# Hudson Technologies HFC Reclamation Project 2020-1

**October 10, 2022**

# Hudson Technologies Company

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# A.
# PROJECT OVERVIEW

# A1. PROJECT TITLE

Hudson Tech HFC Reclamation Project 2020-1

# A2. PROJECT TYPE

*Use of Certified Reclaimed HFC Refrigerants*

# A3. PROOF OF PROJECT ELIGIBILITY

*Table 1: Eligibility Requirements*

| Criterion | Requirement | Proof of Project Eligibility |
|---|---|---|
| Start Date | Non-AFOLU Projects must be validated within 2 years of the project Start Date. AFOLU Projects must be validated within 3 years of the project Start Date. One exception applies to these timeframes: Projects using a newly approved methodology or a newly approved modification that expands the eligibility of a previously published methodology may submit it for listing with ACR within 10 years of the project Start Date. However, the date of listing submittal must be within 6 months of the methodology publication date, and the project must then be validated within 2 years of the listing. The Start Date and the start of the Minimum Project Term shall be the same. The Start Date and the start of the first Crediting Period are generally the same, unless otherwise allowable in the relevant methodology. | Project start date of January 2, 2019 |
| Minimum Project Term | The minimum project term for specific project types is specified in the relevant ACR sector standard and/or methodology. Project types with no risk of reversal subsequent to crediting have no required minimum project term. | There is no risk of reversal for this project type |
| Crediting Period | Version 2.0 of the methodology calls for a crediting period for non-AFOLU projects to be 15 years | Using Methodology 2.0, the crediting period is 15 years |
| Real | GHG reductions and/or removals shall result from an emission mitigation activity that has been conducted in accordance with an approved ACR Methodology and is verifiable. ACR will not credit a projected stream of offsets on an ex-ante basis. | GHG reductions take place at the displacement of virgin HFC production, which takes place prior to the issuance |
| Emission or Removal Origin | Project Proponent shall own, have control, or document effective control over the GHG sources/sinks from which the emissions | Hudson Technologies holds and retains title to the HFC refrigerant and all environmental rights and |

| | | |
|---|---|---|
| | reductions or removals originate. If the Project Proponent shall document that effective control exists over the GHG sources and/or sinks from which the reductions/removals originate | benefits from purchase through reclamation until sale of the reclaimed gas for use in the US refrigerant market |
| Offset Title | Project Proponents shall provide documentation and attestation of undisputed title to all offsets prior to registration, including chain of custody documentation if offsets have ever been sold in the past. Title to offsets shall be clear, unique, and uncontested. | Hudson Technologies demonstrated the title to material purchased via Purchase Order receipts. The title to all offsets is clear, unique, and uncontested |
| Additional | Every project shall use either an ACR-approved performance standard and pass a regulatory surplus test, or pass a three-pronged test of additionality in which the project must: 1)exceed regulatory/legal requirements; 2) go beyond common practice; and 3) overcome at least one of three implementation barriers; institutional, financial, or technical. | This project passes the Regulator surplus test and the ACR---approved practice---based Performance test. Regulatory Surplus Test: Currently, there are no restrictions in the US or elsewhere in North America on the quantities of HFC that can be produced, imported, or used. Because of the lack of production controls for HFC, combined with the additional costs to recover, transport, and separate/process refrigerants to virgin purity levels, there is currently little incentive for recovery, reclamation, and resale of HFC refrigerants. Practice-Based Performance Standard: A review of US EPA's reclamation data indicates that the HFC refrigerant sector has a low market adoption rate for using certified reclaimed HFCs. |

| | | |
|---|---|---|
| Regulatory Compliance | Projects must maintain material regulatory compliance. To do this, a regulatory body/bodies must deem that a project is not out of compliance at any point during a reporting period. Projects deemed to be out of compliance with regulatory requirements are not eligible to earn ERTs during the period of non-compliance. Regulatory compliance violations related to administrative processes (e.g., missed application or reporting deadlines) or for issues unrelated to integrity of the GHG emissions reductions shall be treated on a case-by-case basis and may not disqualify a project from ERT issuance. Project Proponents are required to provide a regulatory compliance attestation to a verification body at each verification. This attestation must disclose all violations or other instances of non-compliance with laws, regulations, or other legally binding mandates directly related to Project Activities. | This project maintains material regulatory compliance for the entire reporting period |
| Permanent | For projects with a risk of reversal of GHG removal enhancements, project proponents shall assess risk using an ACR-approved risk assessment tool. | There is no risk of reversal of GHG removal enhancements for this project type |
| Net of Leakage | ACR requires project proponents to assess, account for, and mitigate certain types of leakage, as summarized in relevant sector standards and approved methodologies. Project proponents must deduct leakage that reduces the GHG emissions reduction and/or removal benefit of a project in excess of any applicable threshold specified in the methodology. | Projects using the HFC reclaim methodology would not increase demand for refrigerant beyond current baseline demand, i.e, use of more reclaimed refrigerant would not cause and increase in virgin HFC production (to the contrary), or increase refrigerant emissions rates. Therefore, for this project, “leakage” can be disregarded. |

