

# DOE-ID NEPA CX DETERMINATION

## Idaho National Laboratory

### **SECTION A. Project Title:** The Energy and Cost-efficient E-waste Recovery Project for Rare-Earths and Precious Metals

### **SECTION B. Project Description and Purpose:**

Quantum Ventura, Inc. (QV), located in San Jose, California, is a technology innovation company with a single mission of delivering customer-centric advanced solutions to United States (U.S.) Federal and State Governments, and private Sector customers. QV focuses on Artificial Intelligence (AI) Machine Learning Verification & Validation, Cybersecurity, Secure Mobile technology, and HPC-driven Big Data Analytics. Recently, QV was awarded a Phase II SBIR/STTR award by the U.S. Department of Energy (DOE) for "Extraction of gold/silver/rare earth minerals from electronic waste", DE-FOA-0002145, which is a high priority project for DOE and the U.S. Department of Defense (DOD).

QV was awarded the FY20 Phase II award, to commercialize the patented Electrochemical Recycling Electronic Constituents of Value (E-RECOV) technology, after a successful completion of a Phase I SBIR/STTR awarded project from FY19, in which INL previously provided support to QV. INL developed the E-RECOV process and is well recognized as the developer of the process as a method which uses an electrochemical cell to efficiently recover metals from complex materials, such as electronic scrap and discarded electronics, which leads to a more complete recycling of materials while significantly minimizing chemical use and waste generation. Once again, INL will support QV in this effort through a consulting role which includes providing technical information and data analyses.

During Phase II, QV will build a 7 kg/day E-RECOV prototype plant which will extract precious metals and rare-earths from e-waste. E-RECOV technology not only recovers more metal from waste electronics, which can reduce chemical reagent use and lessen the toxicity of remaining materials, but it is also 30% cheaper than conventional recovery technologies. E-RECOV extracts both precious metals and other metals. Additionally, E-RECOV extracts valuable and nationally critical rare-earth metals that are currently vulnerable to supply disruptions. The supply disruption of rare-earth minerals, which have a limited supply within the U.S. would be a devastating blow to the U.S. economy. INL developed the E-RECOV process and is distinctively knowledgeable of operations. For QV to effectively commercialize the E-RECOV process, INL will transfer important process knowledge acquired at the bench-scale to QV.

INL developed the Electrochemical Recovery process as a means to recovering metals from various complex matrices. The specific application involves recovery metals from pre-processed electronic scrap. The pre-processing involves isolating metal rich parts of electronic scrap from less valuable materials such as plastics and steel. Pre-processing is performed will likely be performed by Colt Refining and Recycling (<https://coltrefining.com>) in New Hampshire. They produce a metal rich product containing up to 50% metal, primarily copper and tin but also contains precious metals. This material is current sold to metal refiners which use thermal methods to produce metals, and almost exclusively exported. INL developed the process for this material since 2013 and has previously operated the same electrochemical reactor system that will be used in this work. The know-how on performing electrochemical recovery is being transferred to Quantum Ventura.

Quantum Ventura is attempting to commercialize the INL developed technology by operating a pilot scale facility in California. INL will be performing tests on material at a smaller scale in order to guide their work. Specifically, INL will test material that they will process and will allow a comparison to assess the scaled-up facility performance and suggest process improvements. Operating at a smaller scale provides greater flexibility in trying various process strategies.

On this project, INL will provide technical consulting by supplying data and designs for the Electrochemical Recycling Electronic Constituents of Value (E-RECOV) process, perform an updated economical model using existing model based on inputs from the Phase I efforts, assist Plant Designers in building a full-fledged production model based on the INL's model, and also provide input to fine-tune E-RECOV designs process to enable rapid scaling of manufacturing. The specific technical objectives of Phase II are as follows:

INL will perform consulting work through sharing of design ideas, sharing data acquired during Phase I commenting on commercial designs, examining data and performance measures, and suggesting modifications to improve performance. As part of this consulting function, INL will need to view the operations by visiting the location of the QV.

INL will be performing tests on the material supplied by QV at INL facilities (Energy Innovation Laboratory), likely through partner Colt Refining and Recycling. As mentioned above, this material is rich in metals but is similar to material processed at INL previously. The work will generate acid and solid waste.

This task will involve modeling the economics of QV's operations. INL has previously developed a model for assessing the economics of the E-RECOV process. Using data and feedstock information, provided by QV, INL will use this information to model and assess economics including performing sensitivity analysis for important variables. The results will be written into a report, which will be given to QV.

### **SECTION C. Environmental Aspects or Potential Sources of Impact:**

#### **Air Emissions**

This work is expected to release small amounts of chemicals to the atmosphere. All emissions are expected to be well below the quantities evaluated in APAD 12-010.

#### **Discharging to Surface-, Storm-, or Ground Water**

N/A

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### Disturbing Cultural or Biological Resources

N/A

### Generating and Managing Waste

The work will generate acidic liquid and solid waste. The acid waste will contain metal ions from the material: copper, tin, lead, nickel, zinc and other trace metals. The solids remaining after processing will contain remnants of circuit boards such as plastics, fiberglass, silicon chips, and other detritus. As the project will be processing examination amounts of material, the volumes will be limited below 10 L of solution waste and 10 kg of solid waste.

### Releasing Contaminants

Chemical contaminants will be released to the atmosphere as identified in the Air Emissions section.

### Using, Reusing, and Conserving Natural Resources

All applicable waste will be diverted from disposal in the landfill when possible. Project personnel will use every opportunity to recycle, reuse, and recover materials and divert waste from the landfill when possible. The project will practice sustainable acquisition, as appropriate and practicable, by procuring construction materials that are energy efficient, water efficient, are bio-based in content, environmentally preferable, non-ozone depleting, have recycled content, and are non-toxic or less-toxic alternatives. New equipment will meet either the Energy Star or SNAP requirements as appropriate (see <http://www.sftool.gov/GreenProcurement>).

**SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification:** Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

For Categorical Exclusions (CXs), the proposed action must not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not "connected" to other action actions (40 CFR 1508.25(a)(1) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

### References:

10 CFR 1021, Appendix B to subpart D, items B3.6, "Small-scale research and development, laboratory operations, and pilot projects"

### Justification:

Project activities are consistent with 10 CFR 1021, Appendix B, B3.6, "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."

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act)  Yes  No

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on: