Approved VCS Methodology VM0001

Version 1.0

"Infra-red Automatic Refrigerant Leak Detection Efficiency Project Methodology"

Sectoral Scope 11

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

This methodology is based on the project activity "HFC Refrigerant Carbon Credit Project", whose baseline and monitoring methodology and project design document were prepared by CN Business Network in consultation with its Environmental Advisory Board

This methodology also draws upon the latest approved versions of the following tools:

- The CDM "tool for the demonstration and assessment of additionality";
- WRI/WBCSD's "The GHG Protocol for Project Accounting"

Both tools lay out useful guidance regarding the investment and barriers analysis referenced in this VCS methodology; the GHG Protocol is also germane to the common practice assessment. For more information regarding the CDM tools please refer to http://cdm.unfccc.int/goto/MPappmeth. For more information on the WRI/WBCSD tool, please refer to http://www.ghgprotocol.org/files/ghg_project_protocol.pdf.

Selected approach from paragraph 48 of the CDM modalities and procedures

The project will be assessed based upon the following approach:

1. Using "Existing actual or historical emissions, as applicable"

Definitions: Please provide definitions of key terms that are used in this proposed new methodology

2. For the purpose of this methodology, the following definitions apply:

- **Infrared (IR) real time automatic leak detection system**: Refrigerant leak detection system that monitors refrigerant at regular intervals throughout the day using infrared technology and communicates readings back to a central monitoring center on a real time basis.
- **DX refrigeration equipment**: Direct Expansion (DX) refrigeration equipment that uses a two-phase fluid directly in an evaporator to absorb heat through an expansion and evaporation process.
- **HVAC system**: An air conditioning system that provides comfort heating and cooling to a room, area or entire building.
- **Seasonal top-offs and draw-downs**: The adjustment of the refrigerant charge quantity of a system to compensate for the additional refrigerant needed for condenser flooding in winter to maintain

head pressure and the removal of refrigerant in the summer to prevent overfilling of the system receiver.

- **EPA GreenChill program**: An EPA program open to supermarket chains, refrigerant producers and supermarket refrigeration manufacturers whose goal is to reduce supermarket refrigeration leak rates through the collaborative effort of its members.

- **HFC**: Hydrofluorocarbon, a greenhouse gas covered under Kyoto Protocol

- **HCFC**: Hydrochlorofluorocarbon, a greenhouse gas not covered under Kyoto Protocol but under consideration by the VCS as a qualifying credit.

Applicability conditions/Eligibility Criteria

3. This methodology applies to project activities that install infra-red, real-time leak detection systems on US retail DX refrigeration equipment systems in order to reduce leaks of HFC refrigerants. A parallel methodology has been prepared which will include HCFC refrigerants pending VCS board determination regarding the parameters for their eligibility.

4. The methodology is applicable under the following conditions:
    - Applies to the installation of infra-red (IR), real-time automatic leak detection/management systems installed in commercial refrigeration systems in US supermarkets provided the IR equipment is new or has been sourced from within the project boundary as the underlying refrigeration equipment is replaced or decommissioned
    - When installed onto DX refrigeration systems, so that there is no change in underlying refrigeration system technologies
    - Including any associated HVAC systems in these same locations which are managed using the same IR systems
    - Focused exclusively upon HFC leakage rates (since these are the Kyoto gases) (with a contingency to expand to HCFC's pending any VCS policy review as outlined in the second accompanying methodology)
    - Within the United States
    - Focused, in the US, only on refrigeration systems containing less than 2000 lbs[1] refrigerant charge
    - Supported by data systems for leak reporting/management which are used for ozone depleting substance (ODS) compliance purposes

NOTE: If projects seek to qualify located outside of the US, the VCS double approval process will be required to establish whether the conservative baseline cap (in the US provided by EPA's Green Chill program leak rates) can be provided on a credible basis by appropriate entities in those locations.

NOTE: If a country's designated agency is unable to provide the conservative cap baseline cap, then the methodology will still stand without including this potential conservative cap baseline process since the additionality of a project, based upon its historical baseline, can still be adequately assessed, on a retrofit basis, using the CDM and WRI tools referenced.

[1] Quantities are indicated in the imperial units (lb) since the scope of this methodology is currently the US: however, if the methodology is extended to other regions, SI-units should be used and adapted accordingly.

II. BASELINE METHODOLOGY PROCEDURE

Project boundary

5. The physical boundary is the set of retail stores in which the infra-red, real-time leak (IR) detection systems have been installed and HFC refrigerants are used. When HVAC systems in these stores are supported by these same IR detection systems, then the physical boundary includes these HVAC systems also.