| | | |
|---|---|---|
| Independently Validated | ACR requires third-party validation of the GHG Project Plan by an accredited, ACR-approved VVB once during each Crediting Period and prior to issuance of ERTs. Validation can be conducted at the same time and by the same VVB as a full verification; however, the deadline for validation is determined by the methodology being implemented and the project Start Date (see above). Governing documents for validation are the ACR Standard, including sector-specific requirements, the relevant methodology, and the ACR Validation and Verification Standard. | This project will be validated and verified by an independent third party, ACR approved VVB |
| Independently Verified | Verification must be conducted by an accredited, ACR-approved VVB prior to any issuance of ERTs and at minimum specified intervals. ACR requires verifiers to provide a reasonable, not limited, level of assurance that the GHG assertion is without material discrepancy. ACR's materiality threshold is ±5%. | This project will be validated and verified by an independent third party, ACR approved VVB |
| Community & Environmental Impacts | ACR requires community and environmental impacts to be net positive overall. Project Proponents shall document in the GHG Project Plan a mitigation plan for any foreseen negative community or environmental impacts, and shall disclose in their annual attestations any negative environmental or community impacts or claims of negative environmental and community impacts | There are no negative community or environmental impacts for this project type |

# A4. LOCATION

The project location is Hudson Technologies Company located at 3402 N. Mattis Ave, Champaign, IL. Hudson is one of the largest EPA Certified reclaimers in the US and is an industry leader in refrigerant management. All HFC refrigerant reclaimed and reused for this project was sourced from the US refrigerant market.

GPS Coordinates:

Latitude: 40.15603

Longitude: -88.27619


## A5. BRIEF SUMMARY OF PROJECT

The Project Activity is the reclamation and use of certified reclaimed HFC refrigerants to service existing refrigeration and air conditioning equipment throughout the US. Hudson Technologies acquired the HFC refrigerants from multiple sources throughout the US refrigerant market. Hudson retained title to the HFC refrigerants starting with the Purchase order, receipt, through processing and subsequent sale.

Background Information:

The use of refrigerant gas has transformed our society since it's inception. Refrigeration is used to process, store, and transport food, for comfort and process cooling, as well as motor vehicle cooling. The most commonly used refrigerants are HFCs. HFCs are safe for the Ozone Layer compared to CFCs and HCFCs, but are powerful GHGs when released into the atmosphere. Unfortunately, all refrigeration equipment leaks over time, and all HFCs used in them will eventually reach the atmosphere.

An opportunity to mitigate emissions is by using certified reclaimed refrigerant to charge this refrigeration equipment. The business as usual case is for the sale and use of "Virgin" refrigerant to charge refrigeration equipment. The use of reclaimed refrigerant displaces the need to manufacture new, virgin, refrigerant that will ultimately wind up in the atmosphere.

# A6. PROJECT ACTION

*Describe the project action(s), including:*

- *Description of prior physical conditions*

  At the time this project was commenced, there were no restrictions on production of HFC refrigerants, and the virgin product was abundantly available and inexpensive. Because of the additional costs to recover, transport, and separate/process back to virgin purity levels there is currently little incentive for recovery. In contrast, R-22 production has been phased out as of January 1, 2020, therefore creating a strong incentive to recover and reclaim R-22. A conservative approach to estimate the amount of HFC refrigerant reclaimed was used in the development of this protocol, a rate of 8.9%, based on R-22 reclaim rates.

  Under v2.0 of the Methodology, the reclamation rate has been changed to 2% based on EPA data.

