

## **U. S. Department of Energy**

## Portsmouth/Paducah Project Office

# EXPRESSION OF INTEREST for the

## COMMERCIAL DECONTAMINATION OF NICKEL WITH RADIOLOGICAL SURFACE

## CONTAMINATION

Issue Date: Response Due Date: April 12, 2023 Initial Technical Package: July 11, 2023 Commercial Package (and Final Technical Package, if necessary): October 9, 2023

#### AGENCY: U.S. Department of Energy (DOE)

ACTION: Expression of Interest (EOI): Commercial Decontamination of Nickel with Radiological Surface Contamination

SUMMARY: DOE is seeking industry input for operationally mature technologies that could potentially support the recovery and recycle of ~6400 tons of radiologically surface-contaminated nickel recovered from the Portsmouth Gaseous Diffusion Plant (GDP) decontamination and decommissioning (D&D) Project. The information gathered from this EOI will be used to determine whether it is in the DOE's best interest to produce a high purity nickel product that may be released for use in commerce in accordance with the requirements of DOE Order 458.1. This information may also be used in the development of an acquisition strategy for the commercial scale processing of the nickel to remove the surface contamination and supporting DOE initiatives such as clean energy initiatives or zero emission vehicles (e.g., electric vehicle or grid scale batteries). Attachment 1 provides a summary of available characterization data obtained from sampling of Portsmouth nickel material. The primary contaminants of concern include uranium and other actinides, along with technetium. Since information on the specifications of nickel barrier is classified a previous approach considered smelting the material in an effort to remove the classification. This resulted in volumetrically contaminating the nickel which is subject to DOE's moratorium on the release of volumetrically contaminated metals. As such, this EOI is only applicable to the nickel barrier material which has some level of surface contamination based on its use to enrich uranium fluoride gas. Since this barrier material only has surface contamination, it is subject to the authorized release limits in DOE Order 458.1, rather than the DOE's moratorium on the release of volumetrically contaminated metals. It is acknowledged that similar material exists in the Paducah, KY GDP, as well as material at the Oak Ridge, TN GDP site that was shredded into a "flake" form. However, this EOI focuses on pursuit of viable technology for Portsmouth first, but may have potential applicability to the Paducah and Oak Ridge inventories at a later date. The reason DOE is evaluating the potential for use of the Portsmouth first is that the material is available now as a result of significant process building deactivation activities. Similar D&D activities are in preparation at Paducah, but inventory of surface contaminated barrier material is not expected to be available for several more years. While the flake material at Oak Ridge is believed to be surficially contaminated, additional verification activities need to be undertaken to verify container contents and uniformity.

Specifically, DOE requests process technical descriptions, economic data, and market information to: 1) manage the protection of classified nickel barrier material until it can be declassified, 2) decontaminate the nickel barrier material to authorized release levels, and 3) propose an end-use considering the high quality of the Class 1 nickel. Responders will verify the level of readiness for the possible deployment of a proposed processing technology to radiologically decontaminate Portsmouth GDP nickel barrier material at production levels from hundreds to thousands of tons per year without the need for significant research and development activities. DOE's current assumptions for processing are that: unless a pre-existing facility exists capable of meeting the processing and DOE security protection requirements for this material, (1) any constructed nickel barrier material processing facility would be vendor owned and financed; (2) the facility would be sited on DOE property or adjacent to the Portsmouth property; and (3) operations would occur under Atomic Energy Act (AEA) DOE oversight authority or NRC or agreement state regulatory and permitting authority. DOE further assumes that any processing facility would be equivalent to a Radiological Facility under 10 CFR 830. DOE seeks responder's input, through this EOI, to validate these assumptions or to propose alternative viewpoints helpful to the development of a final execution approach.

DOE will evaluate proposed approaches to: determine their technical and economic feasibility; evaluate their significant operational safety risks and required controls; assess the associated environmental risks; review any significant regulatory compliance considerations; evaluate the potential revenue generation from successful processing; gauge any important legal considerations; assess expected product quality and yield; and evaluate all waste volumes and disposal paths. Of

note to prospective respondents, any resultant execution approach must appropriately address DOE security classification requirements for handling the nickel barrier material and demonstrate acceptable Foreign Ownership and Control Information (FOCI) status.

