GIANT MINE
Oversight Board

Box 1602 . 5014-50th Avenue . Yellowknife, NT X1A 2P2
Phone 867.675.0788 . **Fax** 867.675.0789 . **Web** www.gmob.ca

Giant Mine Oversight Board Research Program

TERRE-NET 2019-2020 (Year 1) Summary Report

2020 06 08

Year 1 Progress Report
Remediation Strategies for the Long-term Management of Arsenic-trioxide-bearing Roaster Wastes at the Giant Mine, Northwest Territories

This report was prepared by Toward Environmentally Responsible Resource Extraction Network (TERRE-NET) personnel to provide an update through Year 1 of the main aspects of the TERRE-NET-GMOB research project and to identify any research and budget challenges experienced to date. The research projects reviewed herein include:

Project 1: Examination of arsenic trioxide dust composition and solubility;
Project 2: Sulfidation of As_2O_3 to low-solubility arsenic sulfide (As_2S_3);
Project 3: Incorporation of As_2O_3 into cemented-paste backfill; and
Project 4: Leaching behaviour and geochemical stability of vitrified arsenical glass.

The overall goals of the four projects proposed within Phase 1 are to: provide an enhanced understanding of the physical and geochemical properties of the roaster waste; and screen for potentially viable remediation alternatives that may warrant additional research (*e.g.*, long-term laboratory experiments, pilot-scale trials).

The total combined budget of the proposed research activities within Phase 1 is $931,731 and Year 1 expenditures are briefly summarized in the report (including for the Administrative portion of the project). Phase 1 projects will provide direct stipend support for the training of six highly-qualified personnel (HQP), including two MSc students, one PhD student, two Post-doctoral Fellows (PDFs), and one undergraduate summer student. HQP will be supported by the TERRE-NET co-investigators and administrative and technical staff, and academic collaborators.

Project 1: Examination of arsenic trioxide dust composition and solubility

Investigators:
Joyce McBeth (University of Saskatchewan)
Matthew Lindsay (University of Saskatchewan)
Heather Jamieson (Queen's University)

1.1 Research update

The first study in this project focuses on geochemical and mineralogical characterization of arsenic trioxide (As_2O_3) dust samples obtained from SGS in Lakefield, ON (received ca. August 19, 2019). Jullieta Lum (PDF) has completed synchrotron-based X-ray absorption spectroscopy (XAS) and powder X-ray diffraction (PXRD) analyses. Jullieta has made progress on additional analyses including: (i) geochemical analysis via digestions, laboratory-based X-ray fluorescence, and electron microprobe analysis (EPMA); and (ii) mineralogical analysis via optical examination and scanning-electron microscopy (SEM) based automated mineralogy. Prior to the suspension of on-campus research activities, Jullieta was preparing samples for additional EPMA and SEM analyses to constrain compositional variability of As_2O_3 dust samples. Jullieta has made excellent progress on the analysis and interpretation of existing data. While working from home, Jullieta is focusing on refining XAS models and preparing an associated manuscript for publication. We anticipate the characterization study will continue for an additional six months once on-campus research resumes.

The second study examines the implications of antimony (Sb) substitution for arsenic (As) on As_2O_3 solubility. Jullieta began this study prior to receiving the SGS samples and has made good progress on this research; however, the synthesis methods proved more challenging to implement than originally anticipated. Jullieta has successfully modified an existing synthesis method that facilitates quantitative Sb for As substitution with crystallite-size control. Jullieta was able to synthesize and characterize crystallites with varied As to Sb ratios. Unfortunately, on-campus research was suspended before Jullieta was able to initiate the corresponding solubility experiments. She will initiate these experiments shortly after campus access is reinstated and these will continue for approximately six months.

1.2 Deviations from research plan

All on-campus research activities at the University of Saskatchewan were suspended effective March 24, 2020 due to the COVID-19 pandemic. Progress toward meeting project objectives within the proposed timeline was made prior to this date. Jullieta has been working on the two studies that comprise this project since June 15, 2019.

Overall, we are pleased with our research progress to date and, in particular, the quality of personnel recruited for this research. We are, however, concerned that research delays due to COVID-19 may jeopardize our ability to support personnel - particularly Jullieta, who is dependable, innovative, and driven. We are exploring ideas for additional project work that would complement the activities Jullieta has completed to date and provide additional insight on the materials if campus access remains suspended beyond June 2020. This could involve numerical modeling of Sb substitution into As_2O_3 or other activities. At this time, we expect that the laboratory access restrictions will result in a Project 1 delay of approximately 6 months.

