

PACRO Commercial Nickel Sampling and Analysis Plan Revision 1

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1. General Overview

Background

Project Description

This task is to provide information on the radionuclide activity associated with commercially available nickel. The activity of radionuclides associated with commercially available nickel can then be used to assess the dose resulting from the use of nickel in commercial products. This information on commercial nickel will be used as a baseline to assess Paducah Gaseous Diffusion Plant (PGDP) nickel ingots that have been decontaminated. If the radioactivity in the decontaminated PGDP nickel is equivalent to or less than commercial nickel, the material can be exempted from restrictions on its commercial use.

Radionuclides that may be present in PGDP nickel ingots based on process knowledge include: Cobalt-60, Strontium-90, Technetium-99, Cesium-137, Uranium-238, Uranium-235, Uranium-234, Thorium-228, Thorium-230, Thorium-232, Plutonium-238, Plutonium-239/240, Americium-241, and Neptunium-237. Analytical results from seven nickel ingot samples did not detect the presence of Co-60, Sr-90, Cs-137, U-238, U-235, U-234, Pu-238, Pu-239/240, Th-228 and Am-241. Thorium-232, Thorium-230 and Neptunium-237 were detected in one to four samples. Tc-99 was detected in four of the seven samples.

Data Quality Objectives

The Data Quality Objective for this project is to provide non-biased, technically defensible radionuclide activities that can be used in scenarios for estimation of 'potential radiation dose' from commercially available nickel. The project will provide data from two independent analytical laboratories for evaluations of the radionuclide activity in commercially available nickel. Laboratory analyses will have method detection limits at or below background. The laboratory methods will allow comparison of the verified and assessed data to national standards for radioactivity in commercial materials.

Sample Description

The project team decided that commercially available nickel would provide representative material to develop radionuclide activities that can be used to establish a baseline for nickel regardless of the source. Nickel from three different vendors has been obtained for use in the project. A solid nickel and a powdered nickel was obtained from each vendor. Sample nickel was received from the following sources:

Alfa Aesar Ward Hill, MA	Nickel Rod Powder	99.5% Purity 99.8% Purity –325 Mesh
Belmont Metals Brooklyn, NY	Nickel Cathodes Powder	99.9% Purity 99.9% Purity 100-325 Mesh
Atlantic Equipment Engrs Bergenfield, NJ	Metal Squares Powder	99.99+% Purity 99.9% Purity -325 Mesh

Characterization Objectives

This project is designed to meet the free-release requirements in proposed changes to DOE Order 5400.5, Section 4.a.2. The proposed free-release requirements are (1) the radionuclide activity of the material is indistinguishable from background using appropriate technology and (2) is compared to activity levels of similar non-impacted materials.

2. Organization and Responsibilities

The project is under the overall control of the Purchase-Area Community Reuse Organization (PACRO). Analytical team members include personnel from the University of Kentucky personnel, State of Kentucky Radiation Control Branch, United States Enrichment Corporation (USEC) laboratory, and as needed, other support personnel.

3. Design of Sampling Activities

Site Visits

There are no sites to observe in this project.

Notifications

Team members as shown in the approval signatures have the authority to approve the Sampling and Analysis Plan (SAP) and changes. Approval may be through E-mail, phone conversation or signature. This is documented on the SAP approval page. All changes will be documented in a retrievable electronic format and included in the project records.

Analytical Strategy

Two independent analytical laboratories, the USEC laboratory and the Kentucky Cabinet for Health Services' Radiation, Health and Toxic Agents Branch laboratory will analyze the commercial nickel. Each laboratory will employ established laboratory procedures to provide data that can be verified and assessed to ensure the quality of the data.

To ensure analytical results can be compared the laboratories have agreed on the following analytical methods. Gamma Spectroscopy on solid or dissolved nickel will be used to quantify K-40, Co-60, Cs-137, **Np-237 and Am-241**. Alpha Spectroscopy will be used to quantify U-238, U-235, U-234, Th-228, Th-230, Th-232, Pu-238, Pu-239/240, **Am-241 and Np-237**. Liquid Scintillation will be used to quantify Tc-99. Gas Proportional Counting will be used to quantify Sr-90.

Since no specific regulatory limits for release of nickel or other material have been established both labs will establish method detection limits to analyze approaching or being below background levels. Analytical results will be reported in Bq/g. Internal duplicates and spikes will be performed at a rate of one per ten samples.

K-40 is not a contaminant introduced during the use and processing of the nickel but is included since it is naturally occurring. The presence or absence of K-40 should indicate if any purification steps have removed radionuclides.

Analytical Schedule

Each laboratory has agreed to complete all analyses of commercial nickel material within 90 days of receipt of the sample.

Sample Preparation

The commercial bar and plate nickel will be size-reduced to 200 mesh. One hundred grams of each sample will be provided to the laboratories and the remainder reserved for future needs. One duplicate sample will be prepared for analysis. Sample preparation will be conducted by the University of Kentucky and distributed to the analytical laboratories with appropriate chain-of-custody or sample information.

Post Sampling Activities

An interim draft report will be provided for comment within 30 days of the completion of the analytical work. The final report will be provided after comments are resolved on the interim draft report. Reporting will be coordinated through the University of Kentucky. All parties will discuss and review analytical results. A final report of this study will require signatures of all parties before the results are released for general distribution.

Sampling Notebook

The project file will be used to document actions in this project.

Field QC Samples

One duplicate will be prepared on the commercial nickel and submitted for radionuclide laboratory analysis.

Sample Handling

All samples will be handled under chain of custody procedures requiring control of the samples by maintaining visual contact, locking in an area with limited access or using seals to detect tampering. Chain of custody transfers will be documented on forms provided by the University of Kentucky.

Waste Management

The laboratories will dispose of waste through their normal channels therefore no materials will be returned to the University of Kentucky.

Sample Identification, Numbering and Labeling

Samples will be uniquely identified tying the vendor, the type of material and the date shipped from the University of Kentucky at Paducah. The format will be:

AA-P-mmddyy

AA-S-mmddyy

BM-P-mmddyy

BM-S-mmddyy

AEE-P-mmddyy

AEE-S-mmddyy

Where AA is Alfa Aesar, BM is Belmont Engineering, AEE is Atlantic Equipment Engineers, P is powder and S is solid.

4. Data Management, Data Validation, Data Verification and Assessment

Data Management

Data will be reported in standard laboratory formats. Hard and Electronic copies will be provided to the project team and included in the (electronic) project file.

Data Assessment

Data will be verified and assessed to ensure technical defensibility for further use in evaluating radionuclides present in PGDP nickel.

5. Sampling and Documentation Requirements

The project file will contain the analytical data chain of custody forms, the SAP, change documentation, assessment reports, nickel source information and any correspondence relating to the project. Data shall be placed in an electronic project file.