- *Description of how the project will achieve GHG reductions and/or removal enhancements*

  The current "Business as Usual" case is to use virgin refrigerant is to "charge" refrigeration systems, HVAC systems, and other industrial cooling equipment when they are manufactured and installed. These systems are also "charged" when the systems leak during normal operations. Reusing previously used HFC that has been recovered and reclaimed to virgin grade purity, either to "charge" existing systems that require servicing, or in newly manufactured equipment, displaces virgin production and eventual emissions of virgin refrigerant that would otherwise be manufactured to meet that demand. Hudson Technologies is a refrigerant reclaimer and distributor. Hudson sells HFC refrigerants to wholesalers, contractors, and end users of the refrigerant. Per the methodology, it is assumed that any reclaimed HFC refrigerant sold or otherwise transferred from the reclaimer to a distributor, wholesaler, service technician, or an end-user that will be used

- *Description of project technologies, products, services and expected level of activity*

  The project technology is the reclamation of recovered HFCs. Hudson Technologies is the largest approved Refrigerant Reclamation Facility by the US EPA. In the US, the Clean Air Act requires that used refrigerant be processed by an EPA-certified reclaimer and EPA-certified technicians. With patented and proprietary technology, Hudson is an industry leader in refrigerant reclamation services. Hudson processes all recovered refrigerant and processes it to remove oil, water, and impurities so that it meets specifications for new refrigerant gas. To ensure that HFC refrigerants are reclaimed to the proper specifications for the refrigerant aftermarket, reclaimed HFC refrigerants in this project are tested to

confirm they meet the AHRI 700-2015 Standard for Specification for Fluorocarbon Refrigerants

## A7. *EX ANTE* OFFSET PROJECTION

Quantification of ERs is based on the equations found in version 2.0 of the Methodology. 189,916 tCO2eq have already been issued under the previous Methodology 1.1, the outstanding ERs to be issued are 79,887 tCO2eq, the new total ER's for the project is 269,803.

Table 2: Ex-ante Emission Reductions by Species/Blend using Equations provided by Version 2.0 of the Methodology

| Refrigerant Type | Lbs Reclaimed and sold | Annual Consumption (kgs) | 15-yr Emissions Rate | GWP | Emission Reductions |
|---|---|---|---|---|---|
| R-410a | 118,866 | 53,907 | 100% | 2088 | 110,307.65 |
| R-134a | 57,678 | 26,158 | 100% | 1430 | 36,657.57 |
| R-404a | 51,836 | 23,508 | 100% | 3922 | 90,355.91 |
| R-407c | 33,000 | 14,966 | 100% | 1774 | 26,018.67 |
| R-422d | 5,327 | 2,416 | 100% | 2730 | 6,463.43 |
| | | | | **Total** | **269,803.22** |

Table 3: Ex-ante Emission Reductions previously issued ERTs using Equations provided by Version 1.1 of the Methodology

| Refrigerant Type | Lbs Reclaimed and sold | Annual Consumption (kgs) | 10-yr Emissions Rate | GWP | Emission Reductions |
|---|---|---|---|---|---|
| R-410a | 118,866 | 53,907 | 66% | 2088 | 67,602.83 |
| R-134a | 57,678 | 26,158 | 76% | 1430 | 25,869.77 |
| R-404a | 51,836 | 23,508 | 89% | 3922 | 74,672.83 |
| R-407c | 33,000 | 14,966 | 68% | 1774 | 16,428.93 |
| R-422d | 5,327 | 2,416 | 89% | 2730 | 5,341.56 |
| | | | | **Total** | **189,915.79** |

Table 4: Outstanding ERTs by HFC Species/Blends:

| Refrigerant Type | Baseline Emissions (tCO2eq) | Project Emissions (tCO2eq) | Emission Reductions |
|---|---|---|---|
| R-410a | 42,705 | 0 | 42,704.82 |
| R-134a | 10,788 | 0 | 10,787.80 |
| R-404a | 15,683 | 0 | 15,683.21 |
| R-407c | 9,590 | 0 | 9,589.74 |
| R-422d | 1,121 | 0 | 1,121.87 |
| | | | **79,887.43** |

# A8. PARTIES

*List full contact information, roles, and responsibilities for project proponent, other project participants, relevant regulator(s) and/or administrators of any GHG Program(s) in which the project is already enrolled, and the entities holding offset and land title (if applicable).*

**Project Proponent: Hudson Technologies Company**

Hudson Technologies, along with it's sister company Aspen Refrigerants, is the largest reclaimer of refrigerant gas in the United States. Hudson has dedicated professionals around the country whose goal is to make sure refrigerant gas is managed in the most environmentally friendly way possible.