1.3 Budget update

The total proposed budget for this research in Year 1 is $134,085, including $107,268 for direct research costs plus 25% overhead ($26,817) charged by the University of Saskatchewan (Table 1).

Table 1. Summary of budget proposed and actuals for Year 1.

	Year 1 Budget	Y1 Q1 Actuals May21-Jun30	Y1 Q2 Actuals Jul1-Sep30	Y1 Q3 Actuals Oct1-Dec31	Y1 Q4 Actuals Jan1-Mar 31	Year 1 Actuals Total
Salaries and Benefits	**$ 72,300**	**$ -**	**$ 2,292**	**$ 30,118**	**$ 11,362**	**$ 43,772**
a) PhD students	$ -	$ -	$ -	$ -	$ -	$ -
b) Master's students	$ -	$ -	$ -	$ -	$ -	$ -
c) Undergraduate students	$ 4,800	$ -	$ -	$ 2,601	$ (2,601)	$ 0
d) Postdoctoral fellows	$ 60,000	$ -	$ 2,292	$ 27,517	$ 13,963	$ 43,772
e) Technical/Professional Assistants	$ 7,500	$ -	$ -	$ -	$ -	$ -
Equipment	**$ 26,120**	**$ -**	**$ -**	**$ 810**	**$ 1,567**	**$ 2,377**
a) Purchase or rental	$ 2,400	$ -	$ -	$ -	$ 32	$ 32
b) Operation and maintenance costs	$ -	$ -	$ -	$ -	$ -	$ -
c) User Fees	$ -	$ -	$ -	$ -	$ -	$ -
d) Analytical Costs	$ 23,720	$ -	$ -	$ 810	$ 1,535	$ 2,345
Materials and Supplies	**$ 4,298**	**$ -**	**$ 573**	**$ 1,817**	**$ 615**	**$ 3,005**
a) Laboratory supplies, reagents	$ 4,298	$ -	$ 573	$ 1,817	$ 615	$ 3,005
b) Machining costs	$ -	$ -	$ -	$ -	$ -	$ -
Travel	**$ 4,550**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Conferences and Workshops	$ 2,550	$ -	$ -	$ -	$ -	$ -
b) Field Work	$ 2,000	$ -	$ -	$ -	$ -	$ -
Dissemination	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Publication costs	$ -	$ -	$ -	$ -	$ -	$ -
b) Communication costs (teleconference)	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	**$ 107,268**	**$ -**	**$ 2,865**	**$ 32,745**	**$ 13,544**	**$ 49,154**
University Overhead (25%)	**$ 26,817**	**$ -**	**$ 716**	**$ 8,186**	**$ 3,386**	**$ 12,288**
Grand Total	**$ 134,085**	**$ -**	**$ 3,581**	**$ 40,931**	**$ 16,930**	**$ 61,442**

1.4 Deviations from budget

Primary deviations from the budget include a lower level of salary and equipment disbursements due to the slightly delayed start of the project. We expect that a 6-month extension for Project 1 will be required.

Project 2: Sulfidation of As_2O_3 to form low-solubility As_2S_3

Investigator:
Tom Al (University of Ottawa)

2.1 Research update

The purpose of this project is to explore methods to transform As_2O_3-rich dust to a low solubility As_2S_3 material that is stable in an anaerobic environment such as deep in the mine. The considered sulfur sources are $Na_2S{\cdot}9H_2O$, H_2S gas, and elemental sulfur. Because of the required large-scale implementation, optimal reaction conditions are being explored to allow for full conversion of the As_2O_3-rich dust to As_2S_3. The work is being conducted by two researchers; Evelyn Tennant (MSc) and Erika Revesz (PhD chemist).

Evelyn Tennant is exploring methods to rapidly dissolve the As_2O_3 in preparation for subsequent reaction with sulfide. Heterogeneous experiments with suspensions of As_2O_3 and aqueous sulfide have not been successful because As_2S_3 forms a coating on the surface of the oxide, passivating the surface and preventing further reaction. The alternative is to conduct sulfidation in two steps: 1) dissolve the As_2O_3 and 2) react aqueous As(III) with aqueous sulfide to form solid As_2S_3. Experiments at elevated temperature and pressure demonstrate that it is possible to rapidly dissolve reagent-grade As_2O_3 in a few minutes, compared to several days at room temperature and atmospheric pressure. This is very promising, but the Sb_2O_3 impurity in the Giant Mine dust is expected to decrease the dissolution rate. Similar experiments will be completed with reagent grade Sb_2O_3 and the Giant Mine dust as soon as research activities are allowed to resume.

