INDEPENDENT EXPERT REPORT

Methodology Title	VM0016 Recovery and Destruction of Ozone-Depleting Substances and Hydrofluorocarbons VMD0048 Activity Method for the Determination of Additionality for Recovered and Stockpiled ODS Refrigerants
Version	VM0016 v1.2 VMD0048 v1.1
Sectoral Scope(s)	11: Fugitive emissions from industrial gases
Document Reviewed	Draft revision of *VM0016 Recovery and Destruction of Ozone-Depleting Substances and Hydrofluorocarbons* Draft revision of *VMD0048 Activity Method for the Determination of Additionality for Recovered and Stockpiled ODS Refrigerants*
Date of Issue	03 December 2025
Expert Assessor	Dr. Thomas Grammig
Contact	

1 INTRODUCTION

Verra is managing the development of the revision of the VCS Methodology *VM0016 Recovery and Destruction of Ozone-Depleting Substances and Hydrofluorocarbons* (M0171). Per section 2.1.2 of the *Methodology Development and Review Process, v4.4*, this methodology revision is being developed through an alternative process that has been deemed more efficient and equally robust. The alternative process included:

- Replacement of Section 3.5 Step 5: Validation/verification body assessment of methodology with review by a group of independent experts.
- Conducting the review by a group of independent experts in parallel to the public consultation

Based on their experience in the Montreal Protocol, end-of-life management of ODS and project development for the carbon market, Verra hired Dr. Thomas Grammig (independent expert) to provide an expert assessment of the proposed methodology. The independent expert's assessment focused on:

1. Appropriateness and consistency of the methodological approach for the use of other ODS sources, such as fire suppressants and propellants, and intact foam destruction
2. Expansion of the applicability to HFC and stockpiled HCFC, including appropriateness and stringency of the proposed restrictions and eligibility as per the phase out/down schedule for each substance group as detailed in the Montreal Protocol
3. Appropriateness of the updated positive list in VMD0048 Activity Method for the Determination of Additionality for Recovered and Stockpiled ODS Refrigerants
4. Any specific stakeholder comment that requires input from the expert

2 REVIEW APPROACH & FINDINGS

The independent expert reviewed the draft methodology and module that was published for public consultation and provided feedback to Verra. Verra and ICF prepared responses to the findings and updated the documents accordingly. The independent expert reviewed the responses and provided confirmation that the planned updates address the findings. See section 6 for detailed expert review feedback.

3 REVIEW CONCLUSION

The independent expert has completed the expert review of the draft revision of *VM0016 Recovery and Destruction of Ozone-Depleting Substances and Hydrofluorocarbons* and Draft revision of *VMD0048 Activity Method for the Determination of Additionality for Recovered and Stockpiled ODS Refrigerants*

and confirms the draft methodology and module, and proposed updates adhere to the criteria established.

4 EXPERT QUALIFICATIONS

Dr. Thomas Grammig has extensive experience in the Montreal Protocol and the Kyoto Protocol involving ODS methodologies and project reviews. He is a member of the CDM Methodology Panel and CDM Registration and Issuance Team, and a review expert for UNFCCC Enhanced Transparency Framework (nominated by Germany) for BUR, BR and BTR. He also worked with GIZ-Proklima, bilateral implementing agency for Multilateral Fund of the Montreal Protocol.

5 SIGNATURE

Signed for and on behalf of:

Name of entity: _-_____

Signature: 

Name of signatory: __Thomas Grammig

Date: __03. December 2025_____

6 EXPERT FEEDBACK

6.1 VM0016 RECOVERY AND DESTRUCTION OF OZONEDEPLETING SUBSTANCES AND HYDROFLUOROCARBONS

Section 3 – Definitions			
#1	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
Ch.4	1) The project activity is implemented in countries that are part of the Montreal Protocol.	As proposed VM0016 is silent about the Paris Agreement (PA) and Montreal's Kigali Amendment (KA), while at present elements of both are being realized, and thus VM0016 suffers an incomplete baseline definition. Furthermore, PA and KA overlap for HFC gases and VM0016 must include checks whether project activities are aligned with both and/or can contribute to aligning them. In addition, PA and KA as realized, are shaped by national climate policies more than during Kyoto P era. PA has created "Nationally Determined Contributions" (3rd 'NDCs' are in the works), KA is creating national Kigali Implementation Plans 'KIP', similar to HCFC Phaseout Management Plans 'HPMP'. The A5 group 2 countries are still in the HFC baseline period until 2026. For A5 group 1, the first HFC reduction step is in 2029. Currently >60 NDC mention HFCs. Destroying HCFC and HFC can build on and combine PA and KA elements, thus VM0016 can provide guidance how this shall be verified over the crediting periods. By not providing guidance for PA and KA, VM0016 as proposed will prevent PPs from undertaking "risky" projects in his perspective. VM0016 can provide baseline criteria that effectively reflect national choices clearly visible in official PA and in KA publications, as shown below.	Destruction of unwanted ODS and HFCs is outside the scope of MP activities and while KIPs determine the strategy to phase down HFC consumption, they do not speak to end-of-life management of HFCs beyond collection and storage. Furthermore, both NDCs and Kigali status are not conditions of additionality. If countries implement regulations that REQUIRE destruction of ODS or HFCs, those countries would not be able to participate in the generation of credits on the voluntary market. While NDCs may include conditions that account for reductions in HFC consumption, they do not as a rule mention anything about EOL management of recovered HFCs. To the point of risk taking, it is the responsibility of the project developer and other interested parties to understand the regulatory environment in the country of operation, and potentially the country

