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Draft Quantification Methodologies, Chapter 4 Quantification of Venting Emissions – Summary of Feedback and Responses

#	Page #	Line	Clause/ Section	Intro Section	Table	Equation	Nature of the Comment	Sub-Topic	Comment/Question	Stakeholder Suggestion	Alberta Climate Change Office Response
1			Overall	The entire document			Technical		In this draft it outlines that in Alberta, venting occurs predominantly in the upstream oil and gas industry, and that venting emissions also occur in chemical, coal mining, petrochemical, pipelines and fertilizer industries. It is also apparent that this draft has been specifically scripted towards these industries. The forest industry has been diversifying and supporting Alberta's climate change goals, by implementing bioenergy systems to create renewable energy (e.g. biomethane). It is unclear if this draft intends to capture these types of systems. It is also unclear if this draft has acknowledged and incorporated guidance towards renewable bioenergy systems. We request that this regulation does not include bioenergy systems.		Updated Introduction to address comment. Quantification methodologies for waste and wastewater will be prescribed in separate chapters. The regulation currently does not distinguish between biomethane and methane emissions. However, the combustion of biomethane would result in biomass CO_2 which is not priced under CCIR.
2	Pg 5	14	4.0				Overarching		Need definition of what constitutes a vented gas, too broad.		Updated Introduction to address comment.
3	Pg 5	27	4.0				Overarching		This comment is also too broad. This is worded in such a way that the regulation is primarily for the upstream oil and gas, petroleum refining, petrochemical and fertilizer industries. Please refine statement.		Updated Introduction to address comment.
4	Pg 14	16	4.6.1				Technical		Vessels storing wastewater are not included. This suggests that biomethane generated from wastewater treatment system should not be a consideration in this regulation. Please clarify.		Updated Introduction to address comment. See response to #1.
5	Pg 39	5	4.12.1				Technical		Biomethane biological scrubbers remove H2S and could be considered under this section. Again, it appears that the regulation is primarily for the upstream oil and gas, petroleum refining, petrochemical and fertilizer industries. Please clarify.		Emissions from bio-methane biological scrubbers removing H2S require reporting under CCIR and SGRR. The methodologies for these emissions are classified as waste and wastewater emissions. These emissions will be prescribed in Chapter 6 Waste and Digestion and Chapter 7 Wastewater. Facilities are required to use site specific methodologies to quantify and report these emissions until mandatory methodologies are prescribed.
6	Pg 49	31	4.19				Overarching		Please clarify if non-routine venting-engine and turbine starts includes engines that utilize biomethane to create green energy. It does not appear that this is the intention of this regulation		Bio-methane is not distinguished from methane under CCIR; therefore, the methodology for non-routine venting and turbine starts would be applicable for both types of methane.
7	Overall						Overarching		Because of the large variety of venting scenarios, particularly at more complex chemical production facilities where standardized oil & gas venting quantification practices don't apply, the methodology guidance should clearly provide maximum flexibility to apply sound engineering practices based on specific process information and knowledge. It should be clear to verifiers that facilities not subject to AER Directives for routine venting emission quantifications are permitted, and even expected, to use good engineering practices tailored to the process to quantify emissions. The layout of the draft methodology may not be clear to verifiers to indicate when site or process specific quantifications should take precedence, particularly at non-UOG facilities. The starting point for venting emission quantifications should be using best engineering judgement using site and process specific information, documented in the facility's QMD, which can is universally applicable across all industries, followed by industry or equipment specific methods (AER Directives). It is recommended a better, more universally applicable hierarchy of methodologies be structured that more clearly allows enough flexibility for use of site specific best engineering practices for quantification.		ACCO recognizes that venting sources are present in sectors other than UOG. Section 4.21 allows facilities to apply alternative methodologies including engineering estimates or continuous measurement for venting emission sources that are not covered elsewhere in the chapter. The selection of the appropriate methodology is reliant on the reporter's facility-specific process knowledge and engineering judgement.