Erika Revesz is testing methods of generating aqueous sulfide using elemental sulfur and different forms of organic carbon. The experiments to explore methods for generating sulfide from elemental sulfur and organic forms of carbon are at a very preliminary stage. Quantitative measurements of sulfide have only been done potentiometrically in aqueous solutions of sodium sulfide. The application of quantitative measurements, both potentiometric and spectrophotometric, for systems containing elemental sulfur and sources of organic carbon is complicated by the presence of multiple interferences including undissolved solids and non-aqueous liquids. Significant work remains to refine the method for quantifying the H_2S yield.

2.2 Deviations from research plan

The laboratory facilities at University of Ottawa are currently closed due to COVID-19 restrictions. The lab-based research will continue as soon as possible; however, literature review and experimental design activities will continue. At this time, it is not expected that the laboratory access restrictions will result in a significant project delay.

2.3 Budget update

The total proposed budget for this research program in Year 1 is $48,300, including $34,500 for direct research costs plus 40% overhead ($13,800) charged by the University of Ottawa (Table 2.1).

Table 2.1. Summary of budget proposed and actuals for Year 1.

	Year 1 Budget	Y1 Q1 Actuals May21-Jun30	Y1 Q2 Actuals Jul1-Sep30	Y1 Q3 Actuals Oct1-Dec31	Y1 Q4 Actuals Jan1-Mar 31	Year 1 Actuals Total
Salaries and Benefits	**$ 21,000**	**$ -**	**$ -**	**$ 2,725**	**$ 8,179**	**$ 10,904**
a) PhD students	$ -	$ -	$ -	$ -	$ -	$ -
b) Master's students	$ 21,000	$ -	$ -	$ -	$ -	$ -
c) Undergraduate students	$ -	$ -	$ -	$ -	$ -	$ -
d) Postdoctoral fellows	$ -	$ -	$ -	$ -	$ -	$ -
e) Technical/Professional Assistants	$ -	$ -	$ -	$ 2,725	$ 8,179	$ 10,904
Equipment	**$ 4,000**	**$ -**	**$ -**	**$ -**	**$ 26,374**	**$ 26,374**
a) Purchase or rental	$ -	$ -	$ -	$ -	$ 26,374	$ 26,374
b) Operation and maintenance costs	$ -	$ -	$ -	$ -	$ -	$ -
c) User Fees	$ 2,500	$ -	$ -	$ -	$ -	$ -
d) Analytical Costs	$ 1,500	$ -	$ -	$ -	$ -	$ -
Materials and Supplies	**$ 7,000**	**$ -**	**$ -**	**$ -**	**$ 1,045**	**$ 1,045**
a) Laboratory supplies, reagents	$ 5,000	$ -	$ -	$ -	$ 1,045	$ 1,045
b) Machining costs	$ 2,000	$ -	$ -	$ -	$ -	$ -
Travel	**$ 2,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Conferences and Workshops	$ 2,500	$ -	$ -	$ -	$ -	$ -
b) Field Work	$ -	$ -	$ -	$ -	$ -	$ -
Dissemination	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Publication costs	$ -	$ -	$ -	$ -	$ -	$ -
b) Communication costs (teleconference)	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	**$ 34,500**	**$ -**	**$ -**	**$ 2,725**	**$ 35,598**	**$ 38,323**
University Overhead (40%)	**$ 13,800**	**$ -**	**$ -**	**$ 1,090**	**$ 14,239**	**$ 15,329**
Grand Total	**$ 48,300**	**$ -**	**$ -**	**$ 3,815**	**$ 49,837**	**$ 53,652**

2.4 Deviations from budget

This project overspent slightly in Year 1 due to the purchase of a CEM microwave digester, required to support a slightly adjusted research direction (see attached letter). It is expected that underspending in Year 2 will eliminate the current budget shortfall according to the following revised budget (Table 2.2).

Table 2.2. Summary of proposed budget revision for Year 2 and Year 3.