6. The greenhouse gases included are HFC's, which are increasingly used as refrigerants in retail refrigeration systems. [A parallel methodology has been developed to potentially also include HCFC's pending VCS board confirmation of their status and eligibility criteria.]

7. The methodology covers following categories of HFC emissions reductions from the equipments within the project boundary:
   - HFC emissions during DX refrigeration equipment operations and/or repairs/maintenance
   - HFC emissions during seasonal "top offs" and "draw downs"

Table 1: Emissions sources included in or excluded from the project boundary

Source		Gas	Included?	Justification / Explanation
Baseline	Emissions from Retail Refrigeration Equipment	HFC	Yes	Project activity is prevention of HFC leaks to atmosphere
		HCFC	Pending	Separate methodology considers project activity which would include prevention of HCFC leaks to atmosphere, pending VCS board decision regarding inclusion of ODS's and relevant eligibility criteria. This methodology does not include HCFCs.
		Other: CO_2 CH_4	No	IR systems do not impact energy efficiency of underlying DX systems; rather, more timely maintenance of refrigerant levels enables refrigeration equipment to run more efficiently and thus positive CO2 gains are conservatively set to zero.
	Upstream/ Downstream	HFC	No	Project activity produces positive gains upstream, which are conservatively set at zero. Project activity has no impact or influence on separate end of life decisions regarding refrigerant disposal as equipment is decommissioned: separate credit methodologies exist for these actions taken in this realm
		HCFC	No	Ibid
		Others	No	Ibid
Project activity	Emissions from Retail Refrigeration Equipment	HFC	Yes	Project activity is prevention of HFC leaks to atmosphere
		HCFC	Pending	Separate methodology considers project activity which would include prevention of HCFC leaks to atmosphere, pending VCS board decision regarding inclusion of ODS's and relevant eligibility criteria. This methodology does not include HCFCs.
		Other: CO_2 CH_4	No	IR systems do not impact energy efficiency of underlying systems; rather, more timely maintenance of refrigerant levels enables refrigeration equipment to run more efficiently and thus positive CO2 gains are conservatively set to zero. Electricity required to run IR systems is de minimis (91kwh/year vs 3-4m kwh/year for each store of which 1.5-2m kwh/year for refrigerant equipment/HVAC systems: less than 0.01%)
	Upstream/ Downstream	HFC	Yes	Project activity produces positive gains upstream, which are conservatively set at zero. Project activity has no impact or influence on separate end of life decisions regarding refrigerant disposal as equipment is decommissioned: separate credit methodologies exist for these actions taken in this realm
		HCFC	Pending	Ibid
		Other: CO_2 CH_4	No	Ibid

Procedure for the Selection of the Most Plausible Baseline Scenario

8. Since IR detection systems are retrofitted on top of existing refrigeration management systems, the baseline scenario shall be determined by analyzing the following potential alternatives
   • Implementing the project activity without carbon financing; and
   • Continuation of the present practice without IR detection systems, which shall be described in the PDD.

9. Although retrofit projects do not require any further conservative measure to ensure that credits are not granted for reductions from levels considered to be unacceptably high, this methodology will ideally also include the consideration of a conservative cap baseline. Thus this further conservative cap baseline option will be founded upon the following:
   • Best practice leak rates as demonstrated by a national voluntary leak reduction program supported by a credible agency or organization whose average reported leak rates (at some agreed level of performance) and eligibility as a conservative cap baseline has been separately approved by VCS validators, through a double approval process, as reasonable
      - In the US, this alternative baseline will be provided by EPA Green Chill program's reported leak rates for their supermarket members, as estimated to represent the 50% percentile of industry performance based on their memberships' reported leak rates and share of industry stores (see 20 below)

10. Assessment of National Policy/regulations on HFCs
    • List national or regional policies/regulation to evaluate whether they a) place a fixed limit on cumulative basis for the total HFC emissions within a given year's operations; b) transfer ownership of all resulting HFC reductions to other entities to meet their separate compliance obligations (e.g. such as would arise in upstream cap/trade requirements); c) stipulate the installation of IR leak detection systems as the only option to fulfill retail operations' compliance purposes.
    • If such policies exist, assess the enforcement of the policies.
    • If above-mentioned policies/regulation exist and are enforced, then the project activity without carbon financing is the baseline scenario and thus the project does not qualify for credits.

    This regulatory assessment should be undertaken again when the project comes forward for re-validation at the end of the first and second crediting period (see article 25).