Hudson Technologies is one the largest carbon offset developers under the California Air Resources Board compliance cap and trade program, furthering our goal of safe refrigerant management. Hudson has been involved in the refrigerant market for 30 years servicing Wholesale Distributers, HVAC Contractors, and large End Users throughout the US.

Hudson has purchased, reclaimed, and sold all the quantities of HFCs that make up this project.

Hudson owns the ERTs from this project and is the entity that has registered the project on ACR. Hudson will be responsible for contracting validation and verification services.

Contact Info:

Jonathan Stack
1 Blue Hill Plaza
Pearl River, NY 10965
802-496-3233, jstack@hudsontech.com

# B.
# METHODOLOGY

# B1. APPROVED METHODOLOGY

This project was originally validated and verified according to "*Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from Certified Reclaimed HFC Refrigerants".* Version 1.1, September 2018.

Updated quantification of the Emission Reductions in this document is based on the equations provided by Version 2.0 of the Methodology.

# B2. METHODOLOGY JUSTIFICATION

This project tracks source, reclamation, and sale documentation for the use of certified reclaimed HFC refrigerants to quantify emission reductions from displacing the production and eventual emissions of virgin HFC refrigerants. The chosen methodology provides the quantification framework for the creation of carbon credits from the reductions in GHG emissions resulting from the use of certified reclaimed HFC refrigerants. In Table 3, eligible segments and sectors relevant to this project are highlighted.

| **Project Activity** | **Refrigerant Sector** | **Eligible Segments in Sector** |
|---|---|---|
| Use of Certified Reclaimed HFC refrigerants | Domestic Refrigeration | Residential refrigerators and freezers. |
| | Commercial Refrigeration, also known as Retail Food Refrigeration | Equipment used to store and display chilled and frozen goods for commercial sale such as in supermarkets, convenience stores, bakeries, and restaurants. This equipment includes centralized supermarket systems, remote condensing units, and stand-alone equipment (e.g., beverage vending machines, stand-alone display cases). |
| | Cold Storage Warehouses | Storage for meat, produce, dairy products, and other perishable goods. |
| | Industrial Process Refrigeration | Chemical, pharmaceutical, petrochemical and manufacturing industries, industrial ice machines and ice rinks. |
| | Transport Refrigeration | Refrigerated truck trailers, railway freight cars, ship holds, and other shipping containers. |

| | | |
|---|---|---|
| | Mobil Air Conditioning | Automobiles, trucks, buses, and other motor vehicles. |
| | Stationary Air Conditioning | Comfort cooling for homes and commercial buildings, including multi-family buildings, office buildings, hospitals, universities, shipping malls, airports, sports arenas. |

## B3. PROJECT BOUNDARIES

Physical boundary: The physical boundary is Hudson Technologies at 3402 North Mattis Avenue in Champaign, IL 61822. Hudson Technologies is an EPA certified refrigerant reclaimer. It is the physical and geographical site where the recovered HFC refrigerant is reclaimed in the project for use in equipment operations and servicing/recharging to replace refrigerant that leaks or to charge newly manufactured refrigeration or air conditioning equipment.

## B4. IDENTIFICATION OF GHG SOURCES AND SINKS

*GHG sources and sinks within the project boundaries.*

| SSR | SOURCE DESCRIPTION | GAS | INCLUDED (I) OR EXCLUDED (E) | QUANTIFI - CATION METHOD |
|---|---|---|---|---|
| 1 HFC Production | Fossil fuel emissions from the production of HFCs | $CO_2$ | E | N/A |
| | | $CH_4$ | E | N/A |
| | HFC leaks during HFC production | HFCs | E | N/A |
| 2 HFC Transport | Fossil fuel emissions from transport of HFCs | $CO_2$ | E | N/A |
| | | $CH_4$ | E | N/A |
| | | $N_2O$ | E | N/A |
| | HFC leaks during transport | HFCs | E | N/A |

| | | | | |
|---|---|---|---|---|
| **3** Equipment Manufacture and Installa-tion | Emissions of HFCs during manufacture or installation of equipment or system or product "First-Fill Emissions" | HFCs | I | N/A |
| **4** Equipment Operations | Fossil fuel emissions from the operation of the equipment or system | $CO_2$ | E | N/A |
| | | $CH_4$ | E | N/A |
| | | $N_2O$ | E | N/A |
| | HFC leaks from the operation of the equipment or system or product | HFCs | I | Equation 1 |
| | | $CO_2$ | E | N/A |

| SSR | SOURCE DESCRIPTION | GAS | INCLUDED (I) OR EXCLUDED (E) | QUANTIFI- CATION METHOD |
|---|---|---|---|---|
| **5** Service Equipment | Fossil fuel emissions from servicing equipment or system to replace leaked HFC | $CH_4$ | E | N/A |
| | | $N_2O$ | E | N/A |
| | HFC emissions from servic- ing equipment or system to replace leaked HFC | HFCs | I | Equation 1 |
| **6** Equipment Disposal | Emissions from the disposal of the equipment at end-of-life | HFCs | I | N/A |

