

October 24, 2024

The Air-Conditioning, Heating, and Refrigeration Technology Institute (AHRTI) invites qualified companies to submit proposals for the following research project:

AHRTI Project 9021:

Assessment of a Refrigerant Destruction Technology Using Conversion Technology by Chemical Reaction with Hydrogen (H₂) and Carbon Dioxide (CO₂)

The scope of work is outlined in the attached work statement.

Proposal Submission

Technical and cost proposals are due by 12:00 PM Eastern Time on December 2, 2024.

Proposals should be submitted in electronic form (Adobe PDF or MS Word file format), and be emailed to AHRI Research Coordinator Zoey Scancarello (ZScancarello@ahrinet.org)

Contact for technical questions concerning the scope of work:

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Proposal Evaluation Criteria

Proposals will be evaluated per the criteria and weighting listed below:

Understanding the problem (25%)
Approach to solving the problem (20%)
Probability of (timely) success (15%)
Qualifications and experience of key personnel (15%)
Quality of facilities to perform the work (25%)

AHRTI WORK STATEMENT

AHRTI-EPA Project

Title *Assessment of a Refrigerant Destruction Technology Using Conversion Technology by Chemical Reaction with Hydrogen (H₂) and Carbon Dioxide (CO₂)*

About AHRTI

The Air-Conditioning, Heating, and Refrigeration Technology Institute (AHRTI) is a not-for-profit organization established to undertake scientific research in the public interest. AHRTI's mission is to foster applied research on technologies to improve products, systems, and controls that benefit the general public in the areas of Heating, Ventilation, Air-Conditioning, Refrigeration (HVACR), and Water Heating.

AHRTI is an entity associated with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). AHRI is the national trade association representing manufacturers of HVACR and Water Heating equipment within the global industry.

Background

Until now, destruction of HFC and other fluorocarbon waste has been primarily accomplished by costly incineration technologies such as thermal oxidation, rotary kiln, and plasma arc incineration, each of which consumes a lot of energy, produces a significant waste stream, and does not generate any valuable products for reuse.

AHRTI is conducting a U.S. EPA funded research project to assess a patented refrigerant destruction technology and provide unbiased 3rd party independent evaluation results. The technology uses conversion technology involving chemical reactions with Hydrogen (H₂) and Carbon Dioxide (CO₂). This technology is patented (US 8,043,574) and US 8,128,902). The said technology would create value by chemically breaking the unwanted refrigerants down to molecular level, and then reassemble those molecules to form high purity hydrogen fluoride (HF), hydrogen chloride (HCl), the source chemicals used for the original manufacture of the refrigerants, plus, carbon monoxide (CO), as a product of the reaction. The energy consumption and cost of conversion is expected to be a fraction of incineration because the chemical reaction creates its own heat enabling the electric energy cost to be minimal.

In this project, a pilot plant will be designed and built to demonstrate how the technology will process all end-of-life HFCs (including HFC-23), CFCs, HCFCs, and HFOs, whether a single gas or in a batch of severely mixed gases, by chemically converting them all back into their raw material components for new commercial use.

AHRTI seeks proposals from qualified parties for the use of two U.S. patents in the development and operation of a demonstration pilot plant. The proposals can address one, some or all of the tasks defined in the “Scope” section below. The selected party/parties will be granted the necessary rights to utilize the specified patents for this purpose.

Scope

Task 1. Pilot Plant Design

The contractor shall conduct a thorough review and understanding of the two U.S. patents specified in this RFP and develop a detailed design for the demonstration pilot plant, incorporating the key features and technologies covered by the patents. The target is a small-scale (8 lbs./hour) pilot plant. The designed plant should be capable of demonstrating the critical aspects of the process. This includes the reaction operations and the recovery of the HF, HCl and CO. The design of the demonstration plant calls for high purity recovery columns capable of delivering semi-conductor grade HF and HCl with purities meeting or exceeding 99.999% purity.

Task 2. Pilot Plant Construction

A demonstration plant will be constructed by the design from Task 1. Due to the particularly hazardous nature of HF, considerable time should be devoted to HF safety precautions and sampling methods.