11. This methodology is applicable only if the baseline scenario includes the continuation of the present practice.

12. NOTE: Consistent with the GHG Protocol for Project Accounting, a review of the barriers faced by the two baseline alternatives – continuation of current practice and adoption of the IR project -- is undertaken in the Additionality section below. In a retrofit project, continuation of the present practice typically faces no barriers and thus constitutes the baseline. This methodology is only applicable if, in the barriers analysis below, the continuation of present practice faces no barriers and the IR project without carbon financing can demonstrate, as in the additionality section below, that it faces barriers to implementation.

13. NOTE for US: If EPA Green Chill program is unable in a given year to provide the alternative baseline cap information, then the methodology will still stand without including this potential conservative cap baseline since the additionality of the project, based upon its historical baseline, can still be adequately assessed, on a retrofit basis, using the CDM and WRI tools referenced.

Additionality: Please describe the procedure for demonstrating additionality

14. The additionality of the project activity shall be demonstrated and assessed using the latest version of "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board, which is available on the UNFCCC CDM web site. (See Sources).

    Proponents will use the required referenced CDM tool, and it is required that the investment analysis be performed: this will require applying the investment benchmark (2b Option III) analysis since this is a retrofit project (which precludes 2b Option II) and there are refrigerant cost savings which arise, alongside the carbon reductions(which precludes 2b Option I).

    Using the CDM tool, if a further barriers analysis is required, the investment barriers as outlined in the CDM tool may be augmented with demonstration of other barriers from WRI/WBCSD (e.g. Table 8.1, see sources).

Baseline emissions

15. The baseline emissions will be determined using the yearly average leak rate arising from the total HFC and HCFCs emitted during the baseline period, whether emitted during operations, repair or maintenance of the equipment within the project boundary, and incurred in locations where HFCs are in use. The baseline period will be either:
    a) a period of three years prior to the installation of the IR equipment (year (x))
    b) a three year consecutive period including the IR installation year (x) which can extend at most three years subsequent to such installation if data records for emission rates are not accessible for a)

16. The historical baseline is anchored upon emissions rates for both HFC's and HCFC's since this is more conservative: while HFC's are gradually substituting for HCFC's, HCFC leak rates are lower than those for HFC's as confirmed by both EPA and leading companies. Thus, to adopt a baseline based only on HFC leak rates would potentially inflate credits. Since both refrigerants perform functionally comparable service, taking the blended leak rates for all refrigerants as the historical baseline for HFC credits reflects both historical emission rates for any given location while remaining conservative.

17. The data inputs will be based upon those which the company uses for its ODS/refrigerant compliance purposes. The baseline data shall therefore be based on such corporate records for the relevant project locations including the equipments' refrigerant charges and leaks/use data (based upon the leak records and/or purchase records for replacement refrigerant as reflected in the compliance systems) according to the steps described below.

18. Since this is a retrofit project and the installed base of stores in which IR systems are present may be increasing year on year, this historical baseline will need to be recalculated for each year (y) in which project credits are to be estimated based on the set of stores' equipment which has IR systems installed by year y, the year in which credits are currently to be calculated. This ensures that the historical baseline is taken from the same set of systems against which the new total IR systems have been retrofitted and against which the leak rates for year y will be estimated. Thus the baseline emissions will be given by a baseline leak rate tailored to year y: BLR_y

19. The baseline emissions of HFC's are estimated using the following approach and equations:

For the year x, when the first IR systems are installed: the historical baseline would be calculated based on totals for *all* refrigerants in use (HCFC and HFCs), using totals for both leaks and charges

across all the refrigeration systems in stores where IR systems have been installed and HFC's are in use by year y, the year in which the carbon credits are to be calculated, as:

$$BLR_y = [L_x / C_x + L_{x-1} / C_{x-1} + L_{x-2} / C_{x-2}] / 3$$

Where:
BLR_y = Baseline leak rate from stores which have IR systems installed by year *y* and which have HFC's in use by year y (%)
L_x = Total leaks from HFC and HCFC refrigerants in year x (lb) from equipment in stores which a) have the IR systems installed by year y and b) provided that HFC's are in use in this store by year y
C_x = Total Charge for HFC and HCFC refrigerants in year x (lb) from equipment in stores which a) have the IR systems installed by year y and b) provided that HFC's are in use in this store by year y
Note: C_x will be measured consistent with the requirements for EPA ODS reporting.

Note: as confirmed in the data tables below (see 27), the total leaks and total charge volumes are estimated from the database systems used for ODS management purposes which measure the amounts of refrigerants used to refill the refrigeration equipment each time a leak occurs, reflecting the amount of refrigerant leaked. Each entry will describe the number of pounds of refrigerant installed into the equipment at the time of a leak – thus providing the data inputs which summarized over a year give totals for L_x. These same datasystems also document the refrigerant charges for each piece of equipment in the stores. Thus, again, adding these refrigerant charges for each piece of relevant equipment will give the totals for C_x.