Section 3 – Definitions			
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			where destruction will occur, including determination of additionality. For example, there are regulatory requirements to destroy ODS in the EU and in certain A5 countries.
		Proposal: 1. PP must compare the project to the country's NDC, regarding which HFC gases it contains (refrigerant or blowing agent), what reduction proposed, whether conditional or not, any element of NDC related to Art.6.4 or Art.6.2, and which product type is addressed in a NDC (household, commercial, fishery, buildings). If the HFC being destroyed by the project could be affected by the NDC target and only HFC reductions that are conditional on funding are defined in NDC, then PP shall assess whether there a possibility that the specific HFC gas addressed might appear in the project HFC stream or not. Unconditional reductions in NDCs for HFC gases do not affect the project baseline. For most NDCs appliance recycling is clearly separate. 2. PP must consult the latest national reporting under PA and verify which HFC gas consumptions are reflected or whether the country has declared it requires "flexibility" for its reporting of HFCs. PP shall compare the HFC data in national reporting to the KA reduction schedules. PP can describe how discrepancies are addressed (discrepancies might be just bureaucracy problems or data availability) and show that NDC (policies and measures, PAM) are not affected by the VM0016 using project. **Rd 2**: Agreement that NDCs are not necessary to address. However I would like to point to a policy opportunity for Verra. Credits that somehow reflect NDCs are an area of innovation to invite credit usage or quality. But perhaps it is too early to attempt this in VM0016 while on the other hand, HFCs are popular among NDCs for reasons (Airconditioning share in electricity load curves ….). **In sum, #1 is addressed and closed**.	HFC reporting and any phasedown requirements are separate from provisions on additionality of EOL HFC management, including destruction. NDCs and KIPs are important sources of information on addressable banks of HFCs, which project developers consult to determine when and whether collection of decommissioned equipment will deliver sufficient quantities of eligible substances to lead to a viable project. Hence, these are viable sources of information, but do not influence additionality. They are part of a good due diligence approach, but do not dictate eligibility. **Round 2 response:** We agree that this is important to consider for project proponents but, as discussed, does not need to be addressed in the methodology.

Section 4 – Applicability Conditions				
#2	Paragraph from Draft Methodology		Comment	Developer's Response and/or Update
	4.1.1	Start Date HCFC	Between countries, HPMPs and KIPs are of very divers quality reflecting the National Ozone Unit's 'NOU' capacity, the industry company habits and those of KIP implementing agencies; as demonstrated by some countries with massive increases in HFCs in recent years and others equally massive decreases in HFCs, according to data reported to UNEP's Montreal office [1]. Because HPMPs and KIPs vary, start dates eligible can reflect this national context. Ch.4.1.1 uses the storage >1 year as indicator. An alternative is to consider the probability that more HCFC could be imported. When an HPMP has funded a replacement of HCFC in manufacturing, the new appliances are assumed to replace the HCFC-using one. It is not realistic to burden a PP with assessing an HPMP implementation or judge its adequacy but parameters submitted to UNEP/Montreal unit are reliable criteria. All countries have received funding for at least one HPMP and all countries have "full flexibility" to choose HCFC and HFC replacements.	Not relevant to HFC collection at EOL activities. Article 7 is confidential anyway, and project developers do not have access to this information, only the publicly available aggregated data, which provides only a high-level snapshot of ODS and HFC allocation by end use. That said, Article 7 data, HPMPs, and KIPs are important sources of information, but as stated, do not relate to project eligibility.
			Proposal: PP must summarize past and on-going HPMPs in the country, their technologies and gases, (from Multilateral Fund documentation or from NOU documents), and identify which of the project's HCFC recovered or destroyed are mentioned in them. In countries with only an HPMP stage I, indicating no domestic appliance production and phaseout determined by imports, refrigerant from Airconditioners and all blowing agents are eligible. Countries with HPMP stage II submitted (~120), PP shall assess whether this HPMP has addressed all domestic HCFC-using manufacturers, replaced HCFC (China is the last country with HCFC blowing agent consumption) and then HCFC remains eligible when recovered only. When not all manufacturers were included in that HPMP, this HCFC refrigerant is not eligible (because the replacement of an old appliance can be a new domestically manufactured appliance with this HCFC). Foam destruction (HCFC BA) remains eligible after	Summarizing HPMPs (or KIPs) is not relevant for VM0016 methodology implementation for specific projects, as discussed above. Project developers do consult this information when researching which countries to prioritize for potential projects and start dates. Regarding eligibility, the commenter raises a good point regarding when projects should start, and it is agreed that establishing eligibility dates by country based on phaseout dates for HCFCs and

[1] As illustrated on http://www.thomas-grammig.com/2kyoto/pdfs/2020_country_data_HFC_HCFC.pdf