Responses are requested in two parts:

- A. Initial Technical Package: within 90 days of the EOI
- B. Commercial Package (and Final Technical Package, if necessary): within 180 days of EOI

#### **INFORMATION SOUGHT:**

- I. **Purpose:** The EOI seeks information on commercially mature, metal refining technologies capable of removing surficially deposited radiological contaminants from nickel barrier material recovered from the Portsmouth GDP process equipment. This supplied information may be used to support the development and implementation of an acquisition strategy for potential material recovery and processing, pending:
  - Successful technical validation of the proposed process (including verification testing).
  - Completion of an economic assessment, by DOE, of the proposed approach demonstrating, if appropriate, the overall advantages of the initiative.
  - An acceptable strategy to address the classified aspects of the nickel during recovery and any processing.
  - The development of an acceptable regulatory approval and environment impact evaluation approach.
- Background: DOE is seeking to find the optimal approach for addressing the disposition of the ~6,400 tons of surface contaminated nickel barrier material removed from the Portsmouth Gaseous Diffusion Plant cascades. The barrier material is radiologically contaminated and is part of the overall DOE scrap nickel inventory:
  - Nickel barrier was used for uranium enrichment and is classified for security due to both manufacturing and physical specifications.
  - Secretarial Moratoriums on the release into commerce of any volumetrically contaminated nickel from the Oak Ridge Reservation, specifically from the gaseous diffusion plant (GDP), and other metals within the DOE complex that may be volumetrically contaminated has historically precluded the recycling of nickel from some barrier material because it was smelted and turned into ingots. However, a significant amount of nickel remains in barrier material form that has not been smelted or undergone any other process that would alter its original form.
  - A team of the gaseous diffusion technology subject matter experts (SMEs) convened to determine the validity of identifying the barrier as being surface contaminated material. The team reviewed and evaluated the currently available data and information associated with barrier contamination. The team concluded that based on the currently available information and physical evidence the contamination found on barrier material is surficial rather than volumetric. The team noted that the process history in combination with laboratory studies associated with decontaminating the nickel material provide consistent and definitive proof that the contamination is surficial.
  - Attachment 1 presents data on the anticipated levels of radiological contamination in the Portsmouth barrier material.
  - Attachment 2 presents detail representing a surrogate barrier bundle.

- **III. DOE Evaluation Focus:** To evaluate the potential for DOE asset recovery, the nickel from the proposed process must be decontaminated in a manner that:
  - Meets release requirements developed in accordance with DOE Order 458.1, Radiation Protection of the Public and the Environment.
  - Generates a product that has the lowest residual contamination levels that can be obtained reliably by the respondent's proposed commercial technology compared to the naturally occurring and anthropogenic levels of radioactivity in commercially traded nickel.<sup>1</sup>
  - Meets programmatic, licensing, siting, regulatory requirements, and presents a reasonable allocation of project risk.
  - Generates waste that meets the Waste Acceptance Criteria of the Portsmouth On-site Waste Disposal Facility or another existing waste disposal facility authorized to receive DOE waste.

#### IV. Submission Organization

The requested submissions are to be structured to support the DOE evaluation criteria and topics to demonstrate technical, technology readiness and market maturity. The requested submittals include:

#### A. Technical Package which defines:

- a. <u>Process Background Information and evidence of Process Maturity</u> including:
  - Describe the proposed process design, operations and throughput including:
    - $\circ$   $\;$  Standard feed and product physical and chemical characteristics
    - o Primary/secondary waste quantity and composition
    - $\circ$   $\;$  Availability of disposition options and/or disposal facilities for waste products
    - $\circ\quad$  Principal process hazards and mitigation approach
    - Facility and utility requirements
  - If possible for the proposed process, provide evidence of production scale application of the technology including a commercial facility description which provides:
    - Location and layout (please note if such facilities are available for DOE inspection and tour)
    - State of licensing and permitting requirements as deployed with discussion of the anticipated ability to support design and licensing for deployment at Portsmouth
    - $\circ$  Production history describing market products, product quality and throughput
- b. <u>Product Description and Ability to Ensure Reliable Product Quality</u>: Given an expected feed radiological composition representative of that in Attachment 1 and physical composition representative of that in Attachment 2, propose a method to demonstrate and quantify radiological contaminant removal efficiency, particularly for Tc, U, and actinides. The quantification is to be supported by process data resulting from the proposed demonstration and a proposed validation approach, including:
  - Operating or demonstration (including scale of operation) results obtained on contaminated DOE nickel or relevant surrogate testing.
  - If the Respondent has previously completed a demonstration they determine to be applicable, they may describe the process that was used and present the associated data, addressing any

<sup>&</sup>lt;sup>1</sup> Most transition metals produced, from copper through rare earth ores, have some level of naturally occurring radioactivity associated with their natural ore composition. The refining and processing of the ore to produce products remove these radionuclides to levels acceptable for unrestricted public use.

additional demonstration activities and verification that may be required to meet the intent of this portion of the EOI.