Note: L_x includes adjustments for seasonal "top offs" and "draw downs" if practiced. These are seasonal increases and decreases in the refrigerant charge levels to adjust for seasonal temperature changes in the environment. "Top offs" will be considered a "leak" (thus an addition to emissions); "draw downs" will be considered the opposite and thus a credit to the leakage tally.

If historical leak rate information prior to IR installation is not available, a more conservative alternative historical baseline can be created using emission rates from the year x when IRs are first installed through the subsequent two years:
That is:

$$BLR_y = [L_x / C_x + L_{x+1} / C_{x+1} + L_{x+2} / C_{x+2}] / 3$$

Alternative Baseline Cap:
This alternative baseline cap is introduced only to provide a further measure of conservatism:

20. In parallel, an alternative baseline cap will be calculated using the leak rate information from the credible agency approved under "Applicable Eligibility Conditions". In the US, this will be the EPA Green Chill program leak rates, which EPA will provide annually to reflect, based on its members' annually reported leak rates, its estimate for the 50th percentile performance leak rate for the industry.

EPA will establish this EPA BLR_y leak rate by:
1. Estimating its members' share of total industry emissions, based on their Green Chill members' total number stores divided by the EPA's estimate of the industry's total number of stores
2. If Green Chill members' share of industry is less than 50%, the EPA BLR_y will be the lowest performing leak rate (that is the highest leak rate) from among their members' averages (provided this is not more than the EPA's estimate for the US industry average leak rate of 25% whereupon the EPA BLR_y will be considered EPA's estimate for the industry average, which is 25% in 2007).
3. If Green Chill members' share of industry is more than 50%, the EPA BLR_y will be the leak rate achieved by the supermarket member which, on a ranked basis from highest performing

to lowest performing (that is lowest leak rate to highest leak rate) represents the 50th percentile of stores.

4. A supermarket's industry capacity will be calculated as its number of stores divided by the industry's total number of stores (consistent with #1 above)

Examplle: 50th Percentile Leak Rate Estimated at 17%

Supermarket "i" (anonymous)	LR_i Avg leak rate For Supermarket i	IC_i % Industry capacity	$Sum_{i = 0 \text{ through } i}$ (IC_i) Cumulative Capacity
Supermarket A	7%	3%	3%
Supermarket B	9%	15%	18%
Supermarket C	11%	4%	22%
Supermarket D	13%	12%	34%
Supermarket E	15%	8%	42%
Supermarket F	17%	10%	52%
Supermarket G	19%	5%	57%
Supermarket H	21%	3%	60%

Thus EPA BLR_y is given by:

If sum over all GC members for IC_i <50%, then:

If EPA Green Chill program has members whose total share of industry capacity has not yet reached 50% of the industry, then:

EPA BLR_y = minimum (LR_i=L_i/C_i, 25%)
Where supermarket i has the highest leak rate of the GC members and thus:
$Sum_{i = 0 \text{ through } i}$ (IC_i) is the highest for the group; and
$sum_{i = 0 \text{ through } i}$ (IC_i) < 50%
And
IC_i = S_i / EPA ST
And 25% is the EPA stated average for leak rates in the supermarket sector

If sum over all GC members for IC_i >50%, then:

If EPA Green Chill program has members whose total share of industry capacity has now reached more than 50% of the industry, then:

EPA BLR_y = minimum (LR_i=Li/C_i, 25%)
Where, for supermarket i, the $sum_{i = 0 \text{ through } i}$ (IC_{i-1}) <50% and $sum_{i = 0 \text{ through } i}$ (IC_i) > 50%
And
IC_i = S_i / EPA ST
And 25% is the EPA stated average leak rate for the supermarket sector.

Where:
EPA BLR_y = Baseline leak rate for HFC's and HCFC's for the Green Chill member company estimated to represent the 50th percentile performance leak rate for the industry in year x (%)
LR_i = Average leak rate reported to EPA Green Chill by the supermarket "i" (across its HFC and HCFC refrigerants) in year x (%) whose performance sits at this 50th percentile

L_i = Total leaks from HFC and HCFC refrigerants in year x (lb) from supermarket "i" as reported to EPA Green Chill
C_i = Total Charge for HFC and HCFC refrigerants in year x (lb) reported by supermarket "i" to EPA Green Chill
IC_i = Share of industry capacity represented by supermarket i in year x
S_i = Number of stores operated by supermarket i
EPA ST = Total number US supermarket stores as determined by EPA Green Chill Program

NOTE: If the EPA BLR_y data does not exist for year x for a project seeking validation, because year x precedes 2007, then the first year of EPA Green Chill program available data shall be used as the conservative cap baseline. The EPA 50th percentile leak rate is determined to be 25% for 2007. This approach is conservative, given the gradual improvements which will take place over time in the conservative cap baseline at the 50th percentile leak rate level.