## B5. BASELINE

The baseline scenario is the amount of emissions that would take place without the use of certified reclaimed HFC refrigerant. It is equal to the total amount of reclaimed HFC refrigerant produced and the subsequent sale, title-transfer or return to a refrigerant distributor, refrigerant wholesaler, or an end-user for use in refrigeration or air conditioning equipment during the reporting period. In the absence of this project, most of the refrigerant used to recharge the system would have come from virgin HFC production along with some small portion of reclaimed HFCs (current reclamation rate).

The baseline HFC refrigerant reclamation rate has been set to the 2013 reclamation rate for R-22 (8.9%). Reclaimers in the US are required to report to the EPA the quantities for CFCs and HCFCs reclaimed annually. Currently, there are no reporting requirements for HFC reclamation. R-22 production is phased out as of the beginning of 2020.

In contrast, at the time this project took place, there were no restrictions on production of HFCs, and because the additional costs to recover, transport, and separate/process back to virgin purity levels, there is currently little incentive for recovery, reclamation, and re-sale of HFCs. Thus, a conservative approach to estimate the amount of HFC refrigerant that is reclaimed in the baseline scenario was to use the most recent US EPA R-22 reclamation rate when the methodology was written.

The updated methodology that this project is being reverified to (Version 2.0) has an HFC reclamation rate of 2%, which is more reflective of the current reclamation rate in the US per the EPA

## B6. PROJECT SCENARIO

For this project, refrigerant gas HFCs were recovered from various contractors and either returned to Hudson's wholesale partners (and then sent to Hudson), or sold back to Hudson directly in quantities of 500# or less. Hudson Technologies is one of the largest refrigerant reclaimers in the US, however, our HFC reclamation numbers are very low compared to R-22 and other HCFCs.

Hudson received the recovered HFC refrigerant and reclaimed the refrigerant to AHRI standards for re-sell into the refrigerant aftermarket. Hudson specializes in aggregating, reclaiming, and mixing refrigerants. Their knowledge and expertise includes understanding the relationship between refrigerants, oil, and contaminants, as well as the operation of chiller and refrigerant systems.

Hudson holds title to the reclaimed material from the point of receiving it until it is sold back into the US refrigerant market. According to the methodology, it is assumed that any refrigerant sold or otherwise transferred from the reclaimer to a distributor, wholesaler, service technician, or an end-user that refrigerant will be used. In the case of this project, Hudson Technologies was the buyer of the HFCs, the refrigerant reclamation facility, and the seller of the certified reclaimed gas. The sale of reclaimed refrigerant back to the market displaced the production and eventual emissions of virgin refrigerant gas.

## B7. REDUCTIONS AND ENHANCED REMOVALS

All refrigerant that is produced will eventually reach the atmosphere unless destroyed. Currently, there is little incentive to reclaim and reuse HFC refrigerants because of the low costs associated with virgin HFC production. Using reclaimed refrigerant effectively displaces

the use – and therefore avoids production and eventual emissions – of virgin refrigerant. Within the existing reclamation industry, there is capacity to significantly increase reclaimed refrigerant use, and this protocol will incentivize other companies to increase their reclamation numbers. Thus, using reclaimed refrigerant would result in a new GHG reduction. Reclaimed refrigerant can be used both to "charge" newly manufactured equipment and systems, and to "charge" systems that leak during normal operations.

## B8. PERMANENCE

There is no risk of reversal of GHG removal enhancements for project type.

# C.
# ADDITIONALITY

*ACR requires that every project either pass an approved performance standard and a regulatory additionality test, or pass a three-pronged test to demonstrate that the project activity is beyond regulatory requirements, beyond common practice, and faces at least one of three implementation barriers.*

## C1. REGULTORY SURPLUS TEST

There are no requirements on the quantities of reclaimed HFC refrigerants that must be used for any application. Users are free to use virgin HFC, stockpiled HFC, recycled or reclaimed HFC refrigerant in any amount of their choosing. There are regulatory requirements pertaining to certification of the equipment used to recover ODS refrigerants for servicing equipment and the service technicians that handle ODS refrigerants, as well as certification requirements for refrigerant reclaimers. All of these regulatory requirements that apply to ODS refrigerants must be complied with as part of projects involving HFC refrigerants for this project.