- DOE is considering the conduct of verification testing in the Portsmouth onsite analytical laboratory using contaminated material from the facility. DOE requests the proposed verification testing design and plan for demonstration under respondent's oversight and technical direction, identifying:
  - Test approach, equipment and design
  - Identification of rate limiting steps
  - o Scaling approach for application of the bench data to full scale design
  - Any correlations available to benchmark the demonstration results against the proposed operating scale or existing commercial facility performance

Respondents should also identify proposed option(s) to conduct this verification testing should the Portsmouth onsite analytical laboratory not be available.

- c. <u>Proposed Processing Approach</u>: Based on the Respondent's experience, provide input on the proposed process approach as applied to processing recovered barrier material:
  - Type of facility
  - Infrastructure requirements
  - Respondent's process control approach, product specifications, and facility RAMI<sup>2</sup> characteristics that will ensure attainment of the lowest reliably achievable product composition.
  - Secondary Waste generation and anticipated characteristics and associated disposition options
  - Discussion of proposed arrangements relative to location, financing, and land use
  - Permitting, license and the regulatory basis for siting and operation
  - Ability to handle and properly control classified material
- NOTE: Respondent will be responsible for any preconditioning required to introduce the nickel material into their process.
- d. <u>Production Yield</u>: Given the expected feed radiological contamination and composition as reflected in Attachment 1, define the projected nickel product yield for the proposed process including:
  - Design and operational factors that significantly impact production yield and quality, particularly with respect to:
    - Industry product specifications or standards
    - Tc, U and other actinide removal
    - $\circ$   $\;$  Volumes and activities of all waste streams associated with the proposed yield
  - Volume, composition, and disposition path for all process wastes.
- e. <u>Safety Approach and Hazard Mitigation</u>: Define the industrial operating safety record and expected process safety approach to:
  - Radiological safety.
  - Industrial safety:
    - o Control strategies for hazardous feeds, intermediates and by-products
    - $\circ \quad \text{Approach to reagent/intermediate containment}$
    - o Emissions monitoring and reporting

<sup>&</sup>lt;sup>2</sup> Reliability, Availability, Maintainability and Inspectability

- Permitting (e.g., NRC license, RCRA, Air permits, NSHAPs, etc.)
- f. <u>Miscellaneous</u>: Any other information that is believed to be necessary for DOE to effectively evaluate the responder's submittal.
- **B.** The **Commercial Package** shall include the Respondent's business case for:
  - a. Demonstrating why the proposed nickel decontamination and recovery approach is in <u>DOE's best</u> <u>economic interest</u>:
    - Required project capital with funding and investment recovery approach
    - Revenue generation and revenue sharing proposals
    - Foreign Ownership and Control Information (FOCI) status
  - b. <u>Proposed Process Economics</u> to support DOE's nickel project Net Present Value calculation; Respondent submissions should include:
    - Proposed capital cost for the facility design procurement and construction, and investment recovery approach or costs associated with shipping material to/from and use of pre-existing facility. The nickel material will be provided on a per container basis (ISO container) with enclosed item dimensions generally consistent with those noted for the representative bundle described in Attachment 2, Surrogate Barrier Bundle Detail, and approximate content weight of 11,200 lbs. Each container will be measured and determined to contain a safe mass of U235 (i.e., less than 350 g U-235) prior to transfer for processing.
    - Discussion of the prospect of a modular design such that the process equipment could be moved or replicated at the Paducah, KY Gaseous Diffusion Plant site to process comparable surface contaminated nickel found in facilities there at a later date, or surficially contaminated material stored in flake form at the Oak Ridge, TN site.
    - Operating, maintenance and environmental costs
    - Waste management disposition costs for all primary and secondary wastes
    - NEPA, licensing and permitting costs
    - Siting approach and associated cost for the proposed authorization basis. This approach should assume the construction or use of existing facilities on or adjacent to the Portsmouth DOE-controlled property. Provide clarification if work is expected to be conducted under DOE oversight or under and NRC license. If the work is to be conducted elsewhere, provide the cost benefit and approach.
    - Project cash flow projection
    - Information as to how increased volumes of nickel feedstock could impact the overall project economics including cost allocations and revenue generation/return.
  - c. <u>Proposed Market Characteristics</u> for the envisioned product outlet:
    - Anticipated end use limitations and Respondent participation in that market
    - Proposed market outlet, with bidders' analysis of market risk and stability.
    - Bidder's historic position in the nickel market.