NOTE: If EPA's BLR_y data is not available in a given year, then the prior year's estimates will be used. If the EPA Green Chill program ceases to exist or cannot provide further data, then the alternative baseline will not be considered as part of this methodology.

Final Baseline Selection:

21. If the historical project baseline (BLR_y) is greater than the alternative baseline cap, (EPA BLR_y,) then the alternative baseline cap shall be the baseline. This approach is included in order to ensure that a supermarket chain who's historical emissions rate was particularly large would not be awarded credits for reductions from a baseline that, although historically accurate, could arguably be considered inflated. Using the EPA BLR_y also ensures that, unless the historical baselines are already more conservative, a baseline is selected that will reflect any gradual improvements in the leak rate efficiencies for the Green Chill member companies and thus the industry.

Thus, if BLR_y > EPA alternative baseline selected (EPA BLR_y), then the Final BLR_y would the lower of these options

This is given by:
Final BLR_y = @ min (BLR_y, EPA BLR_y)

Where:
Final BLR_y = Baseline leak rate to be adopted for the project for use by year y (%)
BLR_y = Baseline leak rate for the supermarket submitting the project, arising from stores which have IR systems installed by year *y* and which have HFC's in use by year y (%)
EPA BLR_y = Baseline leak rate for HFC's and HCFC's for the Green Chill member company estimated to represent the 50th percentile performance leak rate for the industry in year x (%)

Note: the project's emission reductions will then be calculated by comparing the final baseline leak rate to the later year's leak rate to derive the total pounds of refrigerant avoided in year y (by applying the difference in leak rates to the refrigerant change in situ in year y). The composition of refrigerants used by year y may have changed from year x. So the average global warming potential of the released gases in year y will then be applied to these pounds reduced in year y since the global warming reduction reflects the reduced usage of the gas combinations used during that particular year y This thus ensures that the credits granted in year y reflects the reduction efficiencies in pounds of refrigerant emitted in year y compared to year x (since the refrigerant

types are interchangeable) but using GWP intensities that reflect the refrigerant usage from the particular crediting year y.

Project emissions

22. Project emissions will be determined using the average leak rate arising from the total HFC emitted during year y, the year in which credits are sought, whether emitted during operations, repair or maintenance of the equipment within the project boundary.

The project emissions from HFC's are estimated using the following approach and equations:

$PLR_y = [L_y / C_y]$

Where:
PLR_y = Project leak rate from equipment which has both HFC's and IR systems installed by year *y* (%)
L_y = Total leaks from HFC refrigerants in year y (lb) from this same set of equipment
C_y = Total Charge in year y for HFC refrigerants (lb) within this same set of equipment
Note: Ly includes adjustments for HFC top offs and draw downs if practiced

Again, the project's emission reductions will be calculated by comparing the final baseline leak rate to the project year y's leak rate to derive the total pounds of refrigerant avoided in year y (by applying the difference in leak rates to the refrigerant change in situ in year y). The weighted average global warming potential of the released gases in year y will then be applied to these pounds reduced in year y since the global warming benefits reflects the reduced usage of the gases used during that particular year.

Leakage

23. There is no requirement for the project to consider leakage as it is not likely to occur for the following reasons:

    a. Any refrigerant savings achieved in the supermarket location due to lower leak rates will result in smaller refrigerant purchases. Thus any upstream leaks during manufacture or transportation of the refrigerant (which are estimated to be a relatively low percentage of the total supply chain leaks from refrigerant use) will also be saved. This constitutes "positive leakage": efficiencies during supermarket use will achieve further leak reductions upstream. These are conservatively set at zero in this methodology and thus there is no further project requirement to consider leakage.

    b. Any "top up" or "draw down" changes in refrigerant use for the relevant periods is already captured under L_y and L_x

    c. The IR systems do not control, influence or impact the release of refrigerants as equipment is decommissioned. Separate credit methodologies already exist to address whether beyond business as usual GHG reductions are gained through completely separate and distinct actions which are not related to IR system installations. Without any influence, this methodology must assume that the refrigeration equipment's original charges are handled on a business as usual basis during decommissioning. Incorporating their future decommissioning choices also risks double counting reductions with other project methodologies which VCS is developing and already exist under CCX and CDM.

d. The methodology does not apply to used IR equipment sourced from outside the project boundary (since in this case emissions could rise in the external location while credits were counted within the project). Note: IR equipment already installed within the project boundary DX equipment can be removed (e.g. if DX equipment is being decommissions) and the IR equipment used again (e.g. if new DX equipment is purchased) since these changes all take place within the project boundary.