Section 4 – Applicability Conditions			
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		the HCFC phaseout in 2030, HCFC refrigerant is not eligible after 2030. Countries with HPMP stage III (~20, addressing the most difficult, consumption for servicing) completed and countries with HCFC bans in place are all eligible for VM0016 projects. *This proposal assumes that the Montreal Protocol bodies will continue to remain silent about carbon markets in general.* **Rd 2**: Developer agrees to reflect HCFC phaseout dates in eligibility dates while rejects a requirement to PP to summarize HPMP. Developer points to ongoing PP preparations which is indeed important, while I propose that there are possibly new PPs attracted by more activities. So a suggestion for the most straightforward form to add to ch.4.1.1: Before jan 2030 / After jan 2030 HCFC-141b eligible where import banned / HCFC-141b eligible where import banned HCFC-22 eligible when HPMP stage II implemented / HCFC-22 eligible when HPMP stage III implemented HCFC-123, HCFC-124, HCFC-142b, HCFC-225 always eligible in countries where any HPMP has been implemented. The main aspect Verra might consider here is whether HCFC-22 destruction after the jan 2030 phaseout can be credited. I suggest as the crucial argument that it can be credited, because HCFCs are >90% produced in China, production will cease (strong government commitment to MP) and then any MP implementing problems in any country will have little influence and any EOL activity is effective to reduce emissions. In a narrow boundary around an VM0016 activity, HPMP implementation does not affect it but in a wider boundary around all similar refrigeration installations, the availability of an HCFC affects additionality because when destroying a	phasedown eligibility by sector for HFCs. Prohibition of imports by HFC is a good indicator of eligibility, for example. **Round 2 Response:** We appreciate these considerations and agree that HCFC projects should not start until the relevant country's phaseout is complete. The methodology is currently structured this way (with the exceptions noted in Section 4.1.1). In terms of the HPMP considerations, similar to the response to comment #1, these are not relevant to the methodology itself.

Section 4 – Applicability Conditions			
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		quantity of HCFC no further HCFC can be imported and a replacement gas (butane, propane, pentane or HFO) is used (although not in one single installation). **Rd 3:** I agree that HCFC phaseout completion as eligibility start date is the simplest solution, and it also treats all countries alike. Possibly both are not positive attributes here. In the present form, VM0016 addresses the MP phaseout schedule and excludes all other MP aspects. Because the remaining HCFC applications are narrow (AC refrigerant and blowing agents) other MP aspects are feasible to define start dates. **Issue #2 is closed.**	

Section 4 – Applicability Conditions			
#3	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
4.1.2	Start Date HFC	4.1.2 eligibility condition 2. seems extreme and unnecessary. It also excludes the very countries with weak or absend KIPs. By demanding >70% phasedown (in VM0016 proposed), destruction is not supported for many more years. 2.a-2.c can be replaced with KIP criteria and thereby reflect and build on national circumstances. Until 2030, HPMP and KIPs co-exist in many countries while in some HPMP finish before KIP start. Montreal rules (and Multilateral Fund) do not specify whether HPMP and KIP should be separated or not (countries decide). KIP funding criteria under KA are not yet fully complete (see UNEP/Ozl.Pro/ExCom/96/56). KIPs cover a larger variety of refrigeration and AC services than HPMP. KIPs started in most countries in 2023 and contain 3 years consumption data for each HFC gas. Finally and most importantly among the submitted KIP, many countries (ex Malaysia and Indonesia) prepare import bans for refrigerators	The 70% value was determined as a reasonable indicator of intent to phasedown, and showing a downward trajectory over time that reflects actual replacement strategies for HFC use. As a counter-argument if 30% or less were the threshold, it would be easy to backslide and ramp up consumption and use and at the same time destroy materials that could have been reclaimed and re-used to meet demand. The VM0016 methodology does not speak to incentives to recover and reclaim

Section 4 – Applicability Conditions			
#3	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		and/or Airconditioners with HFCs in 2029 although KA only requires a 10% reduction, i.e. larger countries move far earlier than required in KA (to prevent or reduce dumping of cheap appliances by importers). Likewise where a KIP addresses blowing agents, PP shall determine whether the project HFCs could contain KIP element HFCs. The eligibility criteria definition using both specific gas and specific sector applies equally to different aerosols and fire-suppression HFCs. An additional policy element with a Montreal analysis focus would be distinguishing countries that have chosen the "double phaseout": got funding for shift to HFC (via HPMP) and then same recipient companies more funding for shift to non-HFC. Because Multilateral Fund attempted but in some countries failed to prevent such "double phaseout". This is not reflected in my proposal below because it would go beyond a narrow counterfactual.	materials, but these approaches are needed in a phasedown environment. Though this careful management of EOL materials is the recognized best practice, such approaches would be the subject of a different methodology (e.g. crediting scheme for reclamation and reuse of HFCs to avoid the need for virgin material).
		Proposal: 1. In countries that have not ratified KA, HFC destruction is not eligible. While in those that not ratified KA but nonetheless report HFC data to UNEP/Montreal office, projects are also eligible under VM0016. 2. The PP shall verify whether the country has implemented a quota system for HFCs imports and only in those countries VM0016 is applicable. 3. Countries where appliance imports with HFC are banned, only those appliances' refrigerants and blowing agents are eligible for VM0016, from the start date of the ban on. 4. PP shall compare KIP technologies (only 'investment projects' not 'demonstration projects') and gases with project and assess whether the HFC destroyed by project is affected by the KIP elements. For example, a project destroys HFC from household appliances and KIP in that country only address commercial refrigeration, thus the HFC from household appliances is not eligible. Or HFC in project is from Airconditioners and KIP works only on refrigerators. Or project destroys HFC from automobiles and KIP addresses other sector, project's HFC is ineligible. Only in a sector that is included in a KIP and the project destroys the same HFC, then this HFC destruction is eligible. This assumes the availability of a particular HFC is reduced when the KIP is targeting a sector and that gas. 5. Until a country reaches its HFC consumption reduction schedule ("Kigali	Ratification of Kigali and a quota system seem like useful benchmarks for project developers to consider in their research on priority countries. Kigali ratification is a prerequisite for VM0016 eligibility. KIPs should be considered for eligibility dates, but this provision has more implications for KIP design, than on VM0016 eligibility. **Round 2 Response:** We believe that it is simplest and most conservative to apply a uniform HFC start date exception requirement. That said, we did revise the 70% language to be specific to non-Article 5 countries and added an Article 5 country-specific requirement.

