

**PEER REVIEW COMMENT TEMPLATE**

An *Emission Reduction Measurement and Monitoring Methodology for Use of Reclaimed HFC Refrigerants and Advanced Refrigeration Systems* was prepared by EOS Climate. ACR reviewed the methodology and provided comments to EOS Climate with a revised methodology presented by EOS based on the ACR review process.

The methodology was posted for public comment from March 16 – April 24. Following public consultation, the methodology will be submitted to an expert scientific peer review panel.

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## 1. Background and Applicability

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>Excellent summary of the background and applicability. For the definition of “Low-GWP refrigerant”, which is a GWP less than 20 in this methodology, please note that this differs from the commonly used low-GWP refrigerant threshold of “less than 150” as used both formally and informally – is there a reason why 20 was chosen for this methodology?</p>	<p>A GWP of 150 was first used in draft EU f-gas regulations as a threshold for “low” GWP alternatives, and subsequently adopted by California ARB for their RMP regulation. That number likely originated so that HFC-152a (GWP of 120-140) could be designated in the EU regs as a low-GWP alternative to R-134a for automotive A/C. Since the regulations were first developed in 2007-2009, the availability of non-HFC alternatives, with lower GWP values (below 120-150) has increased. The more salient point is that unlike the EU and ARB regulations, this Methodology does not have different requirements for refrigerants above and below the “low GWP” threshold. Crediting for advanced refrigeration systems is based on the inclusion of a low/zero GWP technology in the overall system design. Therefore, secondary loop and cascade systems that combine refrigerants with a heat transfer medium (such as glycol) are eligible even if the refrigerant in the system is an HFC. So the term “low GWP” is used as a general descriptor rather than an enforcement tool.</p>	<p>OK</p>	

<p><b>General Comment:</b> Agree with Rich Dykstra’s comment that it would be better to split this methodology into two separate methodologies. While distinct sections are used in the latter sections of the document to discuss each reduction option separately, the upfront sections as well as other subsections are not split out. The content would be clearer and streamlined if the methodology were split into two. It is unclear what benefit there is to having them combined.</p>	<p>The two types of projects (HFC Reclaim and Advanced Refrigeration) are combined in the Methodology because of the common focus on HFC and non-HFC refrigerants, with considerable overlap in the background discussions and technical data and references. (The comment that the upfront sections are not split out makes that very point). Splitting into two separate methodologies would result in redundancy, and the potential that as relevant regulations or science evolve, the two methodologies would not always synch. The Methodology is intended to provide clear guidelines for project developers, verifiers and the Registry which we think is achieved by clear divisions and demarcations in the relevant sections and appendices.</p>	<p>The methodology would be clearer and more streamlined if separated into two separate methodologies, and the redundancy would be minimal.</p>	<p>We maintain that it’s good to have a single resource for various participants in the refrigerant sector.</p>
<p><b>Paragraph #1:</b> The comma between the words “in” and “pharmaceutical” should be deleted.</p>	<p>Yes</p>	<p>OK</p>	
<p><b>Paragraph #2:</b> The acronym GHG should be included in parentheses after the first time “greenhouse gases” is used.</p>	<p>Yes</p>	<p>OK</p>	
<p>Paragraph #2: The way this paragraph is written is misleading. (a) It does not clearly explain that HCFCs are also ODS and are also being phased out per the Montreal Protocol and CAA. (b) It should be made clear that HCFCs can</p>	<p>(a) Footnote #1 after the first mention of HCFCs states that “HCFCs also deplete the ozone layer and are being phased out of production the U.S.”</p>	<p>(a) While footnote #1 does specify that HCFCs are ODS, we still do not agree with the last sentence of paragraph 2 that says “These chemicals [referring to HCFCs and</p>	<p>a) See revised language under b) below. b) Again, the purpose of the protocol is to guide project developers and verifiers and</p>

<p>no longer be used in new equipment as of 2010 and that they can only still be used to service equipment in operation. Some of this is covered in footnote #5 but the status of the market/regulations should better described upfront.</p> <p>(c) Also, the statement “CFC production ended in the U.S. in 1996” is not exactly true. Exemptions still exist that allow for the production of CFCs. This should be reworded.</p>	<p>(b) The most germane information for project developers and verifiers is provided “upfront”, with footnotes employed for more peripheral details. Footnote #5 fully covers this information: “Production and import of R-22 is regulated in the U.S. by annual allocations issued by the U.S. EPA, in accordance with the phasedown schedule established in the Montreal Protocol and U.S. Clean Air Act. Until the complete phaseout in 2020, R-22 can only be produced/imported, and used, to service equipment manufactured prior to 2010...”</p> <p>(c) Proposed revision (with footnote) highlighted:</p> <p>“Under the Montreal Protocol and U.S. Clean Air Act, <u>nearly all</u> CFC production ended in the U.S. in 1996.<sup>1</sup></p> <p><sup>1</sup><u>After 1996, the Montreal Protocol authorized limited production of CFCs for “essential uses” as propellants in medical devices (metered dose inhalers relied upon by asthmatics). Essential use production in the U.S. ended on January 1, 2012.</u></p>	<p>HFCs], while safer for the ozone layer...”</p> <p>(b) Also, while footnote #6 does explain that HCFC-22 is also being phased out under the Montreal Protocol, we do not agree that this piece of information is a peripheral detail. The phaseout of HCFCs is a direct driver for the use of HFCs and is also relevant to the advanced refrigeration systems methodology, which talks exclusively about alternatives to HFCs.</p> <p>We suggest the following edits be made to paragraph 2:</p> <p>Up until the mid-1990s, chlorofluorocarbons (CFCs) were in widespread use as refrigerants. CFCs destroy the Earth’s protective ozone layer and are also powerful greenhouse gases (GHGs). Under the Montreal Protocol and United States Clean Air Act, nearly all CFC production ended in the United States in 1996.<sup>1</sup> <b>As a result, most manufacturers transitioned to using hydrochlorofluorocarbon (HCFC) refrigerants, which also contribute to ozone depletion and climate change, although to a lesser extent than CFCs. With the phase out of HCFCs currently underway,<sup>2</sup> the most commonly used refrigerants today</b></p>	<p>is not a historical review or a commentary on different industry drivers.</p> <p>The suggested addition is not entirely correct as many refrigerant applications transitioned directly from CFCs to HFCs in the mid-late 1990s(e.g., automotive air conditioning, domestic refrigerators, refrigerated containers, centrifugal chillers).</p> <p>Below is the revised language in paragraph 2 that has been added:</p> <p><b>As a result, <u>many applications transitioned to using hydrochlorofluorocarbon (HCFC) refrigerants, which also contribute to ozone depletion and climate change, although to a lesser extent than CFCs. With the phase out of HCFCs currently underway,<sup>2</sup> the most commonly used refrigerants today are hydrofluorocarbons (HFCs).<sup>3</sup> HFCs, while safe for the ozone layer, are <u>also</u> powerful GHGs when released to the atmosphere.</u></b></p>
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		<p>are hydrofluorocarbons (HFCs).<sup>3</sup> HFCs, while safe for the ozone layer, are still powerful GHGs when released to the atmosphere.</p> <p>Discussion on the phaseout of HCFCs should then be moved to footnote #2. In the footnote, it is also important to identify that HCFC-22 was the most commonly used HCFC for refrigeration if the discussion is only focused on HCFC-22.</p> <p>(c) CFCs are still being produced today under the laboratory exemption. We suggest revising the footnote to simply say:</p> <p>“After 1996, CFCs have continued to be produced in the United States in accordance with various exemptions authorized by the Montreal Protocol (e.g., Article 5 exemption, essential use exemption and laboratory and analytical use exemption). Today, only minimal production of CFCs is permitted.”</p>	<p>(c) Yes, there remains an exemption for production and import of CFCs for laboratory and analytical uses, and involve extremely small quantities (10 milliliters to 3 liters). The bulk of CFCs (&gt;99%) that were part of the exemption program was for MDIs and those exemptions are terminated. The reviewer’s suggested sentence is misleading in that it suggests that there is continuing permitted production for all of these exemptions.</p> <p>The revised footnote is as follows:</p> <p>Under the Montreal Protocol and U.S. Clean Air Act, <u>nearly all</u> CFC production ended in the U.S. in 1996.<sup>1</sup></p> <p><sup>1</sup><u>After 1996, the Montreal Protocol authorized limited production of CFCs for “essential uses” as propellants in medical devices (metered dose inhalers relied upon by asthmatics) and for laboratory and analytical uses. Production for essential medical uses ended in the U.S. on</u></p>
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			January 1, 2012. The exemption for de minimis CFC production essential laboratory and analytical uses remains in effect.
General Comment: United States should be spelled out when used as noun (e.g., in the United States)	OK	OK Section 3.1.2, paragraph #2 and #4 – U.S. needs to be spelled out	
Paragraph #3: Consider rephrasing “there are at least two types of activities to avoid” to “there are at least two ways to avoid”	Proposed revision: “Across the various refrigeration and air conditioning applications, there are a number of approaches to <u>reduce GHG emissions</u> ; this Methodology is focused on two of these approaches, described below.”	How about “...there are a number of approaches that can be used to reduce GHG emissions...”	OK
Paragraph #3: Recommend moving the sentence “Table 1 lists the sectors that are eligible under this Methodology” to the following page, right before the table. Its placement now doesn’t make grammatical sense and the table on the next page needs an introduction.	OK	OK	
Page 3 Use of Reclaimed HFC Refrigerants: It is recommended that the sentence and three bullets on ways to reduce emissions be moved up before the subheading. These bullets are not relevant to the discussion on reclamation.	Disagree. These 3 bullets describe ways to reduce emissions from installed equipment. Reclamation is another way.	The distinction of the methodologies being split by their applicability to new vs installed equipment is not clear. If this was made more clear upfront than the organization would make more sense. Suggest changing paragraph 3 as follows:  “Across the various refrigeration and air conditioning applications, there are a number of approaches that can	No change made. As stated on page 4 and in Section 1.3, there is potential to utilize reclaimed HFC in newly manufactured equipment. The suggested change does not acknowledge that potentially important use.