Because of the lack of production controls for HFCs at the time of this project commencement, combined with the additional costs to recover, transport, and separate/process refrigerants back to virgin purity levels, there is currently little incentive for recovery, reclamation, and re-sale of HFC refrigerants. Based on U.S. EPA data the Virgin HFC Replacement Rate is extremely low, 2%.

Hudson Technologies is one of the largest refrigerant buyer and seller, and therefore we are constantly monitoring any changes in refrigerant policy from the Federal, State, and local Governments. Hudson is actively participating in discussions around proposed HFC regulations in the State of California that could affect virgin HFC sales in California starting in 2025.

Hudson Technologies follows all laws regarding the handling of refrigerants, all of our refrigerant techs that handle refrigerant are required to hold an EPA 608 license, and all of our equipment that is used to process refrigerants follows all local, state and federal requirements.

## C2. COMMON PRACTICE TEST

**N/A**

## C3. IMPLEMENTATION BARRIER TEST

**N/A**

## C4. PERFORMANCE STANDARD TEST

The Performance Standard Test to determine whether or not there is a low market adoption rate for certified reclaimed HFC Refrigerant was demonstrated in the protocol by a review of EPAs reclamation data, and by EPA's GreenChill Partnership data. The data provided in the methodology shows that because of the low adoption rate, project activities within the certified reclaimed HFC sector qualify for offset credits created under this Methodology.

# D.
# MONITORING PLAN

## D1. MONITORED DATA AND PARAMETERS

| | |
|---|---|
| *Data or Parameter Monitored* | $VR_{\mathbf{hfc,j,rp}}$ |
| *Unit of Measurement* | Kg |
| *Description* | Total quantity of virgin HFC refrigerant that would have been used to recharge equipment during the reporting period, derived from the quantity of monitored certified reclaimed HFC refrigerant that is documented according to the methodology |
| *Data Source* | Hudson's operating records |
| *Measurement Methodology* | Hudson weighs the individual containers of reclaimed HFC refrigerant using calibrated weight Scales |
| *Data Uncertainty* | Low |
| *Monitoring Frequency* | Determined once for each project (which consists only of one reporting period) |
| *Reporting Procedure* | Purchase Orders and receiving records, production records from reclamation, and sales records of certified reclaimed gas |
| *QA/QC Procedure* | Multiple checks are conducted company wide on all aspects of the purchase, reclamation, and sales of reclaimed material. |
| *Notes* | |

# E.
# QUANTIFICATION

## E1. BASELINE

The baseline emissions are the emissions that would take place without the use of certified reclaimed HFCs. It is equal to the amount of HFC refrigerant reclaimed and the subsequent sale, title transfer or return to a refrigerant distributor, refrigerant wholesaler, or an end-user for use in refrigeration or air conditioning equipment during the reporting period. In the absence of the project, most of the refrigerant used to recharge the system would have come from virgin HFC production, and some would come from HFCs that would normally be reclaimed. The baseline calculation takes into consideration the 2% estimated, current Virgin HFC Replacement Rate.

The baseline emissions are calculated as follows:

$$\mathbf{BEHFCrp} = \sum[(\mathbf{VRHFC,j,\ rp} \times \mathbf{GWPHFC,j})] \times (\mathbf{1} - \mathbf{RRBL}) \div 1000$$

$BE_{\mathbf{HCF,j,rp}}$ = Baseline emission during the reporting period (tonnes $CO_2e$)

$VR_{\mathbf{HFC,j,rp}}$ = Total quantity of virgin HFC refrigerant used to recharge equipment during the reporting period (kgs)

$GWP_{\mathbf{HFC,j}}$ = Global warming potential of HFC refrigerant

$RR_{\mathrm{BL}}$ = Baseline Virgin HFC Replacement Rate (% per year). This is the percentage of Virgin HFC that are replaced by reclaimed HFC's, currently estimated to be 2% per year.