Section 4 – Applicability Conditions			
#3	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		schedule"), the specific HFC remains eligible, equally for A5 group 1 countries and group 2, and respectively for each refrigeration sector. 6. The comparison of project sector to KIP element sector applies only to HFC refrigerants whereas all HFC blowing agents are eligible when a KIP exists. 7. For countries where KIP includes servicing activities (for instance training for handling flammable refrigerants, butane or propane), PP shall determine whether this KIP addresses the same HFC gas as his proposed project and if so, these are not eligible (VM0016 using projects should not compensate ineffective KIP servicing activities). 8. Where no KIP has been implemented, PP shall compare HFC consumption to the Kigali schedule, HFC is eligible only when the Kigali schedule passed (country in non-compliance), irrespectively whether KIP might still be planned or failed because of Multilateral Fund decisions. When country is a "low-volume consuming" country under KA (<360 to/year), PP to compare project gas to KIP and in a country where KIP has addressed this gas it is eligible also before the Kigali schedule is reached. **Rd 2**: Agreement that 70% is an indicator of intent to phasedown and that it is a high bar, delaying crediting to after 2035 (2042 for group 2). Some countries move much earlier limiting HFC imports from 2028 or 2029 on and therefore VM0016 could allow earlier start dates, while excluding in particular countries where cheap (and inefficient) Airconditioner producers resist. I propose to consider that such a high bar is too crude a criterion to apply uniformly across all countries. An alternative to 70% can be a more specific indicator of ambition such as HFC are eligible when a country has a KIP with a reduction above the phasedown schedule, i.e. reduction >10% before 2029, >20% before 2035, >30% before 2040. In Art.6 of PA context, this can be called "encouraging ambition over time", defined in ch.4.1 Art.6.4 methodology standard (para 33 of RMP). This alternative would avoid the need to consider further details of KIPs like whether KIPs address particular cocktails of HFCs or which appliances or details of quota systems. Perhaps an important aspect is that many countries have rapidly rising HFC emissions and ambition in a crucial area can be acknowledged in a simple enough way. In sum: possibly Verra can decide on principle whether a uniform high bar is	

Section 4 – Applicability Conditions			
#3	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		preferable to a differentiation. **Rd 3:** A 70% phasedown value for non-A5 countries implies that EU and most non-A5 countries have already reached it. Indeed the simplest start date, treating all non-A5 countries alike. Among the KIPs submitted from A5 countries: Burkina Faso, Cameroon, Congo, Ghana, Jordan, Lesotho, Liberia, Malawi, Niger, Solomon Islands, Zimbabwe will reach it in 2029 (in UNEP/OzL.Pro/ExCom/96/5) most others in 2035. **Issue #3 is addressed and closed.**	

Section 6 – Baseline Scenario			
#4	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
4.1.2	Start date for Fire suppression HFC	HCFC consumption for fire suppression in A5 countries was reported zero in 2021. HFC-227ea is the only HFC gas widely used and also included in an ACR methodology. ACR does not credit Halon destruction to not incentivize "premature destruction" and thereby implies this availability is a constraint on the main users, computer centres and aviation (other typically critical ones are fire suppression in nuclear power). , Aside, ICAO has a phaseout schedule for Halon in Nov 2024 for new aircraft which is not mandatory but widely effective and applied. In the Montreal protocol recycled Halon is not accounted as consumption and is exempted by countries as "critical use". HFC-227 is not used for other purposes than fire suppression, only other HFC gas is HFC-125 used only in military aviation as fire suppressant. Only in the EU HFC in fire suppression has been mostly replaced. EU's and ICAO's replacement schedule for Halons differ. Ultimately all fire suppression HFCs will be emitted. Fire suppressants are affected by ICAO eligibility for CORSIA. Halon like HFC-227ea can be replaced without technical or safety issues (just cost) according to Montreal Protocol Fire Suppression Technical Options	Destruction of HFC-227ea should be avoided. If materials cannot be reclaimed, they should be destroyed. If they can be reclaimed and reused, they would have value beyond what could be generated through carbon credits. Discussion of interactions with ICAO, CORSIA, NFPA are beyond the scope of VM0016.