Emission reductions

24. Emission reductions are calculated as follows:

$LRR_y = \text{Final } BLR_y - PLR_y$

Where:
LRR_y = Leak rate reduction for project in year *y* (%)
PLR_y = Project leak rate from equipment which has both HFC's and IR systems installed by year *y* (%)
Final BLR_y = Final baseline leak rate (as defined above as the lower of the historical leak rate BLR_y (from equipment which has IR systems installed by year *y* (%)) and the EPA Baseline Cap (%))

$ER_y = LLR_y * C_y * GWP_{HFC\text{-}y}$

Where:
ER_y = Emissions reduction in year y (tCO_2e/yr)
LRR_y = Leak rate reduction for project in year *y* (%)
C_y = Total Charge for HFC refrigerants in year y (lb) within this same set of equipment
$GWP_{HFC\text{-}y}$ = Weighted average global warming potential of HFC's installed/used in year y (tCO_2e/lbHFC)

And, to be clear, $GWP_{HFC\text{-}y}$ is calculated by:

$GWP_{HFC\text{-}y}$ = sum over all HFC types T [$L_{HFC\text{-}T\text{-}y}$ * $GWP_{HFC\text{-}T\text{-}y}$] / sum (over T) $L_{HFC\text{-}T\text{-}y}$

Where:
$L_{HFC\text{-}T\text{-}y}$ = Total leaks from HFC refrigerant Type T in year y (lb) from this same set of equipment
$GWP_{HFC\text{-}T\text{-}y}$ = Weighted average global warming potential of HFC's Type T installed/used in year y (tCO_2e/lbHFC)

Elaborating on this calculation, again for clarity, this is estimated as:
$GWP_{HFC\text{-}y}$ =
[sum HFC leaks (lbs) from HFC #1 * GWP #1 + sum HFC leaks from HFC #2 * GWP #2 + etc + sum HFC leaks (lbs) from HFC#m * GWP#m]
Divided by:
[Total HFC leaks (lbs) (across # 1 through m) from systems with IR installed by year y]

Changes required for methodology implementation in 2nd and 3rd crediting periods

25. No changes are required for consideration of the methodology in future crediting periods. It should be noted that the project developer will need to check on national and regional policies at the renewal of each crediting period, in case these have changed paying particular attention to those already outlined above. In case the project, or part of the project activity, has become part of the baseline due to changes in policies, the project developer will have to redefine the baseline as appropriate or potentially withdraw the project from consideration for a new VCS project period.

Data and parameters not monitored

26. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / parameter:	1 $GWP_{HFC\text{-}T\text{-}y}$ / GWP of HFC type T
Data unit:	t CO2e/lb HFC
Description:	Global warming potential of HFC used in year y
Source of data:	IPCC
Measurement procedures (if any):	Participants should keep track of any change by the CDM Executive Board
Any comment:	Use GWP cited by board for year y

Data / parameter:	2 $GWP_{HCFC\text{-}T\text{-}y}$ / GWP of HCFC type T
Data unit:	t CO2e/lb HCFC
Description:	Global warming potential of HCFC Type T used in year y
Source of data:	IPCC
Measurement procedures (if any):	Participants should keep track of any change by the CDM Executive Board
Any comment:	Use GWP cited by board for year y

Data / parameter:	3 EPA Alternative Baseline Leak Rate EPA BLRy
Data unit:	%
Description:	Baseline leak rate coverage HFC's and HCFC's for the Green Chill member company estimated to represent the 50th percentile performance leak rate for the industry in year x (%)
Source of data:	EPA Green Chill Program Director
Measurement procedures (if any):	For the US: EPA will report these results to the VCS or other designated agency on a yearly basis
Any comment:	Use EPA BLRy cited for year x unless project initiated prior to 2007 whereupon EPA BLR2007 will be used If the EPA Green Chill program ceases to exist or cannot provide further data, then the alternative baseline will not be considered as part of this methodology.