	Year 1 Budget	Year 1 Actuals Total	Year 2 Original	Year 2 Proposed	Year 3 Original	Original Total	Proposed Total
Salaries and Benefits	**$ 21,000**	**$ 10,904**	**$ 21,000**	**$ 16,177**	**$ 21,000**	**$ 63,000**	**$ 48,081**
a) PhD students	$ -	$ -		$ -	$ -	$ -	$ -
b) Master's students	$ 21,000	$ -	$ 21,000	$ 16,177	$ 21,000	$ 63,000	$ 37,177
c) Undergraduate students	$ -	$ -		$ -	$ -	$ -	$ -
d) Postdoctoral fellows	$ -	$ -		$ -	$ -	$ -	$ -
e) Technical/Professional Assistants	$ -	$ 10,904		$ -	$ -	$ -	$ 10,904
Equipment	**$ 4,000**	**$ 27,374**	**$ 4,000**	**$ 4,000**	**$ 4,000**	**$ 12,000**	**$ 35,374**
a) Purchase or rental	$ -	$ 26,374		$ -	$ -	$ -	$ 26,374
b) Operation and maintenance costs	$ -	$ -		$ -	$ -	$ -	$ -
c) User Fees	$ 2,500	$ 500	$ 2,500	$ 2,500	$ 2,500	$ 7,500	$ 5,500
d) Analytical Costs	$ 1,500	$ 500	$ 1,500	$ 1,500	$ 1,500	$ 4,500	$ 3,500
Materials and Supplies	**$ 7,000**	**$ 1,045**	**$ 7,000**	**$ 7,000**	**$ 7,000**	**$ 21,000**	**$ 15,045**
a) Laboratory supplies, reagents	$ 5,000	$ 1,045	$ 5,000	$ 5,000	$ 5,000	$ 15,000	$ 11,045
b) Machining costs	$ 2,000	$ -	$ 2,000	$ 2,000	$ 2,000	$ 6,000	$ 4,000
Travel	**$ 2,500**	**$ -**	**$ 2,500**	**$ 2,500**	**$ 2,500**	**$ 7,500**	**$ 5,000**
a) Conferences and Workshops	$ 2,500	$ -	$ 2,500	$ 2,500	$ 2,500	$ 7,500	$ 5,000
b) Field Work	$ -	$ -		$ -	$ -	$ -	$ -
Dissemination	**$ -**	**$ -**	**$ 2,000**	**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 4,000**
a) Publication costs	$ -	$ -	$ 2,000	$ 2,000	$ 2,000	$ 4,000	$ 4,000
b) Communication costs (teleconference)	$ -	$ -		$ -	$ -	$ -	$ -
Subtotal	**$ 34,500**	**$ 39,323**	**$ 36,500**	**$ 31,677**	**$ 36,500**	**$ 107,500**	**$ 107,500**
University Overhead (40%)	**$ 13,800**	**$ 15,729**	**$ 14,600**	**$ 12,671**	**$ 14,600**	**$ 43,000**	**$ 43,000**
Grand Total	**$ 48,300**	**$ 55,052**	**$ 51,100**	**$ 44,348**	**$ 51,100**	**$ 150,500**	**$ 150,500**

Project 3: Stabilization of As_2O_3 dust in cemented paste backfill

Investigators:
Isabelle Demers (UQAT)
Nick Beier (University of Alberta)
Mostafa Benzaazoua (UQAT; collaborator)

3.1 Research update

To evaluate the effectiveness of As stabilization through incorporation within paste backfill, Amirhossein Mohammadi (PhD) has been recruited and is scheduled to start at UQAT in May 2020. The student is currently conducting a literature review and developing an experimental plan. This work will assess the efficiency of safely and permanently attenuate the As_2O_3 dust.

The University of Alberta components of this project are scheduled to start in Year 3.

3.2 Deviations from research plan

The laboratory facilities at UQAT are currently closed due to COVID-19 restrictions; however, to date this has not resulted in significant delays with Project 3 because the anticipated start date for the laboratory work was May 1, 2020. It is not expected that laboratory facilities will be accessible before June 30, 2020, and possibly not accessible to new users for the summer due to modified work practices. Project delays are anticipated to be approximately 4 to 6 months, mainly related to the delay in laboratory experiments. Amirhossein Mohammadi is currently conducting preparatory work off-site to offset part of the delay and advance in his required course load.

3.3 Budget update

The total proposed budget for this research in Year 1 is $40,710, including $35,400 for direct research costs plus 15% overhead ($5,310) charged by UQAT (Table 3).

Table 3. Summary of budget proposed and actuals for Year 1.