Section 6 – Baseline Scenario			
#4	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		Committee. Therefore KIP funding will be used to eliminate the HFC-227ea usage. Destroying or recovering HFC-227ea can thus reduce HFC emissions since the replacement is accelerated when a countries has decided to include fire suppressants in its KA efforts.	
		Proposal: In countries where a KIP includes replacing HFC as fire suppressant, this HFC is eligible for VM0016. In countries where ICAO rules for Halon replacement are followed, all HFC in fire suppression from the aviation sector is also eligible for VM0016 destruction or recovery. **Rd 2**: Similar to #1, not necessary but a policy opportunity for Verra to reflect CORSIA. The MP continues at the MOP37 (3-7 november) to struggle with fire suppressants for aircrafts. In my opinion the opportunity for Verra is to reflect that replacements for Halon and for HFC-227ea exist but are resisted only for cost reasons (countries demanding MLF $s). Also to consider fire extinguishers can be assumed to get reliably high quality maintenance (esp. in aircraft). The question is thus: can one define an eligibility start date based on efforts in a country to replace both Halon and HFC-227ea. If this is too difficult, then perhaps better to not add a start date for fire suppressant in VM0016. **Rd 3:** It is suitable to define a fire suppression HFC start date when respective MP decisions emerge. Until then, the phasedown criterion of 70% (in 4.1.2) will delay addressing fire suppressants. **Issue #4 is closed.**	**Round 2 Response:** We agree that these are important points and may consider addressing them in a future methodology revision.

Section 8 – Quantification of Estimated GHG Emission Reductions and Removals			
#5	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
8.1.2	Baseline emissions	In VM0016, RAL is only cited in FN 1 and 9, and in Data table p.34 without any	Thank you for your input. Verra will consider

Section 8 – Quantification of Estimated GHG Emission Reductions and Removals			
#5	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
	from BA	further guidance on it. This use of RAL is impossible and misunderstands what RAL is (or rather was). 1. RAL-GZ 728 was used only in recycling plants in Europe where all ODS and HFC are recovered in liquid form. As it states in the title "Quality Assurance for Demanufacture". RAL does not address BA in intact foam as this is not allowed in European countries. RAL applies only to "crushing, grinding and shredding" entire appliances and thus imposes the treatment of appliances according to the EU WEEE, which also regulates how all manufacturers jointly pay for all the recycling operations (as materials recovered do not cover the cost) in EU member states. Also RAL requires "milled PU foam" analysed but VM0016 using projects do not imply the PU is degassed (only for EU WEEE). 2. RAL-GZ 728 requires that appliances enter an automatized and encapsulated plant and all materials leaving this plant are recycled. Non-automatized recycling that does not grind the entire appliances cannot achieve such recycling and VM0016 is intended to allow manual dismantling of appliances (thereby contributing to making CFC, HFC and HCFC destruction realistic in the Global South). RAL would burden PPs and ignore national circumstances such as availability of glass furnaces, steel scrap collection, etc. Besides, most refrigerator recycling plants in Europe actually did not achieve the 283 gr CFC/fridge minimum recovery demanded, as is well document in the scientific literature and policy publications by EU governments. 3. RAL-GZ 728 reflects the average volumes of appliances in use in Europe and says nothing about the differences in volumes in appliances in other continents, for instance in North and South America avr volumes are much larger. 4. RAL ascertains a minimum recovery of ODS and HFC but this is neither required nor appropriate in VM0016. There should be no minimum requirements because in all countries the baseline is no refrigerator recycling in encapsulated plants occurs. 5. To use RAL-GZ 728 realistically, VM0016 must separate the elements of RAL-GZ 728 that are applicable from those that are not. The present VM0016 has no guidance at all on how RAL can be applied. In others words, RAL requires adapting it to VERRA methodologies, it was not intended to be used in carbon accounting, only for controlling the implementation of EU WEEE directive.	referring to RAL-GZ 729 where appropriate.

Section 8 – Quantification of Estimated GHG Emission Reductions and Removals			
#5	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
		6. FN 1 cites RAL-GZ 728 but RAL-GZ 729 could also be reflected, besides RAL CO2OL. 7. RAL-Gütegemeinschaft Rückproduktion von Kühlgeräten e.V. is a separate NGO, and also a one person operation. This one person has implemented several RAL checks across Europe but it has no other function and the majority of recycling operations in Europe do not use it any more. Possibly RAL was effective in the early years of the EU WEEE ~2005 to 2010. In 2025, the share of CFC containing appliances in Europe has declined to <10% of recycled appliances (25 years after CFC ban in production in Europe) and therefore the minimum CFC requirements in RAL-GZ 728 cannot be reached and RAL cannot yield pertinent criteria for the current recycling operations in Europe as the majority of appliances now have Hydrocarbons as refrigerants (isobutane) and as BA (cyclopentane), for which RAL contains no criteria. 8. Since RAL resulted in additional costs for European manufacturers (obliged to pay the recyclers), the European manufacturers association (CECED) produced an alternative called the WEEE-Forum "Requirements for the Collection, Transportation, Storage, Handling and Treatment of Household Cooling and Freezing Appliances containing CFC, HCFC, or HFC" in 2007. This alternative is not revelant for VM016 for the same reasons. 9. Finally VM0016 eq. 6 – 11 require that PP knows how much BA is contained in 3 vol classes (Data table on p.34) applying either official nat. values or from RAL. Neither nat. values nor RAL have data for BA contents in foam for HCFC, HFC nor Hydrocarbons, the majority of models in use. At the least, these equations require that Montreal Protocol TEAP data be applied and VM0016 to define which defaults are conservative. In addition, the RAL volume classes are not representative of appliances outside of Europe. In sum for RAL to be applied, VM0016 must instruct which parts of RAL are realistic, VM0016 must furthermore add monitoring procedures and default values that RAL does no provide. RAL-GZ 729 is an extension of 728 specifically for hot water tanks and contains foam sampling criteria but only for CFC, no other blowing agents or appliance types.	
		Proposal: The minimum requirements of RAL for CFC refrigerant and CFC BA recovered	**Round 2 Response:** We agree with this suggestion and removed appliance types 1-