III. MONITORING METHODOLOGY

27. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

28. As an overview, the monitoring and verification/validation (M&V) system will require:

- Leak management data to be drawn from companies' compliance records for ODS refrigerants under Montreal Protocol
    - Thus the data management systems upon which a project's core leak/charge data draws will already be in place and used for complementary regulatory purposes.
    - If the project draws upon HFC reductions, (when the refrigerant is not an ODS), the HFC leaks must be using the same process and compliance systems that apply to ODS refrigerants in order for this data to have the integrity needed.
- Review of the further calculations performed in order to establish cumulative annual leak rates for systems and relevant averages (historical leak rates and current year leak rates) which will typically be conducted separately from compliance records
    - Including the review of seasonal invoices or data logs for "top up" "draw down" changes in refrigerants if these are not automatically included in the compliance real time data systems.
- Comparison of a companies' historical baseline leak rates (BLR_y) to the EPA Green Chill conservative cap baseline (EPA BLR_y) in order to pick the more conservative baseline and not award credits to those whose historical performance would be outside sensible industry average or better practice norms.
- Review of calculations of the average weighted GWP based on the volume of refrigerants used by the supermarket in the crediting year, allocating GWP savings across HFC404A, HFC507 and other HFC's on an accurate pro-rata annual basis as established by the methodology

NOTE: While the IR systems has a real time, electronic LDMS system in order to provide timely alerts and communications, this methodology does not assume that the monitoring and verification systems are necessarily electronically based. Similarly, although some companies have chosen to use third party agencies (e.g. contractors such as Verisae, Parasense), there is not requirement in this methodology that the data management be performed by such entities. The project's third party VCS verifier is sufficient to establish the integrity of the data systems applied to the project crediting purposes. However, consistent with conflict of interest concerns, the company's third party service agency which provides real time leak rate monitoring services cannot simultaneously serve as the third party carbon credit verifier for VCS carbon crediting purposes.

29. Thus, for clarity's sake only, the verification actions would focus upon:

1. Ensuring that the charge and leak data are consistent with the logs in the companies' compliance record
    a. Measurement units: weight
2. Assessing whether top up/draw down procedures are used for seasonal variations and, if so, ensuring that these refrigerant changes are part of the cumulative leak rate data base (even if they are not part of the compliance records)
3. Reviewing the calculations for the cumulative annual leak rates for the relevant systems to ensure these are accurately assessed
4. Reviewing the calculations for the historical leak rate baseline and current year leak rates across the relevant systems to ensure they meet the Methodology specifications

5. Comparing the historical leak rate to the EPA alternative baseline cap in order to ensure that the more conservative one is selected
6. Accurate estimates of the average GWP for the refrigerants used in each year (since this is updated annually to reflect any changes in the composition of refrigerants used) consistent with the methodology. The lbs of refrigerants used is again taken from the same data log in #1 and 3

30. All the calculations are outlined in the Methodology. The monitoring frequencies and measurement procedures from which the refrigerant leaks are tracked will have been established by the underlying compliance requirements for ODS and will be considered sufficient. In the US, this will typically mean that refrigerant leaks will be aggregated on a monthly basis while refrigerant charges will be updated annually, drawing again on the underlying ODS compliance databases. Similarly, the measurement and monitoring equipment in the IR systems will be calibrated according to current good practice consistent with such compliance requirements.

Data and parameters monitored

Data / parameter:	L_x
Data unit:	Lbs
Description:	Total leaks from HFC and HCFC refrigerants in year x (lb) from all DX equipment in stores which a) have the IR systems installed by year y and b) in which HFC's are in use by year y
Source of data:	Refrigerant compliance logs for relevant stores/equipment
Measurement procedures (if any):	The total leaks volumes are derived from the database systems used for ODS management purposes. These measure the amounts of refrigerants used to refill the refrigeration equipment each time a leak occurs during year x, reflecting the amount of refrigerant leaked. Thus each entry will describe the number of pounds of refrigerant installed into the equipment at the time of a leak during year x – thus providing the data inputs which summarized over year x give the total leak volumes for L_x.
Monitoring frequency:	L_x is annually updated if the IR systems are installed in new stores each year. Leaks are typically reported in compliance logs as new refrigerant is installed in the equipment. Compliance logs report these as monthly totals from which annual totals can be calculated.
QA/QC procedures:	Check for consistency between project data logs and compliance logs
Any comment:	Ensure that any seasonal "top up" or "draw down" additions/removals are included/netted out in Lx even if these are not incorporated into compliance logs