		<p>be used to reduce GHG emissions from both new and installed equipment. This Methodology highlights two of these approaches, one that focuses on reductions from installed equipment and one that focuses on reductions from new equipment, as described below.”</p> <p>We also suggest changing the section headings to the following:</p> <ol style="list-style-type: none"> <li>1. Reductions from Existing Equipment: Use of Certified, Reclaimed HFC Refrigerants</li> </ol> <p>Reductions from New Equipment: Advanced Refrigeration Systems</p>	
<p>Page 3 bullets for ways to reduce emissions: the last bullet on “tracking refrigerant across its lifetime” does not in and of itself reduce emissions.</p>	<p>Just like monitoring equipment leaks allows for targeted leak repair, tracking refrigerants provides information to system owners, technicians, distributors, chemical producers on where refrigerants are being lost to enable targeted fixes.</p>	<p>Monitoring and repairing leaks directly leads to reduced emissions. Tracking leaks does not. To reduce the repetitiveness and change the focus, we suggest changing bullet to:</p> <p>“Refrigerant management practices throughout the lifecycle of the refrigerant, from production, distribution, recovery, reclamation, and end-of-life disposal.”</p>	<p>OK</p>
<p>Use of zero/low-GWP alternative technologies: Stand-alone refrigerators-freezers are commonly considered part of commercial refrigeration – listing it separately in the last sentence before Table 1 implies that it’s not; however, the examples in Table 1 for commercial</p>	<p>We will change “stand-alone refrigerator-freezers” to simply “refrigerator-freezers”. Table 1 defines commercial refrigeration broadly as including refrigeration equipment in stores, restaurants,</p>	<p>If refrigerator-freezers are considered within the definition of commercial refrigeration, then they should not be listed separately. In general, there doesn’t seem to be much value in listing any of the sectors in the body</p>	<p>We thought it’s useful to highlight the primary applications of non-HFC refrigerant alternatives (commercial refrigeration and auto A/C) to distinguish from stationary air conditioning but accept the</p>

<p>refrigeration do not clearly exclude it. In general, the refrigerant sectors need to be clearly defined somewhere in the document.</p>	<p>etc., i.e., stand-alones as well as systems.</p> <p>Intent of Table 1 is to clearly define the refrigerant sectors. I don't see any comments on the table itself.</p>	<p>text. We recommend deleting the entire clause "...used for..."</p> <p>Also, to better clarify what is meant by an 'advanced refrigeration system' it is recommended that the paragraph be revised as follows:</p> <p>"These alternatives include hydrocarbons, ammonia, carbon dioxide, and hydrofluoro-olefins (HFOs). In some advanced systems, these alternatives completely replace the use of HFC refrigerants, while in other advanced systems these alternatives are used in combination with HFCs. Under this Methodology, secondary loop and cascade refrigeration systems, which often use HFC refrigerants in combination with low-GWP alternatives, are eligible within this project activity category. <del>Secondary loop systems will result in lower overall emissions (as compared to systems employing only a high GWP refrigerant) through the combination of a heat transfer medium (such as glycol) and cascade systems may employ a zero/low GWP refrigerant within the system.</del>"</p> <p>The 'definitions' in Table 1 generally describe the end-use sectors, not the system type. Based on these definitions of eligibility, it implies that stand-alone refrigerator-freezers are</p>	<p>suggested revision with the following small changes.</p> <p>"These alternatives include hydrocarbons, ammonia, carbon dioxide, and hydrofluoro-olefins (HFOs). In some advanced <u>commercial refrigeration</u> systems, these alternatives completely replace the use of HFC refrigerants, while in other advanced systems these alternatives are used in combination with HFCs Under this Methodology, secondary loop and cascade refrigeration systems <u>used in supermarkets, for example,</u> which often use HFC refrigerants in combination with refrigerants that have lower GWPs (such as carbon dioxide) or a heat transfer medium (such as glycol), are eligible within this project activity category. <del>Secondary loop systems will result in lower overall emissions (as compared to systems employing only a high GWP refrigerant) through the combination of a heat transfer medium (such as glycol) and cascade systems may employ a zero/low GWP refrigerant within the system.</del>"</p>
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		<p>eligible for credits under the methodology. Is this accurate? Also, what about cold storage warehouses that are not consumer-facing? Our concern with this is that the baseline emissions calculation is based on remote commercial refrigeration equipment used in retail locations – not stand-alone equipment, cold storage warehouses, or industrial equipment, which all would require different baseline assumptions.</p> <p>If table 1 is intended to clearly define the eligible sectors, then the last column should be labeled “sector definition” (not “example segments in sector”) and the definitions should be more precise.</p> <p>On a somewhat related note, a significant portion of cold storage and industrial systems (which are defined as eligible sectors for the adv ref methodology) already use ammonia. This reality conflicts with the definition for ‘eligible refrigerant sector’ in Table 2. In general, it seems unnecessary to include a definition for “eligible refrigerant sectors” in Table 2. We recommend deleting.</p>	<p>Table 1 now states the specific segments in each sector that are eligible (i.e. “example” has been restated to “eligible” in the right column). Stand-alone units within retail food refrigeration remain eligible and this is more explicitly stated in Table 1. Cold storage warehouses and Industrial Process refrigeration have been removed from eligibility under Advanced Refrigeration Systems.</p> <p>Stand-alone equipment used within the Retail Food Refrigeration segments found in Table 1 remain eligible. We have added baseline defaults for stand-alone units to Table 7.</p> <p>Leak rates for stand-alone retail food refrigeration are already found in Table 10.</p>
<p>On page 4: “greenhouse gas emissions (GHGs)” should be revised to “GHG emissions” – GHG is already used on</p>	<p>OK</p>	<p>OK</p>	

<p>the previous page and needs to come before the word emissions.</p>			
<p><b>Definitions:</b>  Low-GWP refrigerant – what is the basis for using 20 as the threshold?</p>	<p>See response on 1<sup>st</sup> page of this document.</p>	<p>The description on pg. 1 identifies why the 150 GWP threshold was not used; it does not explain why 20 was selected as the threshold.</p>	<p>”Low GWP refrigerant” and references to “low GWP refrigerant” have been removed from the methodology when referred to as a defining characteristic of an eligible advanced refrigeration system. The concept is not necessary as a project developer must decide whether it is economically feasible to develop a project through a comparison of baseline and project scenarios. For instance, an advanced refrigerant system with a lower emissions profile (even if still using HFC coupled with CO<sub>2</sub>) is eligible, but there is no requirement that the secondary refrigerant be “low GWP”. If the system results in fewer emissions, as compared to baseline, it is eligible. However, only those systems that result in significant emission reductions are likely to be developed as emission reduction projects due to the transaction costs which must be considered.</p>
<p>Section 1.1 (page 3)- suggest revising the third bullet point to read  <b>“Refrigerant management practices that track</b> refrigerant across its</p>	<p>OK</p>	<p>OK</p>	

lifecycle, from production, distribution, equipment <b>maintenance and repair, recovery</b> , reclamation and end-of-life destruction”			
Section 1.1, Footnote 4 (page 3) – suggest revising to read “Reclaimed refrigerant <b>is used (recovered) refrigerant that has been processed and tested</b> by an EPA certified reclaimer <b>and certified to meet the AHRI 700 Standard for Specifications for Fluorocarbon Refrigerants.</b> ”	ok	OK	
Section 1.1, Footnote 5 (page 4) – EPA issued a final rule in October 2014 which established and fixed annual allocations for the periods 2015-2019, therefore suggest revising comment to read “...greater use of reclaimed R-22 absolutely has positive environmental benefit, <b>and that benefit was accounted for</b> by the EPA in determining the annual R-22 allocations. ...”	Yes	OK	
Section 1.2 Definitions: - Suggest adding a <b>definition for AHRI to be: “Air Conditioning, Heating, and Refrigeration Institute”</b> . (a)  - Suggest revising the definition of Certified Reclaimed HFC Refrigerant to read – “ <b>Used (recovered) HFC refrigerant that has been reclaimed to meet the AHRI 700 Standard for Specifications for Fluorocarbon</b>	<ul style="list-style-type: none"> <li>a- AHRI now spelled out where it is first mentioned (footnote 7)</li> <li>b- yes</li> <li>c- The methodology requires the most current version of the AHRI 700 Standard</li> <li>d- ok</li> </ul>	<ul style="list-style-type: none"> <li>a. Section 1.2 Definitions: In definitions (and throughout document), suggest using the term “Certified Reclaimed HFC refrigerants” without a comma (,) between Certified Reclaimed. The comma suggest two different criteria.</li> <li>b- Section 1.2 Definitions: Suggest revising the definition of Certified Reclaimed HFC Refrigerant</li> </ul>	<ul style="list-style-type: none"> <li>a. ok</li> <li>b. ok, AHRI 700-2015</li> <li>c. The sentences suggested to be removed (“Reclaimer must have paper or electronic records that document the source (facility, equipment) and chain-of-custody of the reclaimed refrigerant and</li> </ul>