	Year 1 Budget	Y1 Q1 Actuals May21-Jun30	Y1 Q2 Actuals Jul1-Sep30	Y1 Q3 Actuals Oct1-Dec31	Y1 Q4 Actuals Jan1-Mar 31	Year 1 Actuals Total
Salaries and Benefits	**$ 28,900**	**$ -**	**$ -**	**$ -**	**$ 4,187**	**$ 4,187**
a) PhD students	$ 24,000	$ -	$ -	$ -	$ 4,187	$ 4,187
b) Master's students	$ -	$ -	$ -	$ -	$ -	$ -
c) Undergraduate students	$ -	$ -	$ -	$ -	$ -	$ -
d) Postdoctoral fellows	$ -	$ -	$ -	$ -	$ -	$ -
e) Technical/Professional Assistants	$ 4,900	$ -	$ -	$ -	$ -	$ -
Equipment	**$ 6,250**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Purchase or rental	$ 1,250	$ -	$ -	$ -	$ -	$ -
b) Operation and maintenance costs	$ -	$ -	$ -	$ -	$ -	$ -
c) User Fees	$ -	$ -	$ -	$ -	$ -	$ -
d) Analytical Costs	$ 5,000	$ -	$ -	$ -	$ -	$ -
Materials and Supplies	**$ 250**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Laboratory supplies, reagents	$ 250	$ -	$ -	$ -	$ -	$ -
b) Machining costs	$ -	$ -	$ -	$ -	$ -	$ -
Travel	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Conferences and Workshops	$ -	$ -	$ -	$ -	$ -	$ -
b) Field Work	$ -	$ -	$ -	$ -	$ -	$ -
Dissemination	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Publication costs	$ -	$ -	$ -	$ -	$ -	$ -
b) Communication costs (teleconference)	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	**$ 35,400**	**$ -**	**$ -**	**$ -**	**$ 4,187**	**$ 4,187**
University Overhead (15%)	**$ 5,310**	**$ -**	**$ -**	**$ -**	**$ 628**	**$ 628**
Grand Total	**$ 40,710**	**$ -**	**$ -**	**$ -**	**$ 4,815**	**$ 4,815**

3.4 Deviations from budget

This project was expected to start in early 2020, it is anticipated that underspending in 2019 will be corrected in the next two years. It is expected that a 6-month extension for Project 3 will be required because of the delay in recruitment and delay in the start of the experiments.

Project 4: Geochemical and leaching characterization of vitrified arsenical glass

Investigators:
David Blowes (University of Waterloo)
Carol Ptacek (University of Waterloo)

4.1 Research update

The conversion of hazardous wastes into ceramics or vitrified products has the potential to mitigate contaminant mobility and toxicity. This approach has received significant attention in the research community over recent years. Bench-scale studies have examined the potential utility of vitrification for attenuation of contaminants associated with coal fly ash (Guzmán-Carrillo et al., 2018), metallurgical slag (Guzmán-Carrillo et al., 2018; Karamanov et al., 2018), asbestos-bearing wastes (Iwaszko et al., 2018), and fly ash derived from the incineration of medical wastes (Stoch et al., 2018; Tsakalou et al., 2018). In addition, vitrification has been identified as a solution for the long-term disposal of low- and high-level nuclear wastes (*e.g.*, Kim & Kruger, 2018).

Incorporation of reagent-grade arsenic compounds into vitrified products, including As_2O_3 and sodium arsenate (Na_3AsO_4), has been demonstrated under laboratory conditions (*e.g.*, Shi et al., 2015; Zhao et al., 2016, 2017). However, knowledge gaps exist in the scientific literature surrounding the long-term stability of vitrified arsenical glass, and the vitrification of arsenic-bearing industrial residues that are not derived from pure-phase, reagent-grade compounds.

Research on this project has not yet been initiated but is expected to start when laboratory access restrictions are lifted.

4.2 Deviations from research plan

The vitrified material required for this project has not been received at UW resulting in a project start delay. In addition, the laboratory facilities at UW are currently closed due to COVID-19 restrictions. It is not expected that laboratory facilities will be accessible before June 30, 2020 resulting in a Project 4 delay of approximately 1 year.

4.3 Budget update

The total proposed budget for this research in Year 1 is $81,900, including $63,000 for direct research costs plus 30% overhead ($18,900) charged by the University of Waterloo (Table 4).

Table 4. Summary of budget proposed and actuals for Year 1.

