially implemented over multiple phases where each phase results in a decision whether to proceed to the subsequent phase.

Based on my review of the proposed action, I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

Approved by Robert Douglas Herzog, DOE-ID NEPA Compliance Officer on: 4/14/2026