<p><b>Refrigerants by an EPA certified reclaimer utilizing equipment listed by the reclaimer to the EPA, and tested by an AHRI certified refrigerant testing laboratory to meet the AHRI 700 Standard.</b> Reclaimer must have paper or electronic records that document the source and chain of custody of the used refrigerant and physical address where reclamation is conducted.” – <b>omit words “(this must match the address of the certification granted by EPA.)” See comment to Section 5.2.1. below.</b> (b)</p> <p><b>NOTE</b> – EPA regulations have adopted the AHRI 700-1995 standard. Consider whether to utilize the standard required by EPA or the current AHRI 700 standard.(c)</p> <p>- Should harmonize language in definitions of CFC, HC, HCFC, HFC and HFO, so each start with: “A class of compounds containing...”(d)</p> <p>-Reference to hydrocarbons should be deleted from definition of HCFC.(e)</p> <p>-In definition of Project Activity, suggest following changes:  - Item “2)”, change to read “The reclamation and use of certified, reclaimed HFC refrigerants <b>in newly</b></p>	<p>e- ok – technically correct but could be confusing to mention hydrocarbons as part of HCFCs</p> <p>f- ok</p> <p>g- yes, intent is to include appliances. We can add that term.</p> <p>h- OK</p> <p>i- Production by the reclaimer.</p> <p>j- Yes</p>	<p>to refer to the most current version of the AHRI 700 standard and</p> <p>c-to remove from the definition the last two sentences altogether since they are not relevant to the definition, but rather relate to the eligibility for the project. Believe that a discussion as to records and sources should be covered in Section 5.2.1. Therefore, suggest the definition should read as follows: “Used (recovered) HFC refrigerant that has been reclaimed by an EPA-certified reclaimer to meet the <b>most current version of the</b> AHRI 700 Standard for Specifications for Fluorocarbon Refrigerants by an EPA certified reclaimer utilizing equipment listed by the reclaimer to the EPA, and tested by an AHRI certified refrigerant testing laboratory to meet the AHRI 700 Standard.”</p> <p>d- Section 1.2 Definitions: In definition of “Refrigeration or air conditioning equipment” should capitalize the word Appliance and insert a footnote to refer to the EPA definition of “Appliance” to mean “any device which contains and uses a refrigerant and which is used for household or commercial purposes, including, without limitation, any air</p>	<p>physical address where reclamation is conducted. The HFCs can originate either from refrigeration or air conditioning equipment, or discarded aerosol products.”) are important specifications. We can remove from definition but will make sure those points are covered in the methodology.</p> <p>d. Ok</p> <p>e. A description of advanced refrigeration systems is found on page 4. Additionally, a footnote has been added that refers a reader to U.S. EPA’s discussion of advanced refrigeration. As discussed herein, the concept of “low GWP” has been removed as it is not a requirement of an advanced system.</p>
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<p><b>manufactured</b> refrigeration or air conditioning equipment.” (f)  <b>Also, does this include appliances (e.g. refrigerators), water coolers, etc.?</b>  <b>Should “refrigeration and air conditioning equipment be further clarified and/or defined? (g)</b>  -Item “3)”, change to read <b>“Use of Low-GWP refrigerant in newly manufactured commercial and industrial process refrigeration.” (h)</b></p> <p>- In definition of “Use of certified, reclaimed HFC refrigerant”:  -Don’t understand the use of the word “Production” – is it production of reclaimed refrigerant by the reclaimer, or the production of the refrigerant by the manufacturer? If the latter, why is that necessary? (i)  - suggest change to read “Transfer /return/sale of certified, reclaimed <b>HFC</b> refrigerant to refrigerant distributors, wholesalers, <b>original equipment manufacturers,</b> or refrigerant end users who are in the business of selling or using <b>HFC</b> refrigerant ...” (j)</p>		<p>conditioner, refrigerator, chiller, or freezer.” 40 CFR §82.3</p> <p>e- Section 1.2 Definitions: There is no actual definition of “Advanced Refrigeration System”. Suggest adding a clear definition. Also, please clarify whether the definition includes a system that utilizes a low-GWP refrigerant. If there is a distinction, then suggest having a separate definition for a system utilizing a low-GWP refrigerant.</p>	
<p>Section 1.3:  - In first paragraph, correct numbering to 1,2,3 (now reads 4,5,6);(a)  - Numbered paragraph “4)”, suggest change to read: “the reclamation and use of certified, reclaimed HFC</p>	<p>a-yes  b-yes  c-ok  d-ok</p>	<p>Section 1.3,  a- Suggest adding a new paragraph to read: <b>“For purposes of this Methodology, “installing newly manufactured commercial and industrial process refrigeration”</b></p>	<p>a- The methodology has been revised with the following language: <b>For purposes of this Methodology, “installing newly manufactured</b></p>

<p>refrigerants to service existing <b>HFC</b> refrigeration and air conditioning equipment.” (b)</p> <p>- Numbered paragraph “5)”, suggest change to read: “the reclamation and use of certified, reclaimed HFC refrigerants in <b>newly manufactured</b> refrigeration and air conditioning equipment.”(c)</p> <p>- Number paragraph “6)”, suggest change to read: “deployment of <b>Low-GWP refrigerant in newly manufactured commercial and industrial process refrigeration equipment.</b>” (d)</p> <p>-in paragraph “c)” should use defined term of “<b>certified, reclaimed HFC refrigerant</b>” in first line; (e)</p> <p>- in paragraph “d)”, suggest changing to read: “<b>For a project activity that involves the replacement of CFC–based equipment with either: (i) HFC-based equipment where certified, reclaimed HFC refrigerant is used exclusively, or (ii) newly manufactured equipment using Low-GWP refrigerant; any CFCs in the original equipment must be recovered and either reclaimed for re-use or destroyed ...</b>” (f)</p>	<p>e- the reference is to the definition of reclaimed HFC refrigerant in this Methodology so no need to repeat that definition</p> <p>f- For projects where replacement of CFCs is conducted, the CFC must be destroyed (not reclaimed). If CFCs were allowed to be reclaimed/reused, this would result in leakage which is not allowed via a carbon offset methodology. Additionally, the methodology does not track end use of the reclaimed refrigerant and therefore this comment is only relevant for advanced systems.</p>	<p><b>refers specifically to (i) the complete replacement of CFC, HCFC or HFC – based equipment (including all components) with an advanced refrigerant system, or (ii) the installation of newly manufactured equipment using low GWP refrigerant (or an advanced refrigeration system) in new construction or as a new and additional system at a facility.</b></p> <p>b- Section 1.3, subclause (e) Refers to “replacement of HFC-based equipment with an advanced refrigerant system”, but subclause (f) refers to “newly manufactured equipment using low-GWP refrigerant”. As stated above, there is no definition for Advanced Refrigerant system. What is the distinction between and advanced refrigerant system and equipment using low-GWP refrigerant? If none, should use consistent in terminology.</p> <p>c- Section 1.4.1.b. – this provision states that the reclaimed refrigerant is to be sold or returned to use to an “end-user ... who is in the business of ... using refrigerant, for use in refrigeration or air conditioning</p>	<p><b>commercial refrigeration” refers specifically to (i) the complete replacement of CFC, HCFC or HFC –based equipment (including all components) with an advanced refrigerant system at an existing facility, (ii) the installation of an advanced refrigeration system as a new and additional system at an existing facility, or (iii) the installation of an advanced refrigeration system in new construction.</b></p> <p>b- The methodology has been revised per the above comments.</p> <p>c- The clause has been modified as follows: Emission reductions shall be quantified for a period not to exceed 12 months based on the total amount of certified reclaimed HFC produced and the subsequent sale, title transfer or return to a refrigerant distributor,</p>
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		equipment.” Suggest simply clarifying that an end-user does not need to be “in the business” of using refrigerant, but simply that the end-user is using the reclaimed refrigerant in equipment. (this same language is found throughout the methodology)	refrigerant wholesaler, or an end-user (either through direct sale, title transfer or return to an end user or through installation conducted via service technician) for use in refrigeration or air conditioning equipment.
Section 1.1 - Either add “natural” to this sentence or remove the word “chemical.” It seems irrelevant to the point whether coolants are chemical or natural, so I’d remove it. (These diverse applications typically rely on refrigerants, the chemical coolants that can reach low temperatures ...)	Ammonia, CO2, hydrocarbons are chemicals just like fluorinated chemicals. The descriptor (chemical) is because coolants are often thought of as products like antifreeze.	OK	
Section 1.1 - Just a grammar correction: “While some older equipment still contain CFCs, the most commonly used ...” “Contain” should be plural.	OK	OK	
Section 1.1 - “For the large installed base of HFC-based equipment and infrastructure that will continue to operate, there are a number of ways that emissions can be reduced:” I’d put some kind of indication that this is just a list of examples. You could just add a “for instance.”	Ok, intent was to be comprehensive.	OK	
You might want to think about clarifying that when you refer to HFCs, you are not including HFOs in that definition. Environmental groups especially take great pains to point out	On p 4 and subsequent tables in the Methodology, HFOs are included in list of non-HFC alternatives.	OK	