8	9	3	4.2.3				Technical		There are significant flaws with the current methods used to estimate casing venting from crude bitumen batteries (CHOPS facilities). Recommendations for improving estimates based on current GOR tests are summarized in a two reports by New Paradigm Engineering from 2004 and 2017. This source accounts for a significant portion of Alberta's methane emissions. Recent studies have shown these emissions to be 360% higher than reported. We recommend that the Government of Alberta improve the measurement requirements to align with recommendations from the New Paradigm Reports. Specific recommendations are summarized below. The federal methane regulations also include updates to GOR measurement methods that should be considered. These are outlined in Sections 23 and 24 of the federal regulation.	The most straightforward way to improve the accuracy of current production reporting protocols is to require operators to measure, rather than estimate, gas production. Current reporting protocols require infrequent testing of the gas-to-oil ratio (GOR) at facilities which is then used to report production. However, study data from Alberta demonstrates that gas production is highly variable. Accordingly, GOR measurements can vary significantly depending on when they are taken. There is also reason to suspect that current GOR tests have poor accuracy because of a lack of quality control requirements.	ACCO is currently reviewing these recommendations and intends to update this methodology in future revisions of the document.
9	14		Figure 4-1				Technical		An Inconsistency noticed in CCIR's Venting Chapter 4 versus AER Manual 015. Under Chapter 4, the Method 5 (Measured GIS) is required to quantify the Tank Flashing losses while AER Manual 015 has offered the greater flexibility by allowing to use the rule of thumb based GIS value. CCIR methodology should be consistent with AER Manual 015.		ACCO has adapted methodologies from AER Manual 015 and other directives, where appropriate. AER directives were not developed to address specific requirements under CCIR and SGRR. Therefore, it was necessary in some cases to add or modify an AER method to address regulatory needs.
10	14		4.6 Figure 4-1				Overarching		Flashing loss: Tank emissions constitute only a small portion of site's total GHG's. Additional effort in this category may not improve the overall accuracy of TRE; therefore table 4-1 Tier classification and methodology mapping, must be updated to allow facilities with tier 3 requirements to follow method 4 or 5		If the facility emissions for a particular source meets the definition of a negligible emission sources, the facility may apply an alternative methodology, which includes the use of methods under a different tier.

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11	14		4.6	Routine Venting-Atmospheric Liquid Storage Tanks			Overarching		We are hoping that this section applies to UOG only and expecting that for tanks in refining sector CCIR will be aligning with WCI or federal GHGRP methodologies (where CH4= 0.1* throughput)		The section is applicable to all facilities regulated under CCIR and SGRR. SGRR reporters are required to use tier 1 methodology which is aligned with GHGRP requirements.
12	34		4.9	Compressor seal venting			Overarching		Emissions from compressor seals are currently included in site's LDAR (or component count) program. Separating compressor seals from these programs will result in inconsistent fugitives emissions reporting amongst various regulatory reports (including CCIR, fed GHGRP, NPRI etc.), therefore it is highly recommended to keep compressor seals emissions under fugitives category.		A factor was developed to separate the venting and fugitive emissions. Refer to Section 4.9 for updated emission factors.
13	44		4.14	Oil-Water Separator Venting for Refineries			Technical		Looks like there is a typo in the Table 4-11 for "gravity type-covered": non-methane hydrocarbon (NMHC) factor (kg/m3) should be 3.30*10^-3 (instead of 3.30*10^-1)		Corrected.