For Hudson Tech HFC Reclamation Project 2020-1, the following baseline calculations apply using Version 2.0 of the Methodology

**2019 R-134a Reclamation**

| Parameter | Value |
|---|---|
| $BE_{\mathbf{HCF,j,rp}}$ | 36,657.57 tonnes $CO_2e$ |
| $VR_{\mathbf{HFC,j,rp}}$ | 26,158 kgs |
| $GWP_{\mathbf{HFC,j}}$ | 1,430 |
| $RR_{\mathrm{BL}}$ | 2% |

**2019 R-410a Reclamation**

| Parameter | Value |
|---|---|
| $BE_{\mathbf{HCF,j,rp}}$ | 110,307.65 tonnes $CO_2e$ |
| $VR_{\mathbf{HFC,j,rp}}$ | 53,907 kgs |
| $GWP_{\mathbf{HFC,j}}$ | 2,088 |
| $RR_{\mathrm{BL}}$ | 2% |

**2019 R-404a Reclamation**

| Parameter | Value |
|---|---|
| $BE_{\mathbf{HCF,j,rp}}$ | 90,355.91 tonnes $CO_2e$ |
| $VR_{\mathbf{HFC,j,rp}}$ | 23,508 kgs |
| $GWP_{\mathbf{HFC,j}}$ | 3,922 |
| $RR_{\mathrm{BL}}$ | 2% |

**2019 R-407c Reclamation**

| Parameter | Value |
|---|---|
| $BE_{\mathbf{HCF,j,rp}}$ | 26,018.67 tonnes $CO_2e$ |
| $VR_{\mathbf{HFC,j,rp}}$ | 14,966 kgs |
| $GWP_{\mathbf{HFC,j}}$ | 1,774 |
| $RR_{\mathrm{BL}}$ | 2% |

**2019 R-422d Reclamation**

| Parameter | Value |
|---|---|
| $BE_{\mathbf{HCF,j,rp}}$ | 6,463.43 tonnes $CO_2e$ |
| $VR_{\mathbf{HFC,j,rp}}$ | 2,416 kgs |
| $GWP_{\mathbf{HFC,j}}$ | 2,730 |
| $RR_{\mathrm{BL}}$ | 2% |

## E2. PROJECT SCENARIO

By using previously used, reclaimed HFC refrigerants, this project displaces new production of virgin HFC. Any project related emissions from using reclaimed refrigerant, for example, from transport of certified reclaimed HFCs, are considered negligible and outside the project boundary. Project emissions can be disregarded. The baseline emissions for the reporting period equal the project emissions reductions.

**ERrp = BEHFCrp**

| Parameter | Value |
|---|---|
| Errp | 269,803 tonnes $CO_2e$ |
| Behfcrp | 269,803 tonnes $CO_2e$ |

## E3. LEAKAGE

Projects involving certified reclaimed HFC refrigerant would not increase demand for refrigerant beyond current baseline demand, i.e., use of more reclaimed refrigerant would not cause an increase in virgin HFC production or increase refrigerant emission rates. For this project, leakage can be disregarded.

## E4. UNCERTAINTY

For the purposes of this methodology, it is assumed that from the time any reclaimed HFC refrigerant is sold or otherwise transferred from the reclaimer to a distributor, wholesaler, service technician, or an end-user that refrigerant will be used. There is no ex post uncertainty accounted for in this methodology.

## E5. REDUCTIONS AND REMOVAL ENHANCEMENTS

Project emission reductions during reporting period equals baseline emissions of HFC refrigerant during reporting period.

$$ER_{\mathbf{rp}} = BE\text{hfcrp}$$

## E6. EXANTE ESTIMATION METHODS

Ex-ante Emission Reductions by Species/Blend using Equations provided by Version 2.0 of the Methodology

| Refrigerant Type | Lbs Reclaimed and sold | Annual Consumption (kgs) | 15-yr Emissions Rate | GWP | Emission Reductions |
|---|---|---|---|---|---|
| R-410a | 118,866 | 53,907 | 100% | 2088 | 110,308 |
| R-134a | 57,678 | 26,158 | 100% | 1430 | 36,658 |
| R-404a | 51,836 | 23,508 | 100% | 3922 | 90,356 |
| R-407c | 33,000 | 14,966 | 100% | 1774 | 26,019 |
| R-422d | 5,327 | 2,416 | 100% | 2730 | 6,463 |
| | | | | **Total** | **269,803** |

Ex-ante Emission Reductions previously issued ERTs using Equations provided by Version 1.1 of the Methodology

| Refrigerant Type | Lbs Reclaimed and sold | Annual Consumption (kgs) | 10-yr Emissions Rate | GWP | Emission Reductions |
|---|---|---|---|---|---|
| R-410a | 118,866 | 53,907 | 66% | 2088 | 67,603 |
| R-134a | 57,678 | 26,158 | 76% | 1430 | 25,870 |
| R-404a | 51,836 | 23,508 | 89% | 3922 | 74,673 |
| R-407c | 33,000 | 14,966 | 68% | 1774 | 16,429 |
| R-422d | 5,327 | 2,416 | 89% | 2730 | 5,342 |
| | | | | **Total** | **189,916** |