<p>that HFOs are really just lower GWP HFCs.</p>			
<p>Section 1.1 - What are you including in commercial refrigeration? In this sentence (These alternatives include hydrocarbons, ammonia, carbon dioxide, and hydrofluoro-olefins (HFOs) used for commercial refrigeration, stand-alone refrigerator-freezers, and automobile air conditioning) you refer to commercial refrigeration and then you refer to stand-alone refrigerator-freezers. There are commercial stand-alone refrigerators and there are residential stand-alone refrigerators, i.e. the standard home refrigerators).</p>	<p>See response above. We will simply use term “refrigerator-freezers”. Commercial refrigeration in Table 1 refers generally to refrigeration equipment in stores, restaurants, etc so stand-alones would be included.</p>	<p>You list “cold storage” under commercial refrigeration, but cold storage is generally thought of as industrial refrigeration. I think what you are referring to within the commercial sector is “cold rooms,” while cold storage is thought of in the warehouse context.</p>	<p>Correct. We have clarified in Tables 1 and 9.</p>
<p>It is unclear to me whether you are including the replacement of high GWP HFC self-contained units in supermarkets with natural refrigerant self-contained units. You refer to commercial refrigeration, which also includes commercial self-contained units. The transition of existing SC units that are in stores now from high GWP HFCs to natural refrigerants will be a very important one over the next 3 years. It is important to offer additional motivation for people to decommission their existing 404A self-contained units and replace them with hydrocarbon self-contained units. The potential volumes are substantial: average of 12</p>	<p>See above</p>	<p>I’m not sure what I’m supposed to be seeing “above.” I understand that you are including self-contained units in the definition of commercial refrigeration equipment, but that doesn’t answer whether replacing high GWP HFC self-contained cases with hydrocarbon or HFO cases qualifies under what is now called the advanced refrigeration credit. Under advanced refrigeration, you define several types of systems, but you don’t mention whether you can get credits for exchanging self-contained units.</p>	<p>Methodology clarified to state that self-contained cases are eligible.</p>

<p>self-contained units per store, each with a pound of HFC.</p>			
<p>Are you aware that all of the HFOs that are approved for use supermarket systems are HFO blends, which have GWPs in the hundreds? The only part of commercial refrigeration that can use very low GWP HFOs is in self-contained. There is nothing wrong with that; I just want to point out that the use of existing HFO blends for commercial systems will be excluded from credits.</p>	<p>New commercial refrigeration equipment or systems that use HFO blends would be eligible for credits. HFO-based primary and secondary systems are eligible under advanced refrigeration systems as the emissions associated with these systems will be lower than baseline systems in common practice. It is up to a project developer to analyze the emission reduction opportunity to determine if it is economic to develop a carbon offset project based on baseline and project scenarios.</p>	<p>OK</p>	
<p>Do you want to define an HFO blend, as they are the most commonly used HFOs in every refrigeration/AC sector other than MVAC.</p>	<p>See above</p>	<p>OK</p>	
<p>Do you want to stipulate somewhere that the refrigerant under consideration for these projects has to be approved for the end use by SNAP? We are seeing an alarming number of cases of illegal use of hydrocarbons in end uses that have not yet been found acceptable by SNAP. It might also be important to stipulate that it be verified that all the SNAP use conditions be followed as required for refrigerants</p>	<p>Added</p>	<p>OK</p>	

<p>that have been found acceptable subject to use conditions.</p>			
<p>The phrase “use of ... HFC refrigerants in the manufacture of new ... equipment...” seems strange to me. It seems to refer to refrigerants that are used to manufacture the equipment. Don’t you mean that the refrigerants are used to charge newly manufactured equipment? Can you use the term “factory-charged” or “pre-charged” equipment? (it makes more sense the way it is phrased in the 1st paragraph of section 2.1.</p>	<p>Language in prior comment will be used: “Use of <b>Low-GWP refrigerant in newly manufactured commercial and industrial process refrigeration equipment.</b>”</p>	<p>OK</p>	
<p>Under section 1.3, are you excluding the use of reclaimed HFC refrigerants in R-22 retrofits? That use of HFCs is not considered servicing, and it’s not considered new equipment. It is a very important potential use of reclaimed HFC refrigerant. Why make someone retrofit into virgin HFC refrigerant and then give them credit for servicing with reclaimed HFCs after that. The volumes should be higher for re-charging retrofitted systems than they are for servicing.</p>	<p>If the commenter is suggesting that the Methodology would “make someone retrofit” their R-22 system “into” HFC refrigerant – whether it is virgin HFC or reclaimed HFC - that is not the case. The Methodology enables crediting when reclaimed HFCs are produced and put into commerce by the reclaimer – the credits are not issued based on which specific systems or facilities ultimately acquire the reclaimed gas. If a system owner makes a decision to retrofit their system from R-22 to an HFC refrigerant (for which there are significant economic considerations – e.g., energy performance - that go beyond this Methodology), and if that system owner wants to use reclaimed HFC</p>	<p>No, that wasn’t the point. I am asking why #1 and #2 under applicability conditions do not allow for retrofits of existing R-22 systems with reclaimed HFC instead of virgin HFC as a “project activity.” The use of reclaimed HFC in R-22 retrofits does not currently fit under 1), because you are not using the reclaimed HFC to <u>service existing equipment</u>, and it does not fit under 2), because an R-22 retrofit does not involve <u>newly manufactured equipment</u>.</p>	<p>The end use of certified, reclaimed HFC is not tracked (i.e. the credit is created when the certified, reclaimed HFC is returned to commerce). Therefore, R-22 retrofits, as described here, are automatically eligible. To avoid confusion, what is now 1) under Section 1.3.1 has been modified as follows:</p> <ol style="list-style-type: none"> <li>1) the reclamation and use of certified, reclaimed HFC refrigerants to service existing HFC refrigeration and air conditioning equipment,</li> </ol>

	refrigerant, there is no guarantee any GHG credits would be transferred by the reclaimer along with the gas itself.		
You should define the word “retrofit.” Most of the world understands retrofit to mean a change made to existing equipment, i.e., retrofit cases to use LED lights. In refrigeration, we have a much more specific definition.	Because of the ambiguity regarding the definition of “retrofit” in different contexts, we have removed language referring to retrofits. We now state that advanced refrigeration systems can be installed at new or existing facilities. This clarifies that, for an existing facility, an advanced refrigeration system is not considered to be a “retrofit” of an old system.	See above question about whether retrofitting an existing R-22 system with reclaimed HFC qualifies. That would not be an advanced refrigeration system.	The methodology has been clarified per the above change.
Section 1.3 – 4) This sentence is confusing to me: “the reclamation and use of certified, reclaimed HFC refrigerants in the manufacture of new refrigeration or air conditioning equipment.” How can you reclaim refrigerants in the manufacture of new equipment? Shouldn’t it read “the use of certified, reclaimed HFC refrigerants ...”	Revising language as described above	OK	
Section 1.3 6) - does this include self-contained commercial units?	See above for revision	OK	
In this sentence (and subsequent sale, title transfer or return to a refrigerant distributor, wholesaler, or end-user who are in the business of selling refrigerant, or using refrigerant, for use	Reclaimers may sell to large contractors in addition to distributors so we can add service technicians to this list.	OK	

<p>in refrigeration or air conditioning equipment) do you consider sec contractors to be end-users? Normally, they are not considered to be the end-users, but they are often the people who purchase the refrigerant that is then charged into the end-users equipment.</p>			
<p>Section 1.3: Do you want to stipulate what has to be done with used R-22 in projects where R-22 systems are retrofit into reclaimed HFCs?</p>	<p>For any R-22 system that is retrofitted to use HFCs, EPA regulations would require that the R-22 be recovered, i.e., not vented. It would be up to the refrigerant owner (e.g., the facility owner or manager) to determine the most advantageous disposition of the R-22 – whether reclamation or possibly destruction. In either case, the project proponent would be required to comply with any other relevant EPA regulations.</p>	<p>OK</p>	

