# Idaho Incubation Fund Program

Progress Report Form

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| **Proposal No.** | **17-004** |
| **Name:** | **Daniel S. Dale** |
| **Name of Institution:** | **Idaho State University** |
| **Project Title:** | **Commercialization of Trace Element Detection Technology** |
| **Reporting Period:** | **7/1/2016-12/30/2016** |

**Information to be reported in your progress report is as follows (attach additional information as needed):**

1. Summary of project accomplishments for the period just completed and plans for the coming reporting period:

   (1) A nuclear engineering M.S. student, Nate Gardner, was recruited for the project.

   (2) During this reporting period, we have made significant progress in developing a database for use in identifying elements and nuclides with photon activation analysis. 48 out of a planned 75 elements have been entered, with a total of 598 photon lines.

   (3) We have also made significant progress on a web page which will advertise the technique to potential customers. It can be found at:

   http://www2.cose.isu.edu/~dale/research.html

   (4) Samples of coal ash and fly ash obtained from Rocky Mountain Power have been analyzed with photon activation analysis to identify the potential presence of rare earth elements. Rare earth elements consist of 17 metals with atomic numbers between 57 and 71 plus scandium and yttrium. Used in high-tech equipment for health care, transportation, national defense, aerospace, green energy, and other industries – computers, smart phones, rechargeable batteries, electric vehicles, magnets, chemical catalysts. They support $329 billion in economic output in North America.US Geological Survey expects worldwide demand to grow 5% annually through 2020. China produces more than 85% of the world's rare earths.US is second with just over 6%. Clear signatures of scandium, yttrium and other rare earth elements were observed.

   (5) In conjunction with National Security Technologies, LLC, two samples of uranium compounds of different enrichment were irradiated. The goal of this research is to establish the effectiveness of photon activation analysis as a tool to measure uranium enrichment for homeland security and nuclear fuel cycle application. The data is under analysis.

(6) A high purity germanium detector was obtained from colleagues at the Pacific Northwest National Laboratory, and has been assembled and commissioned.

(7) The next planned experiments will involve using photon activation analysis to do lead isotope fingerprinting for forensics purposes. Initial experiments will involve analyzing lead bullets from different sources. Samples from the US, Russia, Bosnia Hertzegovina, Romania, and Germany have been procured. A vendor for separated isotope sample of lead has been identified.

(8) In conjunction with item (7) experiments are planned to analyze soil samples for selenium.

2. Summary of budget expenditures for the period just completed (**include project burn rate**):

Total remaining funds are $59,714.35 amounting to 20% of the funds spent. Expenditures include faculty support, and some initial sample procurement.

Major expenditures including beam time, and separated isotope lead calibration samples will occur within the next month.

3. Numbers of faculty and student participation resulting from the funding, including internships:

M.S. student: Nate Gardner
Faculty: Dan Dale, Tony Forest, Frank Harmon
Scientific staff: Jon Stoner

4. List patents, copyrights, plant variety protection received or pending:

None.

5. List technology licenses signed and start-up businesses created:

None.

6. Status of private/industry partnerships (include enough information to judge level of engagement):

Discussions of future collaborations with Diego Fernandez of Isoforensics, Inc. in Salt

Lake City.

Data taking run performed with David Schwellenbach from National Security Technologies, LLC. Two NSTech personnel visited the Idaho Accelerator Center for a week to perform these experiments.

7. Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.

Training of M.S. student, Nate Gardner, on the photon activation analysis technique is well underway. Significant data taking operations are in advanced stages of planning.