#### V. Submittals:

A. Each submittal should consist of one original and five copies, preferably not exceeding 100 pages, divided into the following sections:

Volume A: Technical Package - basis of the approach

Section 1: Summary Section 2: Decontamination technology description by focus area above Section 3: Additional comments, recommendations, and information. **Volume B: Commercial Package** - Economic and business case for the approach

Section 1: DOE's Best Economic Interest Assessment Section 2: Process Economics Section 3: Proposed Market Characteristics

Respondents should avoid including any business confidential or proprietary information in their response. However, if an interested party must submit such information, the responder must first contact Tyler Hicks at EOI@pppo.gov for specific guidance and the information must be clearly marked accordingly, and the interested party must provide sufficient justification as to why such information is business confidential and/or proprietary. DOE will review said information and safeguard as DOE deems appropriate. Further, Respondents acknowledge that any or all of the information provided may be shared within the DOE or DOE support contractors that have executed the appropriate non-disclosure agreements. DOE shall handle the information in accordance with applicable laws and regulations.

Initial Technical Package responses shall be submitted by 3:00 pm Eastern Standard Time, July 11, 2023. Upon receipt of the Initial Technical Package, DOE will perform a review and make a viability determination within 30 days, or by August 10, 2023. DOE will invite those respondents who DOE has determined to be technically viable to attend a briefing/discussion session which will take place by September 8, 2023 (approximate). Final Technical Package (if update is required) and Commercial Package responses shall be submitted by 3:00 pm Eastern Standard Time, October 9, 2023. Responses must be submitted electronically to Tyler Hicks at EOI@pppo.gov. Electronic submittal must be in PDF format. Should another file format besides PDF be needed, respondents must first contact DOE at EOI@pppo.gov to ensure alternate file formats are acceptable. E-mail submittal must contain Expression of Interest number in Subject field. E-mail submittal must contain the body of the e-mail.

#### VI. Questions and Agency Contacts

#### A. Questions

Questions regarding the content of this EOI must be submitted to Tyler Hicks at EOI@pppo.gov. DOE will respond promptly to questions, unless a similar question and answer have already been posted on the website.

Questions and comments concerning this EOI shall be submitted not later than 10 calendar days prior to the submittal due date. Questions submitted after that date may not allow DOE sufficient time to respond.

Following submittal, DOE may set up a Question and Answer (Q&A) session with respondents if clarification or additional information regarding submittals is necessary. Please ensure contact information can be found in the submittal.

#### B. Agency Contact

All program, administrative and technical RFO-related questions must be directed to:Name:Tyler Hicks, DOE Portsmouth Paducah Project OfficeE-mail:EOI@pppo.gov

#### VII. Use of the Submittals

The purpose of this EOI is to engage leading industry expertise to assist DOE in the potential development of a new strategy and path forward for the decontamination of DOE's surface-contaminated nickel. A response to this EOI is voluntary and does not commit DOE to a future issuance of a solicitation, or subsequent award of a contract. Any and all costs associated with the preparation and submission of information in response to this EOI shall be the sole responsibility of the Interested Responders. DOE may request additional information as a result of responses to this notice.

#### **ATTACHMENT 1: PORTSMOUTH RADIOLOGIC NICKEL INFORMATION**

Note: DOE does not in any way warrant, guarantee, or otherwise vouch for the accuracy of the properties of the inventory.

- 1. Composition of the Selected DOE Inventories
  - a. The results are listed below for a limited sampling campaign for the Portsmouth GDP Cascade Buildings X-326/330/333 as of January 2012. We have reported the maximum reading for each cascade to provide the potential vendors a basis on which to judge whether their process can perform. DOE does not warrant these numbers for reasonableness or accuracy; they represent a single snapshot of a limited sample of the cascades.

Radionuclide	<sup>99</sup> Tc	<sup>228</sup> Th	<sup>230</sup> Th	<sup>233/234</sup> U	<sup>235</sup> U	<sup>236</sup> U	<sup>238</sup> U	<sup>237</sup> Np	<sup>238</sup> Pu	<sup>239/240</sup> Pu	<sup>241</sup> Am
Activity Units	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
Building X-330 Sampling Results											
Upper Measured Value	45100	0.4232	24.29	11560	540.3	82.44	2753	5.17	-NA-	0.509	0.0929
Number of Quantifiable Readings	5	1	6	9	6	5	8	3	-NA-	2	2
Building X-333 Sampling Results											
Upper Measured Value	1700	-NA-	0.861	22.7	1.65	-NA-	30.7	0.207	-NA-	-NA-	-NA-
Number of Quantifiable Readings	1	-NA-	1	2	2	-NA-	2	1	-NA-	-NA-	-NA-



#### **ATTACHMENT 2: SURROGATE BARRIER BUNDLE DETAIL**