	Year 1 Budget	Y1 Q1 Actuals May21-Jun30	Y1 Q2 Actuals Jul1-Sep30	Y1 Q3 Actuals Oct1-Dec31	Y1 Q4 Actuals Jan1-Mar 31	Year 1 Actuals Total
Salaries and Benefits	**$ 45,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) PhD students	$ -	$ -	$ -	$ -	$ -	$ -
b) Master's students	$ -	$ -	$ -	$ -	$ -	$ -
c) Undergraduate students	$ -	$ -	$ -	$ -	$ -	$ -
d) Postdoctoral fellows	$ 40,000	$ -	$ -	$ -	$ -	$ -
e) Technical/Professional Assistants	$ 5,000	$ -	$ -	$ -	$ -	$ -
Equipment	**$ 8,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Purchase or rental	$ 2,000	$ -	$ -	$ -	$ -	$ -
b) Operation and maintenance costs	$ 500	$ -	$ -	$ -	$ -	$ -
c) User Fees	$ 500	$ -	$ -	$ -	$ -	$ -
d) Analytical Costs	$ 5,000	$ -	$ -	$ -	$ -	$ -
Materials and Supplies	**$ 10,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Laboratory supplies, reagents	$ 10,000	$ -	$ -	$ -	$ -	$ -
b) Machining costs	$ -	$ -	$ -	$ -	$ -	$ -
Travel	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Conferences and Workshops	$ -	$ -	$ -	$ -	$ -	$ -
b) Field Work	$ -	$ -	$ -	$ -	$ -	$ -
Dissemination	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Publication costs	$ -	$ -	$ -	$ -	$ -	$ -
b) Communication costs (teleconference)	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal	**$ 63,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
University Overhead (30%)	**$ 18,900**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Grand Total	**$ 81,900**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

4.4 Deviations from budget

This project has not yet started; it is expected that a 1-year extension will be required.

Administration

Investigators:
David Blowes (University of Waterloo)
Carol Ptacek (University of Waterloo)

5.1 Budget update

The total proposed budget for this research in Year 1 is $42,900, including $33,000 for direct research costs plus 30% overhead ($9,900) charged by the University of Waterloo (Table 5).

Table 5. Summary of budget proposed and actuals for Year 1.

	Year 1 Budget	Y1 Q1 Actuals May3-Jun30	Y1 Q2 Actuals Jul1-Sep30	Y1 Q3 Actuals Oct1-Dec31	Y1 Q4 Actuals Jan1-Mar 31	Year 1 Actuals Total
Salaries and Benefits	**$ 32,000**	**$ -**	**$ -**	**$ 7,468**	**$ -**	**$ 7,468**
a) PhD students	$ -	$ -	$ -	$ -	$ -	$ -
b) Master's students	$ -	$ -	$ -	$ -	$ -	$ -
c) Undergraduate students	$ -	$ -	$ -	$ -	$ -	$ -
d) Postdoctoral fellows	$ -	$ -	$ -	$ -	$ -	$ -
e) Technical/Professional Assistants	$ 32,000	$ -	$ -	$ 7,468	$ -	$ 7,468
Equipment	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Purchase or rental	$ -	$ -	$ -	$ -	$ -	$ -
b) Operation and maintenance costs	$ -	$ -	$ -	$ -	$ -	$ -
c) User Fees	$ -	$ -	$ -	$ -	$ -	$ -
d) Analytical Costs	$ -	$ -	$ -	$ -	$ -	$ -
Materials and Supplies	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Laboratory supplies, reagents	$ -	$ -	$ -	$ -	$ -	$ -
b) Machining costs	$ -	$ -	$ -	$ -	$ -	$ -
Travel	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Conferences and Workshops	$ -	$ -	$ -	$ -	$ -	$ -
b) Field Work	$ -	$ -	$ -	$ -	$ -	$ -
Dissemination	**$ 1,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
a) Publication costs	$ -	$ -	$ -	$ -	$ -	$ -
b) Communication costs (teleconference)	$ 1,000	$ -	$ -	$ -	$ -	$ -
Subtotal	**$ 33,000**	**$ -**	**$ -**	**$ 7,468**	**$ -**	**$ 7,468**
University Overhead (30%)	**$ 9,900**	**$ -**	**$ -**	**$ 2,240**	**$ -**	**$ 2,240**
Grand Total	**$ 42,900**	**$ -**	**$ -**	**$ 9,708**	**$ -**	**$ 9,708**

5.2 Deviations from budget

The administration portion of the project incurred some costs in Q3 but has not yet fully started; it is expected that a 1-year extension will be required to coincide with other extended portions of the project.