Section 8 – Quantification of Estimated GHG Emission Reductions and Removals			
#5	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		are not necessary in VM0016, all CFC destroyed in the project case would otherwise be emitted (as assumed by CAR and ACR). The minimum requirements for other material fractions required are not necessary in VM0016, . RAL-GZ 728 ch. 3 and 4 are applied for Step 1, Step 2 is not applied (because is requires en "encapsulated plant"). Step1 in ch.4.2 requires selecting 100 appliances 60, 25, 15 is used and is equally applied for HFC containing appliances and Hydrocarbon containing appliances separately. RAL-GZ 728 ch. 5 and 6 are disregarded as they refer to German recycling regulations and their third-party attestation. **Rd 2**: Agreement that RAL is not transferable to VM0016. Because a) VM0016 covers other activities and b) covers other gases than RAL. This requires changing the monitoring. There is no need anymore to distinguish appliances type 1, type 2 and type 3 (VM0016 p.34). I suggest to consider that $M_{app,foam.i.p.y}$ can not be defined because there are no official national values available (and RAL is not usable). Furthermore there is no need to know the volume of foam in an appliance and the VM0016 monitoring can use only the destroyed volume of foam to calculate blowing agent emissions avoided by destroying the foam. The changes in monitoring are addressed in #7 below. **Rd 3:** Removing RAL is a mayor improvement to VM0016. **Issue #5 is closed**.	3 and reference to RAL in terms of foam monitoring and sampling.

Section 9 – Monitoring			
#6	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
8.1.2	Parameter $ER_{foam,i}$	Values in the Data table for $ER_{foam,i}$ (p.33) reflect disposal practice with shredding of appliances and disposal on landfills, as widely used in the US, according to Scheutz (2007). Most other countries do no use car shredders for appliances (or for cars) and all appliances are discarded as such or, if treated	Calculations of $ER_{foam,i}$ are supposed to illustrate foam emissions including a worst-case baseline, which would be shredding. This demonstrates the amount of foam BA

Section 9 – Monitoring			
#6	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		at all, the compressors are removed and enter metal recycling. In many countries, it is not possible for a PP to document "baseline disposal practice" and the only realistic guidance for a PP is to assess whether there are regulations for municipal solid waste sites regarding appliances. ACR methodologies credit 100% of BA as emitted to the atmosphere.	that would be released under business-as-usual scenarios and hence would mean that a project would be additional if it avoided this practice. The landfilling of entire cars with upholstery foam, or appliances containing eligible BAs would have a much lower emissions baseline compared to crushing or shredding. Using this non-crushing/shredding baseline would imply less emission abatement in the "project" and would create a negative incentive to undertake these types of projects.
		Proposal: PP must document whether landfills in the country are under regulations on how to deal with end-of-life appliances. Where there are no regulations then all BA is credited and $ER_{foam,i}$ is 1.0. PP must document whether there are car shredders in operation and whether these receive and process appliances. If one car shredder is in operation, then it is assumed that baseline disposal practice is as analysed by Scheutz (2007) and all appliances arrive there. **Rd 2**: Disagreement because a non-crushing/shredding baseline has higher emission abatement from VM0016 projects. The $ER_{foam,i}$ values (p.33) from the CAR US ODS protocol were obtained by Scheutz and Fredenslund with samples from automotive shredder residue taken in US landfills when anaerobic conditions cause dechlorination and defluorination of blowing agents in foam (by bacteria that arise only in anaerobic conditions in landfills). Without shredding no anaerobic conditions arise and the blowing agents HCFC and HFC do not decompose. When entire appliances are corroding away blowing agents are 100% released, more slowly than during shredding and dependent on the decomposing of hulls of steel or plastic.	**Round 2 Response:** While it's true that 100% of the blowing agent from appliances that were not shredded would be released eventually, the time period over which those emissions occur is so long that it would be inappropriate to credit 100%. Therefore, we are keeping the baseline scenarios and calculations as-is to be conservative and broadly applicable.

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#6	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		Shredding of cars and appliances occurs only in very few countries and VM0016 should include some form of approximation of the most likely disposal practice in most countries. Since car shredders are big, costly and clearly visible any PP can be tasked to ascertain whether there are any in a country. The "worst-case baseline" does not correspond to shredding. **Rd 3:** Including options for non-crushing/shredding baseline disposal would increase incentives to abate blowing agents in intact foam, however there are no respective solutions in the literature other than the 100% crediting in ACR methodologies. **Therefore issue #6 is closed**.	