## 2. Project Boundaries

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>Table 3 – Equipment Operation – Under what circumstances would CFC/HCFC leaks be applicable?</p>	<p>This was a remnant of an earlier version. The baseline scenario for a new commercial or industrial refrigeration system is HFC-407C so CFC or HCFC leaks would not be applicable. The Protocol will be corrected.</p>	<p>OK</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>The table reference in the text for Table 3 needs to be revised, as the table shows what is and is not included in the project boundary, not the emission rates of refrigerants during equipment operations.</p> <p>Also, all of the table cross-references need to be fixed.</p>	<p>Looks like a recurring glitch. Yes, will be corrected.</p>	<p>OK</p>	
<p>Section 2.1, second paragraph (p.8) - suggest change to read: “For projects deploying <b>newly manufactured equipment using Low-GWP refrigerant</b>, the project boundary, ... site where the <b>Low-GWP refrigerant is installed in newly manufactured equipment</b>, as well as the locations involved in disposal of the older technology, including <b>reclamation or destruction of the CFC refrigerant (if applicable)</b> in the older system that is replaced.(a)</p> <p>- Need definition of SSR</p>	<p>(a) language modified (b)SSR is defined in the definitions section</p>	<p>2.1, 2<sup>nd</sup> paragraph – in connection with an advanced refrigeration system, the revised draft requires destruction of any CFCs and HCFCs from the older system. Requiring destruction of these products, particularly HCFCs, make it more likely that other CFC or HCFC systems will be replaced with HFC systems due to both reduced availability of these products and due to cost of destruction. Unless the credits more than offset the destruction cost, this methodology will not promote use of advanced refrigeration systems.</p>	<p>CFCs and HCFCs are required to be destroyed under this Protocol to ensure there is no transfer of GHG emissions outside the project boundary. It will be up to the project developer to determine the economics.</p>
<p>Note “Error” reference on page 9 in middle paragraph. Insert omitted text.</p>	<p>Yes</p>	<p>OK</p>	
<p>Section 2.1 - second paragraph: What about when high GWP HFC equipment is replaced with low GWP equipment? Do you really want to require that the</p>	<p>The Protocol has been revised to clearly state that CFCs and HCFCs recovered from older equipment that is replaced by new commercial or industrial refrigeration equipment</p>	<p>Why do you want to destroy the used HCFC? The used HCFC may be sold to a reclaimer or reused in other equipment owned by the same company.</p>	<p>HCFCs are required to be destroyed under this Protocol to ensure there is no transfer of GHG emissions outside the project boundary. It will be up to</p>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
HFC refrigerant in the older equipment be destroyed?	be destroyed. There is no requirement for destruction of HFC refrigerant when new equipment is replacing HFC-based equipment (protocol requires HFC to be reclaimed).		the project developer to determine whether to embark on a project knowing that the HCFC will have to be destroyed.
Section 2.1 - Figure 1: Isn't installation exactly where you want the project to take place? That is when the refrigerant is added?	Good catch. Originally we had separate figures for the 2 types of projects. The blue dotted line that represents the project boundary for installation of new low-GWP commercial/industrial equipment should have been drawn to include equipment installation. Projects involving use of reclaimed HFC refrigerant (black dashed line) would not include equipment installation	OK	
Section 2.1 - Table 3: Why are the emissions of HFCs during the installation of equipment excluded?	See above.	OK	