Outstanding ERTs by HFC Species/Blends:

| Refrigerant Type | Baseline Emissions (tCO2eq) | Project Emissions (tCO2eq) | Emission Reductions |
|---|---|---|---|
| R-410a | 42,705 | 0 | 42,704.82 |
| R-134a | 10,788 | 0 | 10,787.80 |
| R-404a | 15,683 | 0 | 15,683.21 |
| R-407c | 9,590 | 0 | 9,589.74 |
| R-422d | 1,121 | 0 | 1,121.87 |
| | | | **79,887.43** |

# F.
# COMMUNITY & ENVIRONMENTAL IMPACTS

## F1. NET POSITIVE IMPACTS

Positive community impacts from the project include the reduction of emissions and economic benefit to refrigerant recovery technicians/contractors, transportation companies, and the communities around the reclamation facility. HFC refrigerants are the ozone friendly alternative to CFC and HCFC refrigerants, but HFC refrigerants are powerful greenhouse gases. Currently, there is no phase out plan proposed for reducing the production of HFC refrigerants. As discussed, there is currently no incentive to reclaim and reuse HFC refrigerants because of the low costs associated with purchasing virgin from the producers.
Because all HFC refrigerants produced eventually reach the atmosphere, decreasing virgin production creates an emissions reduction. The purpose of this methodology is to transition the refrigerant industry from using virgin HFC refrigerants to using reclaimed HFC refrigerants.

This HFC reclamation project supports Sustainable Development Goals (SDGs) 9 (Industry, Innovation and Infrastructure), 12 (Responsible Consumption and Production), and 13 (Climate Action).

**SDG Goal 9** – Industry, Innovation, and Infrastructure – is met, because the use of reclaimed refrigerant effectively displaces the use and avoids the production and eventual emissions of virgin refrigerant. The industry has little incentive to use reclaimed refrigerant because of abundantly and cheaply available virgin HFC refrigerants. There is capacity to significantly increase reclaimed refrigerant use in the refrigeration reclamation industry.
**SDG Goal 12** – Responsible Consumption and Production – is met because the Project enables the end use of reclaimed HFC refrigerants to service existing and newly manufactured refrigeration and air conditioning equipment.
**SDG Goal 13** – Climate Action – is met because the use of reclaimed refrigerant effectively displaces the use and avoids the production and eventual emissions of virgin refrigerant. HFC refrigerants are powerful GHGs, which contribute significantly to total GHG emissions, and thus anthropogenic climate change. The reclamation and use of reclaimed HFC refrigerant is undertaken voluntarily by all parties with the purpose of reusing existing supplies of HFC refrigerants, reducing GHG emissions, and reducing the impacts caused by refrigerant gas emissions.

There are no negative community or environmental impacts for this project.

## F2. STAKEHOLDER COMMENTS

Not applicable for this project type.

# G.
# OWNERSHIP AND TITLE

## G1. PROOF OF TITLE

Hudson Technologies retains title to all refrigerant and environmental attributes once purchased from the entity selling the material, or transferring it to Hudson for reclamation, destruction and/or resale, as evidenced by payment to customer, or credit memo given.

## G2. CHAIN OF CUSTODY

The offsets from this project have not been bought or sold previously. There is no forward option contract for the offsets from this project.

## G3. PRIOR APPLICATION

Hudson has not applied for GHG emission reduction or removal credits for this project through any other GHG emissions trading system or program.

# H.
# PROJECT TIMELINE

# H1. START DATE

The reporting period start date for this project is January 2, 2019. The reporting period begins on the date that the initial volume of refrigerant is received and reclaimed. The reclaimed HFCs were sold to various participants in the US refrigerant market between January 2, 2019 and December 31, 2019.

# H2. PROJECT TIMELINE

- *Initiation of project activities*
  January 2, 2019
- *Project term*
  January 2, 2019 – December 31, 2019
- *Crediting period*
  January 2, 2019 – January 1, 2034
- *Frequency of monitoring, reporting and verification*
  Initial Project Validation/Verification Date: November 18, 2020
  Re-Verification Validation/Verification Date: September 27, 2022