The contractor shall obtain necessary permits, approvals, and licenses required for the construction and operation of the pilot plant, procure, and install all equipment, materials, and infrastructure needed for the pilot plant. The plant should consist of a catalytic reaction system, which will be capable of operating at a temperature of 800°C to convert feed refrigerants with a stream containing HF, HCl, CO, CO₂ and H₂. Post-reactor treatment will include recovery columns for HF, HCl, and CO followed by post-treatment of the CO stream via membrane technology.

The contractor shall engineer, construct, and operate a process based on this technology that will be capable of demonstrating the conversion of unwanted refrigerants to a salable set of product streams. This part of the project will include finalizing the flowsheets and developing Piping & Instrumentation Drawings (P&ID's) specifying all equipment and completing design. These will be used in the scale up for a commercial plant which is outside the current scope.

Task 3. Conduct Demonstration Testing and Test Result Analysis

Once the pilot plant is constructed, demonstration testing will be conducted to prove out the system and verify its capability. Demonstration tests will be conducted using the following samples (the exact samples will be selected by the project advisory committee), and the conversion products will be collected and analyzed for production rate and purity:

- Single component HFC, such as R-134a
- HFC blends, such as R-404A

- HFOs
- Assortments of severely mixed refrigerants (combined CFCs, HCFCs, HFCs, and HFOs)

Task 4. Reporting and deliverables

The report of the project shall be a compilation of the information generated throughout the project. AHRTI reserves the right of withholding any part of this research to be published. Report in detail all data, procedures, and equipment in sufficient detail to enable others to fully understand the procedures and results and to be able to replicate the procedures if needed.

The contractor shall provide the following:

- Monthly invoices and letter reports on progress and task results;
- Progress reviews in the contractor’s facilities and/or by teleconference, by AHRTI project monitoring committee members, to assess the work-in-progress;
- Draft technical report, executive summary, tabulated data, and recorded video files documenting the procedures, conditions, and findings, for review by and a presentation to an AHRTI project monitoring subcommittee; and
- Final technical report, executive summary and tabulated data resolving review comments provided by AHRTI. Included as part of this deliverable is the source code for any model tools developed, which are expected to be AHRTI properties.

Unless otherwise specified by AHRTI, printed material will be delivered on standard 8-1/2 by 11-inch paper. Electronic documents shall be delivered as a consolidated document file that integrates all text, figures, tables, and photographs into a single file in both Microsoft Word and PDF file format.

Unless otherwise specified by AHRTI, the contractor shall deliver the following as scheduled:

Invoices & Letter Reports on Progress	Monthly, within 30 days of reported period
Review Presentation Materials	Within 1 week after review
Technical Papers/Presentations Upon Approval by AHRTI	30-days prior to submission due date
Draft Final Technical Report; Executive Summary and Tabulated Data	60 days prior to contract completion date
Final Technical Report; Executive Summary; and Tabulated Data	30 days after receipt of AHRI comments

Level of Effort

The entire work (Tasks 1, 2, 3, and 4) conducted under this project will be 12 months with a cost not to exceed \$ 1,600,000. Should bidders’ cost proposals exceed \$1,600,000, bidders must provide two sets of cost proposals with one set elaborating what can be completed within

\$1,600,000 and another set with justifications for extra cost to complete all required tasks. It is anticipated that the contract for this work will be awarded at the best value based on selection from competitive proposals. However, price will not be the only factor weighed in the selection process. Prior experience and expertise in the field of study, access to laboratory and/or field sites required for completion of this project, and competitive prices will all be considered in selecting a contractor for this project.

Limitation

Solicitation of this project does not commit AHRTI to award a contract, pay any cost incurred in preparing a proposal, or to procure or contract for services or supplies. AHRTI reserves the right to accept any or all proposals received, or to cancel in part or its entirety a solicitation for this work prior to the signing of a contract agreement, when it is in AHRTI's best interest. AHRTI reserves the right to negotiate with all qualified sources.

Other Information to Bidders (Optional)

This is work-for-hire for AHRTI. Results of this work will be held confidential and releasable only to AHRTI, unless otherwise released by AHRTI.