### 3. Baseline Determination and Additionality

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
The reclaim rate of HFCs set equal to HCFC-22 at 8.9% is clearly too high, although using the most conservative estimate to avoid over-counting reductions is commendable. Would it be reasonable to set the reclaim rate	We took the most conservative approach conceivable, understanding that the reclaim rate for HFCs will be significantly lower compared to R-22, as noted in the Protocol. We believe assuming half of the R-22 rate is	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>of HFCs at one-half that of HCFC-22? (Even this reclaim rate may be too high.) I doubt if anybody could object to a reclaim rate of 4.45% for HFCs, which is still probably generous. Although the U.S. EPA does not report on reclaimed HFC amounts, the CA Air Resources Board may have collected data on reclaimed HFC amounts.</p>	<p>reasonable but will want other input from US EPA, ARB or other experts.</p>		
<p>In section 3.2.1, paragraph headed “Zero/low-GWP Refrigeration Technology”, the HFC blend proposed for prohibition in new systems is R-507A (not R-510A).</p>	<p>The Protocol will be updated to reflect the final EPA SNAP rule, published on July 20, 2015.</p>	<p>OK</p>	
<p>Directly before Table 4 it is mentioned that manufacturing and installation losses are less than 1% and therefore negligible. What is the source for this assumption? Recommend adding citation. Also, see Table 7.9 in IPCC 2006, which identifies initial losses that are as high as 3%.</p>	<p>If the IPCC rate of 3% is the most up to date and accurate we will use that. We are reviewing the latest EPA VM as well. This would not affect the Protocol either way for projects involving use of reclaimed HFC refrigerant; emissions of using virgin HFC refrigerant (baseline) or using reclaimed HFC (project) would be the same in scenarios involving newly manufactured equipment.</p>	<p>OK – the VM does not currently account for losses during manufacturing; however, EPA is in the process of incorporating these losses into the model, using assumptions consistent with IPCC, unless other data is available. Regardless of what assumption is used, it should be citable.</p>	<p>The Protocol will be updated as the EPA Vintaging Model is updated</p>
<p>The Table reference in the text for Table 4 needs to be corrected. Text should also say “Table 4 lists the...” rather than “Table 4 lists he...”</p>	<p>ok</p>	<p>OK</p>	
<p>Table 5: Reference in text includes a hard return after it, which needs to be deleted.</p>	<p>Ok – part of the technical glitch – will fix</p>	<p>OK</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
Table 5: Suggest ordering the refrigerants by either GWP or numerically; currently, the order appears random.	ok	OK	
Table 6: Why is Table 6 included under section 3.1.1? This table seems more relevant to the low/zero GWP methodology. The table should be introduced somewhere in the text to explain its relevance. Also, the word “selected” in the table heading should be changed to “select” or “key”.	Correct; glitch will be fixed	OK	
<p>Section 3.1.2, 4<sup>th</sup> paragraph: The example given on “retrofitting an existing supermarket to a secondary loop system” is not appropriate, since a change to this type of system design would require wholesale system <i>replacement</i> (not simply a refrigerant retrofit).(a) Additionally, secondary loop systems typically use an HFC as the primary refrigerant and would not necessarily be eligible for credits under this methodology. Eligibility is based on refrigerant type not system design; therefore, mentioning secondary loop systems in this context is confusing.(b)</p> <p>In addition to the above, while retrofits of HFC systems to low-GWP systems may occur when new low-GWP refrigerants (e.g., HFO blends)</p>	<p>(a) Retrofit is used in different ways; the intention here was on installation of a new, low GWP system to replace an existing, high GWP system in existing facility. The language regarding “retrofits” nevertheless been removed for clarity.</p> <p>(b) Secondary loop systems that use HFC as the “primary” refrigerant would absolutely be eligible. Section 1.1 has been clarified to specifically state that secondary loop and cascade systems are eligible.</p> <p>(c) The term “retrofit” has been removed. Only SNAP acceptable alternatives are eligible under this Protocol, as stated elsewhere in the document.</p>	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>become available, refrigerants with a GWP of less than 20 are not currently SNAP-approved for use as a retrofit. Therefore, we suggest modifying this paragraph to make clear that the methodology includes scenarios where “existing commercial/industrial refrigeration systems are retrofitted to or replaced by zero/low GWP refrigerants/technologies.” It may also be helpful to define what is meant by the term “retrofit” and to clarify that “low-GWP” retrofit refrigerants (as defined for this Methodology) are currently not available. (c)</p>			
<p>Table 7 - Refrigerant Charge Baseline: To calculate baseline emissions for newly installed systems, it does not make sense to apply a default charge size assumption of 3,500 lbs for all systems. Commercial and industrial refrigeration systems vary significantly in size, which makes the flat assumption of 3,500 lbs not necessarily appropriate. Instead, it is recommended that the default charge size be calculated based on the cooling capacity of the system. For example, a 3500 lb system is usually associated with an average sized supermarket that has 1,000 MBTU/hr of cooling capacity. A baseline ratio of 3.5 lb/MBTU/hr could then be used to</p>	<p>The 3500 lb charge for an average system was based on input from the EPA GreenChill Partnership program manager and the GreenChill website (“Most of the 35,000+ supermarkets in the United States use centralized direct expansion (DX) systems to chill their products. Typically, these refrigeration systems are charged with 3000 – 4000 pounds of refrigerant and can leak in excess of twenty percent of their charge each year.”) We made a revision to use the baseline ratio of 3.5 lb of refrigerant charge per MBTU/hr of cooling capacity of the new system - what is the proper citation to use?</p>	<p>While an average charge size is useful for analyzing the entire sector, it is not an accurate way to analyze individual systems that vary significantly in size.  Unfortunately, the baseline ratio assumption (which is only really used to estimate environmental benefits) is not clearly documented in any of the publicly available GreenChill resources. However, the certification criteria ratios, which range from 0.5 – 1.75 lbs/MBTU/hr are found here: <a href="http://www2.epa.gov/greenchill/greenchill-store-certification-criteria">http://www2.epa.gov/greenchill/greenchill-store-certification-criteria</a>  Resources that do identify a ratio include the following:</p>	<p>OK, great input. Much appreciated. We were using the ratio of 3.5 lbs per MBTU/hr based on a comment from another reviewer who cited the GreenChill program approach. Based on the collective comments, and the data summarized here, we will retain the approach of using a baseline ratio of lbs/MBTU/hr. We will use the average of the different inputs cited here:</p> <ul style="list-style-type: none"> <li>• 2.43</li> <li>• 2.68</li> <li>• 2.58</li> </ul>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>calculate a baseline charge size using the actual cooling capacity of the system, which can then be incorporated into equation #3. The GreenChill Store Certification Program similarly uses a lb/MBTU/hr ratio rather than the charge size alone to evaluate stores.</p>		<p>ADL 2002.  <a href="https://unfccc.int/files/methods/other_methodological_issues/interactions_with_ozone_layer/application/pdf/adli_ttle.pdf">https://unfccc.int/files/methods/other_methodological_issues/interactions_with_ozone_layer/application/pdf/adli_ttle.pdf</a> - page 103 identifies an average load as 1,480 MBTU/hr and an average charge as 3,600 lbs, which is a ratio of 2.43 lbs/MBTU</p> <p>Baxter 2003.  <a href="http://www.arb.ca.gov/cc/commref/adv_supmkt_ref_syst.pdf">http://www.arb.ca.gov/cc/commref/adv_supmkt_ref_syst.pdf</a> - page 6 identifies a ratio of 4.15 kg/kW or 2.68 lbs/MBTU</p> <p>Armines 2009.  <a href="http://www.arb.ca.gov/research/apr/past/06-325.pdf">http://www.arb.ca.gov/research/apr/past/06-325.pdf</a> - page 22 identifies a ratio of 2.8 kg/kW for med temp and 5.5 kg/kW for low temp, or 3.99 kg/kW for the entire store or 2.58 lbs/MBTU</p> <p>Given the sources identified above, we recommend that further consideration be given to determine an appropriate ratio baseline assumption.</p>	<p>Which translates into an average of 2.56 lbs/MBTU/hr. This will be used as the default baseline factor for newly installed advanced commercial refrigeration systems for all but stand-alone commercial refrigeration.</p>
<p>Table 7 – 10-year Leak Rate: The 10 year leak rate as calculated does not account for servicing and recharging of equipment. Annual leak rate assumptions reflect an average loss rate relative to the full charge.</p>	<p>This is an excellent point. The Methodology has been revised to account for servicing requirements as well as the initial refrigerant charge. Under the revision, credits will be issued (with accompanying</p>	<p>OK</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
Therefore, it may be more appropriate to assume a 200% 10-year leak rate for the low/zero-GWP technology option.	verification) on an annual cycle. As such, annual monitoring and reporting of the leak rate will be required for a newly installed system with annual calculation of the project emissions. Likewise, baseline emissions will be calculated such that the 20% annual leak rate will ultimately add up to the cumulative 200% 10-year leak rate suggested by the commenter.		
Section 3.2.1 – Zero/Low GWQP Refrigerant Technology. EPA’s proposed regulation restricts the use of R-404A and R-507A (not R-510A). The paragraph should also reference R-407A (not R-407C in the first sentence).	As noted above, the Protocol will reflect EPA’s final SNAP listings issued July 2, 2015.	On page 16, suggest deleting reference to R-407B in both the paragraph and the footnote since this is refrigerant is not currently being used to our knowledge.	ok
Section 3.1. - Note “Error” reference on page 11 in middle paragraph. Insert omitted text. Table 4 & Table 7– what is source of 10-year emission rate. How calculated?	The 10-year emission rate (ER) is calculated from the annual emission rate by the following equation: $10 \text{ yr ER} = 1 - ((1 - \text{Annual ER})^{10})$	OK	
Section 3.2.1, “Use of Reclaimed HFC Refrigerant” (page 14): NOTE: Most of the regulatory requirements for equipment, technicians and reclaimers do not currently apply to HFC refrigerants – EPA has been petitioned to extend the 608 regulations to HFCs, but no action has been taken yet.	Several key provisions of EPA’s refrigerant recycling regulations under Section 608 of the Clean Air Act do in fact cover HFC refrigerants, including: <ul style="list-style-type: none"> <li>• Venting prohibition (release of refrigerants during service, maintenance and repairs, and</li> </ul>	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
	<p>at end-of-life) applies to ODS and substitutes (i.e., HFCs).</p> <ul style="list-style-type: none"> <li>• Safe disposal: All refrigerants (including HFCs) must be removed from equipment prior to appliance disposal.</li> <li>• Reclamation: Before any recovered refrigerant (including HFCs) can change ownership, it must be reclaimed to virgin specifications by a reclaimer that meets EPA certification requirements.</li> </ul> <p>There are other provisions in the 608 regulations that only apply to ODS as the commenter noted, e.g., leak monitoring and repair, sale of refrigerants to certified technicians. The Protocol will clarify that the regulatory requirements pertaining to certification of recovery equipment, and the certification requirements for service technicians and refrigerant reclaimers currently apply only to ODS but that the HFC projects conforming to this Protocol will be expected to conform to the same requirements.</p>		
Follow up on the comment about 407A, 407C, and 407F: The two main 407 series refrigerants are 407A and	We used 407C based on input from a large supermarket chain indicating that is direction they have started	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>407F, with 407A being the vast majority of the installed base of 407 series refrigerants. 407A makes up more than 11% of the total refrigerant used for all GreenChill partners. 407F is on the rise, because of its GWP which is similar to that of R-22. 407C is not used much at all. It is so insignificant as to not even be registered in the list of refrigerants used by GreenChill partners. Several supermarket companies have decided on 407F as their standard moving forward; no one has selected 407C that I or anyone I checked with knows of. 407C can be used in AC. It should be possible to get exact numbers from the GreenChill partnership on the installed base of 407A, 407F, and 407C for the year 2014. With the addition of Kroger to the GC partners, the partnership data should represent at least 35% of the supermarket industry.</p>	<p>going. We will adjust so baseline is 407A.</p>		
<p>How do you know that the use of reclaimed HFCs won't increase leak rates? Is it possible that people will feel that emitting the reclaimed HFC is OK, because this project is telling them that the reclaimed refrigerant "doesn't count" as harm to the environment? Do you want to include some kind of provision that the leak</p>	<p>Leak rates are typically not dialed up or down – they are function of equipment age and maintenance and in some cases, technician behavior. It would be extremely unlikely that technicians or facility managers would decide to release more or less of any particular refrigerant, as it would put them in risk of non-compliance (in CA</p>	<p>OK</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
rate of the equipment that uses the reclaimed refrigerant cannot increase after the equipment is charged with the reclaimed refrigerant?	if HFC) and it would be costly. Further, end-users and technicians will have no idea whether the HFC in the equipment is virgin or reclaimed.		
“Supermarkets rely on refrigeration systems that are comprised of centralized compressor racks that provide cooling throughout the stores via an extensive network of pipes and valves”. Many systems do not use centralized racks. They use distributed racks.	We rely on the GreenChill web page that states that at least 70% of U.S. supermarkets use centralized systems.	OK	
There have been more than 5 GC platinum certified systems. I think there are 8 right now, and there are a few that were certified at new construction and they didn’t bother to re-certify. If you check with EPA, they have a database of all the stores that have ever been certified platinum.	At the time of drafting, there were five. Today there are eight listed.	The GreenChill site only lists the stores that are currently certified - regardless of the level. You corrected it by changing “have been” to “are.”	OK – correction made.
It is not correct to say that “xxx have been certified by EPA’s GreenChill Partnership as having an advanced refrigeration system with zero/low-GWP refrigerants.” Most of the gold certified stores and many of the silver certified stores use low GWP refrigerants. Also, all the GC certified stores are advanced systems, because the definition of an advanced system is one that uses technology to both	According to the GreenChill website, gold and silver certified stores use HFC refrigerants. Does the commenter have an accurate estimate of the number of GC stores that use low-GWP alternatives and if so, how many use low GWP-based systems vs standalone appliances? If not, we will again confer with EPA on most up to date characterization.	Most gold stores use a very low HFC charge and CO2. Most of the gold stores use CO2 cascade, CO2 secondary, or CO2 hybrid stores. I’d guess that 80-90% of gold stores are CO2 systems. Usually HFC stores can only achieve silver, if they achieve any level at all. I don’t understand the reference to stand alone appliances, as they don’t have anything to do with the certification program.	We don’t see a reference to the standalone appliances in the context of GreenChill certification.

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
reduce charge size and reduce leak rates.			
Table 7: If these are supposed to be the default assumptions for new commercial refrigeration projects, it seems that 20% is much too high. 20-25% is the average of all systems, including the majority of systems that are (very) old. The leak rates for new systems are much lower, and they depend greatly on the technology that is installed.	See Table 9 in Appendix A; data come from EPA. The Vintaging Model assumes 20% average leak rate for “medium and large commercial refrigeration”; EPA GreenChill and numerous other EPA communications (e.g., R-22 Regulatory Impact Analysis) estimate average leak rate of 25% for U.S. supermarkets. What would be a more accurate avg leak rate for new supermarkets today and what would be the source of the data?	The vintaging model and GreenChill national averages refer to ALL systems, the vast majority of which are very old and thus have very high leak rates. New systems don’t have anywhere near that high of a leak rate. GreenChill has averages for newly installed systems, see page 10 of the GC progress report for instance. I’m sure you can get updated numbers from the EPA. In 2010, new DX systems had an average leak rate of 3.5%; distributed 2.1%; hybrid CO2 0%.	We are using the most comprehensive data base available that reflects leak rates in the United States. The Protocol will be updated as the Vintaging Model is updated.