Section 9 – Monitoring			
#7	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
9.3.2 and 9.3.3	Composition and Quantity Analysis Requirements for Dilute Sources	VM0016 has no sampling instructions for intact foam and only refers to Scheutz (2007) sample heating method (ch.9.3.2.3) and RAL-GZ 728 1000 appliances test. There are no criteria for foam samples from intact foam in RAL-GZ 728 and in RAL-GZ 729 only for hot water tanks and flat products (ch. 4.2.7.2) (VM0016 does not refer to RAL-GZ 729, only "RAL"). Therefore the monitoring in VM0016 is not viable for intact foam, at all, nowhere. Viable monitoring for CFC, HCFC and HFC containing appliances must address the unavoidable condition that appliances rarely indicate the BA contained in their foam and therefore any removal of intact foam from any appliances leaves any PP with a pile of foam with an unknown mix of different BAs. For example refrigerator recycling data from Ghana (VCS project 1752) in recent years show 1/3 appliances with CFC-11 as BA, 1/3 with HFC-134a and 1/3 with cyclopentane as BA, from ~20 different brands in use in Ghana (most brands ship appliances globally).	Thank you for your input. Verra believes that the methodology already identifies robust sampling requirements, provided in Section 9.3.2.2. These proposed procedures were developed to simplify sampling requirements so as to encourage project development.

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		Because in the large majority of countries, appliance brands from maybe 10 or up to 50 and more manufacturers in different countries are in use and thus have different BAs in the foam. It is not possible to establish for an appliance model and production year for any manufacturer what BA was used. Any realistic sampling of intact foam must require a sufficient number of samples for BA content % for CFC11, for HCFC-141b (and HCFC-142b), for HFC-134a, for HFC-245fa, HFC-265mfc and for cyclopentane (other BA are not frequent). Number of samples required for each BA has to be specified in VM0016. Any pile of intact foam can be sampled and with information on total number of appliances, volumes of all appliances (from which foam was removed), the total BA quantity destroyed can be calculated. For quality control of monitoring, there is one effective possibility that can be applied in VM0016, the volume ratios of BA to refrigerant lubricant oils recovered (CFC12 runs with mineral oil lubricant, HFC-134a polyolester, HCFC-22 naphtenic mineral oil and alkylbenzene, and isobutane also mineral oil). Without exception all appliances have a very narrow range of total BA content to lubricant oil recovered because all appliances have a very narrow ratio of refrigerant to lubricant oils (specific for each type of refrigerant), since the thermodynamics of the refrigeration cycle is of course universal (mass ratio of a refrigerant to lubricant oil is uniform and the ratio of insulation foam volume to refrigerant volume also). Thus controlling lubricant oil recovered allows to prevent errors in foam sampling. CAR US ODS protocol allows appliance foam destruction only for BA in concentrated form, Appendix E includes RAL and WEEE standards and in ch.E.1 foam sampling requirements (one sample each of 4 sides, 4 in. square, 10 appliances). ACR allows appliance BA destruction in intact foam and Appendix B contains intact foam BA, but does not contain guidance for mixes of foams with different BAs. In Appendix D possible foam with Hydrocarbon BA are only mentioned. Neither the 2 CAR nor the 4 ACR standards require a minimum recovery of ODS	

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		or of any other material. CAR and ACR contain assumptions about industrial economics and household economics concerning appliances, as well as environmental policy and consumer behaviour as these exist in the USA. Art.5 countries impose different eligibility criteria and different baseline assumptions for VM0016. The CDM Sampling Standard has suitable criteria for sampling results and these apply to foam BA. Example a 90/10 confidence criterion to be applied for each BA chemical, and is suitable to extrapolate to the entire foam volume. Only CAR US ODS Protocol contains a sampling confidence criterion in Appendix E, but CAR US ODS does no relate it to CDM explicitly.	
		Proposal: Use ACR Destruction of ODS and High-GWP foam (vs.2) baseline assumptions in ch.5, esp. eq. 5 and 10, and Appendix B. This reflects destruction of BA in intact foam removed in non-enclosed demanufacturing. Eq.10 has a suitable default for BA lost during foam removal of 10%. Many more published data sources can be added to justify this. Use CAR US ODS Protocol Appendix E for appliance foam sampling requirements and statistical analysis criteria of 90% upper confidence for BA concentration results in foam. Combine the above two with additional guidance to reflect mixes of appliances with different BA in foam. VM0016 should add total random sample to analyse and for each BA the sampling must meet a specific confidence value for BA content (%), if this value of confidence is not reached in the monitoring, no crediting for that BA is allowed. Share of a BA among all samples is considered share of BA among entire foam volume from where random samples where taken. Scheutz heating method to be used for all BA. Necessary defaults to add to VM0016 so that intact foam with mixes of BA can be credited: avr foam vol / litre refrigerator (for each BA), avr foam vol / kW Airconditioner (or BTU) (for each BA), PP shall compare the total volume of foam arriving at destruction facility with	Removed requirements to follow RAL specifications. Removed appliance types.