Data / parameter:	C_x
Data unit:	Lbs
Description:	Total Charge for HFC and HCFC refrigerants in year x (lb) from all DX equipment in stores which a) have the IR systems installed by year y and b) in which HFC's are in use by year y
Source of data:	Refrigerant compliance logs for relevant stores/equipment
Measurement procedures (if any):	These same ODS management datasystems also document the refrigerant charges for each piece of equipment in the stores. Thus, again, adding these refrigerant charges for each piece of relevant equipment as itemized for year x will give the totals for C_x.
Monitoring frequency:	C_x is annually updated if the IR systems are installed in new stores each year to include the total HFC + HCFC capacity charges for the new stores
QA/QC procedures:	Check for consistency between project data logs and compliance logs
Any comment:	Note that charge capacities for HFCs may have changed over baseline period because these refrigerants are gradually replacing HCFC's, whose charge levels could be declining. Since Cx can fractionally change if IR systems are installed in new stores, annual monitoring of data/compliance logs in year y for total HFC and HFCF charge amounts in baseline years is required to take into accounts stores where new IR systems have been installed by year y. Note: Cx will be measured consistent with the requirements for EPA ODS reporting.

Data / parameter:	L_y
Data unit:	Lbs
Description:	Total leaks from HFC refrigerants in year y from equipment which has HFC's installed by year y and which also has IR systems installed by year y
Source of data:	Refrigerant compliance logs for relevant stores/equipment
Measurement procedures (if any):	The total leaks volumes are derived from the database systems used for ODS management purposes. These measure the amounts of refrigerants used to refill the refrigeration equipment each time a leak occurs during year y, reflecting the amounts leaked. Thus each entry will describe the number of pounds of refrigerant installed into the equipment at the time of a leak during year y – thus providing the data inputs which summarized over year y give the total leak volumes for L_y.
Monitoring frequency:	Assessed once for year y. Leaks typically totalled on a monthly basis in compliance logs.
QA/QC procedures:	Check for consistency between project data logs and compliance logs
Any comment:	Ensure that any seasonal "top up" or "draw down" additions/removals are included/netted out in Ly even if these are not incorporated into compliance logs

Data / parameter:	C_y
Data unit:	Lbs
Description:	Total charge in year y for equipment which has HFC installed as refrigerant by year y and which also has IR systems installed by year y
Source of data:	Refrigerant compliance logs for relevant stores/equipment
Measurement procedures (if any):	These same ODS management datasystems also document the refrigerant charges for each piece of equipment in the stores. Thus, again, adding these refrigerant charges for each piece of relevant equipment as itemized for year y will give the totals for $C_{y.}$
Monitoring frequency:	Assessed once for year y.
QA/QC procedures:	Check for consistency between project data logs and compliance logs
Any comment:	Note that charge capacities for HFCs will likely be rising over time as these refrigerants are installed across more equipment in a given store, replacing HCFC's. Thus annual monitoring of data/compliance logs in year y for total HFC charge amounts is required since they will likely not equal C_x.

Data / parameter:	$L_{HFC\text{-}T\text{-}y}$
Data unit:	Lbs
Description:	Total leaks from HFC refrigerant Type T (only) in year y (lb) from equipment which has HFC's installed by year y and which also has IR systems installed by year y
Source of data:	Refrigerant compliance logs for relevant stores/equipment
Measurement procedures (if any):	As above for Lx and Ly for relevant HFC leaks by individual type.
Monitoring frequency:	Assessed once for year y. Leaks typically totalled on a monthly basis in compliance logs.
QA/QC procedures:	Check for consistency between project data logs and compliance logs
Any comment:	Ensure that any seasonal "top up" or "draw down" additions/removals are included/netted out in $L_{HFC\text{-}T\text{-}y}$ even if these are not incorporated into compliance logs

IV. REFERENCES AND ANY OTHER INFORMATION

ICF report for GreenChill Partnership, EPA
http://www.epa.gov/Ozone/partnerships/greenchill/downloads/EPASupermarketReport_PUBLIC_30Nov05.pdf

CARB: Appendix A
http://www.arb.ca.gov/cc/reftrack/refrigerant_mgmt_program_appendix_a_1_26.pdf

CARB: Appendix B
http://www.arb.ca.gov/cc/reftrack/refrigerant_mgmt_program_appendix_b_1_26.pdf

CARB: Draft Regulations
http://www.arb.ca.gov/cc/reftrack/refrigerant_mgmt_program_draft_rule_1_26.pdf

EPA Award to Giant Eagle
http://www.achrnews.com/Articles/Breaking_News/BNP_GUID_9-5-2006_A_10000000000000424358

EPA Green Chill Update: “EPA and the Supermarket Industry: Partnership in Environmental Protection”

Document History

Version	Date of Issue	Comment
1.0	16 Feb 2010	Initial version, developed by CN Business Network