#### 4. Quantification of GHG Emission Reductions

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
In terms of quantifying reductions, would any new or retrofitted commercial refrigeration system with lower-GWP than the default R-407A (GWP 2107) be eligible, even if the alternate refrigerant still had a GWP as high as 1300, for example? Where do hydrofluoro-olefin (HFO) refrigerants and HFO-HFC blends fit in?	The Protocol does not specify which refrigerants used in new installations would be eligible for credits; it would be at the discretion of a prospective project developer to determine whether the GWP of the new system/equipment would justify a project to be developed.	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>For the leakage issue in section 4.1.3, consider adding a brief analysis of the effects of increased HFC reclamation on the price of HFC refrigerant (i.e., the supply and demand argument). Without any HFC production quotas in place, is it possible that increasing the amount of recovered HFC, decreasing demand for virgin HFCs, leading to lower prices (theoretical), and therefore theoretically increasing HFC usage/emissions?</p>	<p>Increasing the supply of reclaimed HFC refrigerant would reduce demand for virgin HFC refrigerant. Total demand for HFC refrigerant would not be affected if there is more reclaimed HFC available, so price of HFC refrigerant would not be impacted because the source won't matter to buyers unless they are also getting the credits from the reclaimer.</p>	<p>OK</p>	
<p>Section 4.1.1, Equation #1. - Note "Error" reference in description of AL HFC,j,i. (a) - Two different descriptions of VRHFC,j,i,y (b)</p>	<p>(a) yes (b) yes, good catch – another vestige from earlier draft – we will clarify</p>	<p>OK</p>	
<p>Section 4.2.1. Page 16. Retrofitting is not included, so should delete last two lines of first paragraph</p>	<p>Adjustment made:  For projects that involve newly installed systems or equipment in existing facilities, project proponents shall use historical system-specific data for refrigerant type and quantity used. These data shall be generated from regulatory compliance reporting and other verifiable, historical operating documentation. Leak rates found in Table 7 shall be applied in projects installed at existing facilities.</p>	<p>OK</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>Equation 2: I may be missing something, but this seems to be saying that the project emission reductions during year y equal the baseline emissions of HFC refrigerant in year y. What is the purpose of this?</p>	<p>Typical GHG quantification would use the following construct:</p> $ER_y = BE_y - PE_y$ <p>Where PE = Project Emissions in year y.</p> <p>For use of reclaimed HFC refrigerant this Protocol does not quantify project emissions (e.g., GHG emissions associated with transport of reclaimed gas, energy used in distillation process) because they are considered relatively minor and not significantly from similar emissions that would be associated with manufacture and use of virgin HFC refrigerant (also not included).</p>	<p>OK</p>	

### 5. Monitoring and Data Collection

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>You should incorporate some type of monitoring to be sure that the equipment's leak rate does not increase after charging it with reclaimed HFC.</p>	<p>There are no requirements for tracking the ultimate fate of the reclaimed HFC refrigerant once it is put into commerce by the reclaimer.</p>	<p>OK</p>	
<p>I assume that the documentation of the amount of refrigerant charged in a system from a cylinder or taken out of equipment and put into a cylinder will always mandate that the cylinders are</p>	<p>We will clarify that in documenting the quantity of refrigerant that is recovered that empty cylinders must be weighed to account for heels.</p>	<p>OK</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
weighed? Common practice is to disregard the refrigerant heel that is left in the cylinders.			
Table 5.2.3: The source of data won't be operating records if it is a new system or a retrofit.	We will clarify that installation records can be the source of information for new systems.	OK	
I was unable to understand from the methodology whether the project will qualify for credits every year, or just in the year that it is charged with the reclaimed refrigerant.	The GHG emission reductions are calculated over a 10-year period but the crediting will be "front loaded".	OK	
<p>Section 5.0. The words "monitoring" or "monitor" is used throughout section 5, when it appears that the word "verification" of "Verify" would appear to be more accurate. The project doesn't seem to require any form of monitoring, but rather seems to require recordkeeping, collection of information, and documentation to verify compliance with the methodology. (a)</p> <p>Section 5.2.1. - Should have a separate process for small quantities received through contractor networks. System documentation should be limited to larger commercial and industrial systems holding more than 500 lbs.(b)</p>	<p>The term monitoring is standard nomenclature for GHG Protocols – it encompasses all data gathering used to document project activities for eventual check by a 3<sup>rd</sup> party verifier.</p> <p>(b) A similar approach was established for the ODS destruction protocol where point of origin documentation for ODS stockpiles less than 500 lbs is different than for larger volumes. For this Protocol, it is critical to document that all reclaimed HFC originates from equipment, and that same equipment does not become a temporary way-station for gas that is repeatedly used to generate credits under this Protocol.</p> <p>(c) ok</p>	<p>Section 5.2.1. a- Should have a separate requirements for small quantities received through contractor networks. Therefore, suggest that first bullet point should be revised to read: <b>"Where the HFC was recovered by service technicians in individual quantities of 500 pounds or more, documentation of the point of origin of the reclaimed HFC including: ..."</b> Add a new second bullet point to read: <b>"Where the HFC was recovered by service technicians in individual quantities of less than 500 pounds, documentation of the point of origin of the reclaimed HFC including:</b></p> <ul style="list-style-type: none"> <li>- <b>Name and address of the service company, wholesaler or distributor that delivered</b></li> </ul>	<p>a- We have adjusted the requirement on point of origin for small quantities using very similar language as that suggested.</p> <p>b- This is addressed by adjusting the point of origin requirement for &lt;500 lbs noted above.</p> <p>c-That term "repeatedly obtaining" is not in the protocol; it was intended, in the previous response, to explain the rationale.</p> <p>d- No change to requirements for monitoring have been made. Reclaimers must be able to demonstrate that an equal volume of reclaimed HFC is</p>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>- 4<sup>th</sup> bullet point on page 19: Suggest changing this bullet point to read:  <b>“Documentation demonstrating that the reclaimer is an EPA Certified reclaimer and reclaimed the refrigerant using equipment listed with the EPA, including</b></p> <ul style="list-style-type: none"> <li>• <b>The most recent equipment list provided to the EPA by the EPA Certified reclaimer; and</b></li> <li>• <b>The physical address where the reclamation was conducted. (c)</b></li> </ul> <p><b>Note</b> - EPA does not issue a certification for a specific address. EPA only issues an initial certification letter to a reclaimer when reclaimer first files, and then EPA posts reclaimer’s address and contact information on the EPA website, which address is not required to be the reclamation facility. Information provided by reclaimer to EPA as to locations and equipment is not publicly available.</p> <p>- 5<sup>th</sup> bullet point on page 19: suggest change to read <b>“Documentation showing that the used (recovered) HFC refrigerant processed by the EPA certified reclaimer was tested by an AHRI certified refrigerant testing laboratory to meet the AHRI 700</b></p>	<p>(d) ok</p> <p>(e) It is necessary to verify that the reclaimer is not repeatedly obtaining HFC refrigerant from the same equipment.</p>	<p><b>the quantities of less than 500 pounds to the reclaimer;</b></p> <ul style="list-style-type: none"> <li>- <b>The cylinder number, size, gross weight, tare weight, and net refrigerant weight of each container received by the reclaimer; and</b></li> <li>- <b>Date(s) received by the reclaimer.</b></li> <li>-</li> </ul> <p>b- Section 5.2.1, third bullet point, specifically relating to Author response (e) - provides for the reclaimer to attest as to whether the reclaimer has previously obtained recovered HFC from the same source. For small systems this typically is not possible since the reclaimer in most cases will not be receiving the refrigerant from the contractor and the contractor may not have records as to the specific systems the HFCs have been recovered from.</p> <p>C- As for larger systems, what is meant by “repeatedly obtaining”? Is there some acceptable frequency, such as one time per year?</p> <p>d- Section 5.2.1, 6<sup>th</sup> bullet. The current language regarding the required documentation for showing</p>	<p>returned to commerce per the methodology requirements.</p>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p><b>Standard for Specifications for Fluorocarbon Refrigerants.” (d)</b></p> <p>-6<sup>th</sup> bullet point: Do not understand the attestation as to “whether the reclaimer has previously obtained recovered HFC refrigerant from the source”. Why is that relevant? (e)</p>		<p>a sale of reclaimed HFC is problematic. Typically, recovered HFC refrigerants are received by the reclaimer in individual cylinders. Typically each cylinder is screened and the reclaimer will typically record (i) the name of the company that sent the refrigerant, (ii) the cylinder number, (iii) the gross weight, (iv) the tare weight, (v) the net refrigerant weight before reclamation, (vi) the net refrigerant weight after reclamation, and (vii) the weight of any waste oil and contaminants removed. However, once the refrigerant has been reclaimed it is typically added into the reclaimer’s inventory of saleable refrigerant, which may include both virgin and reclaimed refrigerant, and loses traceability. At that point, it is not possible to show “that the same quantity of reclaimed HFC refrigerant” is sold. The methodology needs to reflect that reality and permit the reclaimer to demonstrate through inventory and accounting records and procedures that it sold the “volume of HFC that was reclaimed during the reporting period”.</p>	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
		One suggestion could be to have the reclaimer demonstrate its starting inventory at the beginning of the reporting period and provide records showing pounds reclaimed and/or purchased, and pounds sold during the period, with a final inventory at the end of the reporting period as the basis for determining that the reclaimer sold the “volume of HFC that was reclaimed during the reporting period”.	
Section 5.2.2. – The process for monitoring ( <b>verifying</b> ) should be complete and clear. Not clear what documentation or information is specifically required or desired.	The parameters listed are required to be documented under the Protocol. We can make that clear.	OK	