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		the calculated total volume based on these defaults and appliances sizes, and use the lower value (calculated versus monitored volumes) of the two for baseline emission calculation. The result is more reliable than eq. 6-11 because the types and sizes of appliances treated can differ from national averages. Quality control ratios for refrigerants CFC-12, HCFC-22, HFC-134a, R410, isobutane and propane: lubricant oil mass / litre refrigerator (for each refrigerant) lubricant oil mass/ kW Airconditioner (for each refrigerant) PP shall include monitoring of lubricant oil recovered from appliances. When the recovered lubricant oil corresponds to a lower number of appliances, this lower number is used to calculate BA destroyed with the intact foam. Equations for foam BA% to calculate total BA destroyed to be added. Additional quality control can be imposed on PP via the composition of BA sampled in intact foam volume to coincide with the same composition of different lubricant oils. If these ratios differ there is an error in the sampling and no credits given.	
		Rd 2: When removing the RAL standard from VM0016 since RAL does not contain HCFC and HFC defaults and no guidance for non-encapsulated recycling installations, then Ch. 9.3.2 and 9.3.3 are incomplete. Ch.9.3.2 and 9.3.3 are also not realistic as explained above (BA contained not known for most appliance models, neither the chemical nor the weight %). Ideally the monitoring shall allow to apply VM0016 for all sizes and types of appliances that contain ODS and HFC, and reflect recycling operations with no information or incomplete information on refrigerant and BA contained in individual appliances. I am certain that ch.9.3.2 can be developed enough to account for all intact foam destruction and the current simplified shape does not in fact enable PPs to monitor intact foam destruction. Furthermore, documenting foam blocks by images is not realistic or reliable because manual removal is not uniform and images are not practicable for 1000s of appliances.	**Round 2 Response:** We agree that 9.3.3 no longer applied and, therefore, removed the section. Otherwise, we believe that 9.3.2 sufficiently outlines sampling and analysis requirements, though we may consider future revisions if project proponents report significant trouble monitoring intact foam destruction. The requirement to sample 1000 appliances was in the removed section, so this has been addressed. We also agree that it is difficult to ensure reliability in documenting foam blocks, but we believe that images are the most reliable option.

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#7	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
		Ch.9.3.2.1 specifies that one sample per appliance must be used to identify the BA. This is excessive and at the same time insufficient. Ch.9.3.2.2 describes how individual samples are treated but have no guidance on total number of samples and the sample size relative to sample results distribution. Ch.9.3.2.3 describes the Scheutz et al heating method that yields the BA content (% w/w). As an alternative to requiring a sample from each appliance, a standard deviation requirement for BA content results allows to limit the number of samples to perhaps between 100 and 300, taken at random from all appliances. A sufficiently high standard deviation for a sample allows to calculate BA emissions avoided with the average BA content. Furthermore ch.9.3.2.3 can be expanded to reflect mixes of BA, by specifying a standard deviation requirement for each BA chemical (CFC, HCFC and three HFCs, as explained above). The share of each BA chemical among all random samples can be applied to the total intact foam volume to establish which share of the total contains which BA. The defaults defined on p.18 above can be applied to control the total BA content calculated with the average BA content from the sample results. Ch.9.3.3 contains the 1000 appliances test and a total mass balance (both from RAL). Neither of these two are necessary for VM0016 because recovery efficiency is not a parameter for ODS/HFC emissions avoided. Without RAL, the equations 7 to 10 need to be replaced, data table on p.34 moved to Ch.9.2 and at least instructions for Air conditioners added. $M_{app,foam}$ can be calculated from the BA content and the total volume of foam destroyed, instead of "official national values" or RAL results. I am certain that this approach is the only viable one for intact foam destruction monitoring. Finally, data tables on p.53 to 55 can be removed or detail added. "Input flow of appliances p, q, r" reflects RAL refrigerator size ranges (not applicable outside Europe) and "Total weight of output fractions" is not necessary to document because the various material fractions are not required. **Rd 3:** I believe that currently the monitoring as in section 9 is not widely	The requirement to take one sample per appliance applies to the entire process of identifying and quantifying the blowing agent, as outlined in 9.3.2. While this is an onerous process, we believe it is necessary to avoid crediting non-eligible gases. As noted above, the requirement to test 1000 appliances is no longer included in the methodology. With the removal of appliance types 1-3, we removed equations 8-10 and revised equation 7 to apply to all collected appliances. $M_{APPLIANCE,foam,i,y}$ will be determined through monitoring, as outlined in Section 9. Lastly, we agree that the parameters "Input flow of appliances p, q, r" and "Total weight of output fractions" are no longer needed; as such, we have removed these from the methodology.

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		applicable because of the "unavoidable condition" outlined on page 17 above. 9.3.2 can be expanded and made more widely applicable with further guidance how sampling results from 9.3.2.3 shall be assessed to determine $M_{Appliance\ foam,I,y}$ (used in eq.7) under a variety of circumstances (similar to CAR ODS foam sampling). Possibly such a further improvement can be made via a methodology clarification at a later stage. **Therefore issue #7 is closed**.	

6.2 VMD0048 ACTIVITY METHOD FOR THE DETERMINATION OF ADDITIONALITY FOR RECOVERED AND STOCKPILED ODS REFRIGERANTS

Section 3 - Definitions			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
		No comments, the module VMD0048 is viable and accurate as is.	