### Appendix A: Baseline Data Inputs

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>Table 10, “10-Year Emission Rates for Individual HFC Refrigerants”: In addition to referencing Table 7.9 of the 2006 IPCC Guidelines, recommend adding this IPCC table to the Appendix after existing Table 10, will make it easier to understand how the 10-year emission rate was derived. (a)</p> <p>Also, would it be reasonable to base the 10-year emission rates on the average</p>	<p>(a) The IPCC Table 7.9 (and the EPA Vintaging Model) only provide annual emission rates – we added the equation used to calculate 10 year emission rates.</p> <p>(b) All annual emission rates are averages from either EPA or IPCC – when lower bounds are used, it is because either the EPA or IPCC present ranges of</p>	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
leak rates, and not the lowest? The lower end of the leak rate range is very difficult to achieve in actual practice, and does not occur when averaged over all equipment in a given region.(b)	average emission rates and we use the lower end of those ranges to be conservative.		
Table 9 and 10 – the end-uses identified in this table should be defined somewhere. It is also suggested that these end-uses be consistent with the sectors identified in Table 1. Suggest revising Table 1 and including definitions in the table rather than examples.	The end-uses in Table 9 and Table 10 are based on categories defined by US EPA and the IPCC. The end-uses listed in Table 1 are more descriptive but absolutely consistent with Table 9. We can add clarifiers where the exact nomenclature is not the same.	<p>a- This comment has not yet been addressed in the report. One inconsistency of note includes reference to “Industrial Refrigeration including Food Processing and Cold Storage” in Table 9, while in Table 1 Cold Storage is grouped under commercial refrigeration.</p> <p>b- Also, the breakout of commercial refrigeration into stand-alone and medium/large, and the different leak rate for industrial refrigeration identified in Table 9 further highlight the need to have different baseline assumptions for non-supermarket systems. It is recommended that either non-supermarket systems be excluded from eligibility or different baseline assumptions be developed for stand-alone commercial refrigeration systems, cold storage refrigeration systems, and industrial refrigeration systems, and presented in Table 7.</p>	<p>a- Our oversight in not harmonizing the tables. We corrected the discrepancy in reference to Industrial Refrigeration/Cold Storage. Table 9 has been updated to correlate to the sectors/segments found in Table 1.</p> <p>b- As stated above, only retail food refrigeration is eligible for credits involving deployment of advanced systems. The breakouts in Table 10 are to inform the reader on the range of emission rates across the various end-uses, not just retail food refrigeration. The methodology can be expected to evolve over time to include crediting for advanced HVAC and we believe it is important to characterize the data base now where possible. may include eligibility for other</p>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
			end-uses or Advanced Refrigeration systems
<p>Table 9 – footnote #3: GreenChill certified stores and GreenChill partners are not the same thing. The 13% cited is the average leak rate of GreenChill Partners, who represent roughly 20% of the supermarkets in the United States. See <a href="http://www2.epa.gov/sites/production/files/2014-09/documents/gc_awards_ceremony_2014.pdf">http://www2.epa.gov/sites/production/files/2014-09/documents/gc_awards_ceremony_2014.pdf</a></p>	<p>We can make that clarification. We assume that 20% of all supermarkets in the US have an avg leak rate of 13%.</p>	OK	
<p>Table 9 – The values listed in this table are based on old resources and also are not specific to HFCs. We recommend using the HFC emissions rates published in the US GHG Inventory – See Table A170: <a href="http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Annex-3-Additional-Source-or-Sink-Categories.pdf">http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2015-Annex-3-Additional-Source-or-Sink-Categories.pdf</a> These rates should be reviewed each year, and updated, as needed.</p>	<p>Great, we will update with the new Inventory report; it had not been available at time of Protocol drafting.</p>	OK	
<p>Table 10 – Footnote #1 – should reference Table 9 not Table 8</p>	yes	OK	
<p>Section A.1. - Suggest revising the first paragraph to state: "... to EPA the quantities of <b>CFCs and HCFCs</b> that they reclaim. Currently there are no reporting requirements for</p>	<p>(a) ok (b) ok – higher cost for reclaim will be clarified</p>	OK	

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>HFC reclamation. Because <b>CFC production ended in 1996, reclaimed CFCs are essentially the only source of CFCs for CFC-based equipment still in use. Similarly, because HCFC-22</b> production is being phased out <b>and will end in 2020</b>, there is a strong incentive... ." (a)</p> <p>- The statement in second paragraph that virgin is generally lower in price is not accurate. Suggest changing the first sentence to read: "In contrast, there are no restrictions on production of HFC refrigerant <b>and, because of</b> the additional costs to recover, transport, and separate/process back to virgin purity level, there is currently little incentive for recovery, reclamation, and re-sale of HFC refrigerants." (b)</p>			
<p>Section A.2.          – Need correct Table Reference in last line above Table 9 (and also in footnote 1 on page 24 – should it be Table 9?)          -Table 9 and 10- what is source of 10-year emission rate. How calculated?</p>	<p>(a) yes          (b) see response to same comment on p.21 of this document</p>	<p>OK</p>	
<p>Section A.2: 404A is not only used in systems. It is used in self-contained commercial refrigeration units. 407-A is also used in self-contained equipment.</p>	<p>ok</p>	<p>You still list 404A and 407A as being used 100% in large commercial refrigeration. Both are used in other types of equipment.</p>	<p>Thanks for noting those oversights.          We have made a correction to the 10 year leak rates reflected in Table 10. Here is the data used to calculate the revised weighted average for 404a:</p>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
			<p>Stand-Alone Commercial Applications: 5%</p> <p>Commercial Refrigeration: 80%</p> <p>Industrial Process Refrigeration: 15%</p> <p>The wt avg leak rate is 84%</p> <p>We do not see in the Vintaging Model that 407A is used in self-contained equipment.</p>
<p>Section A.3: There may be additional stores in the U.S. that have very low GWP refrigeration systems not recognized by EPA <u>because they are owned by companies that are not members of the GreenChill Partnership.</u> There is no requirement that you be a green chill partner to get your store certified. There are many GC certified stores that are not owned by GC partners.</p>	<p>Ok – we expect the number of stores with advanced, low GWP systems in the US to still be quite low.</p>	<p>Under Adoption of Advanced Refrigeration Systems, you need to change the sentence “As of July 2015, of the more than 37,000 supermarket stores in the US, eight ARE certified by GC at the platinum level. More than 8 “have been” certified, but as of July, 8 ARE certified.</p>	<p>ok</p>

### Appendix B: Other Methodology Considerations and Guidance

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>Including Best Practices is very helpful.</p>	<p>ok</p>		
<p>Section B.3, Page 27, last two bullet points:</p>	<p>These are suggested best practices, not requirements. Tracking cylinders allows system owners to know</p>	<p>Section B.3., last bullet point – what is a “qualified facility”?</p>	<p>Language updated as follows:  <u>“Refrigerants should be managed so that system owners can access</u></p>

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>- Why need to track the location of a cylinder and the status of the refrigerant, and why owners must be able to know the location of the cylinders at all times? Recovered refrigerant is received by the reclaimer in recovery cylinders that are typically swapped out with the customer, such that the cylinder owner does not receive the same recovery cylinder back when empty. Reclaimed refrigerant is packaged in clean cylinders that are typically owned by the reclaimer and given to a customer upon payment of a deposit. A reclaimer will certify that the refrigerant received has been reclaimed, not that the same refrigerant sent by the customer has been reclaimed and returned. Therefore tracking the cylinder and the refrigerant as suggested adds no value.</p>	<p>where their gas is going and coming from, and allows technicians to better manage their inventories and flows. Reclaimers that use cylinder tracking would be better positioned to take advantage of this Protocol by having more autonomous, electronic tracking of the origin of recovered gas which can be more readily verified by a 3<sup>rd</sup> party.</p>		<p>information that shows the cylinder number, the location of the refrigerant, the quantity and overall status (reclaimed, needs to be reclaimed, etc)”</p>

### Appendix C: References

1 <sup>st</sup> Peer Review	Author Response	2 <sup>nd</sup> Peer Review	Author Response
<p>Would be helpful to provide internet links for the references (realizing that these can change without notice).</p>	<p>Done in footnotes.</p>	<p>OK</p>	
<p>Should make overall reference to EPA regulations governing ozone substances 40 CFR Part 82</p>	<p>Links to EPA regs are footnoted in body of document.</p>	<p>OK</p>	

<b>1<sup>st</sup> Peer Review</b>	<b>Author Response</b>	<b>2<sup>nd</sup> Peer Review</b>	<b>Author Response</b>
You refer to GreenChill several times, but it is not listed as a reference.	GreenChill information (links to web pages) is referenced in body of document in footnotes.	OK	