14	5	30	4				Overarching		It is redundant to repeat Alberta Energy Regulator (AER) directives for venting in the venting chapter. As stated in the chapter, this is mandated for Upstream Oil & Gas (UOG) facilities. By restating directives, it creates confusion as to whether Alberta Climate Change Office (ACCO) or AER rules take precedent. It also opens up room for discrepancies if either reference source changes, but the other does not. Many of the venting categories described in the chapter would apply mostly, if not exclusively, to UOG facilities (e.g. venting related to well operations). Specific examples include: 4.2 Routine Venting–Produced Gas at a Well Site 4.9 Compressor Seal Venting (being "venting" only applies to UOG facilities) 4.15 Produced Water Tank Venting 4.16 Non-Routine Venting- Well Tests, Completion, and Workovers 4.18 Non-routine Venting-Gas Well Liquids Unloading	The entire chapter should be revised, deleting venting from sources covered by the AER directives. Instead, it is recommended that references to the AER directives be given.	ACCO intended to align with AER methodologies for various venting sources where it was appropriate. AER directives were not developed to address specific requirements under CCIR and SGRR. Therefore, It was necessary to tier these methodologies to correspond with regulatory requirements.
15	All						Overarching		The methodologies outlined in the draft Chapter 4 Venting mandate that certain process models and methodologies be used and in a very prescriptive manner. As mentioned in the previous comment, this chapter has been very much focused on UOG processes; thus, the calculation methodologies prescribed are often not applicable for other processes, plants, and/or technologies. Throughout the document there are multiple references to using "process knowledge and engineering best practices" in limited circumstances and multiple references to documenting judgements and estimates "transparently". The Association of Professional Engineers and Geoscientists of Alberta (APEGA) regulates the practice of engineering and geoscience in the province on behalf of the Government of Alberta through the Engineering and Geoscience Professions Act. The draft Chapter 4 is proposing methodologies to quantify the venting, which would need to be process specific. This selecting of a process model would then fall under the scope of "practice of engineering" under the Engineering and Geoscience Profession Act. The draft Chapter 4 quantification methodologies should not replace engineering judgment. For reference, APEGA has guidance on this topic. Choosing which process model is appropriate for a given situation is clearly engineering work as defined in the Engineering and Geoscience Professions Act and as such should always be completed by a Professional Engineer. In many of the sections where particular methods are prescribed, they should instead be given as an "acceptable method" and the use of engineering best practices also be allowed.	Requirements could be added such that calculations based on models and process knowledge not provided in the chapter are documented and stamped by a Professional Engineer (P. Eng.). This would satisfy both the desire for transparently documented assumptions and certify that engineering best practices were being followed. Any specific concerns about a given set of calculations would then be within APEGA's purview and thus alleviate the requirements of verifiers and ACCO to validate engineering work that may be outside their particular scope of experience.	Refer to Section 4.21 for Other Venting Emission Sources.
16	5	40	4				Editorial		It states that "[f]or all sources discussed in this chapter, CO2 emissions are considered to be formation CO2". This statement is concerning as it is possible to vent CO2 that is not from an underground formation. As examples, these CO2 emissions could be from: • A water treatment plant with deaerators, where CO2 vented will be from the intake water. (This is independent from the Industrial Process emission CO2 generated from pH control; • Analyzer vents; • Industrial Process Emissions; and, • Imported CO2 Declaring that this all should be reported as Formation CO2 would be an egregious error.	Clarification should be given that any CO2 vented that is otherwise accounted for, such as in Formation CO2 or Industrial Process, should not be reported as venting as this would lead to double counting of emissions.	The Standard for Completing Greenhouse Gas Compliance and Forecasting Reports provides a definition for formation CO_2, which states that these are "direct emissions of CO_2 that are recovered or are recoverable from raw gas in an underground reservoir". For many venting emissions sources, the CO_2 emissions would fit into this category. The examples provided such as IP or CO_2 from water treatment would not be classified as formation CO_2.
17	5	47	4				Editorial		Sentence beginning "In some cases…" is a non-sequitur. The sentence immediately preceding it would appear to forbid using such estimates for venting purposes.	If this is supposed to be an exception to that rule it needs to be spelled out. If it is not, the sentence should be removed	Section updated.
18	5		4				Overarching		Throughout the chapter, there are inconsistencies in the amount of methane emissions that can be assumed negligible. In section 4.13.1, the guidance "For loading operations in which the equilibrium vapor-phase concentration of methane is less than 0.5 volume per cent, zero methane emissions can be assumed." is applied solely to emissions from loading and unloading operations. For non-upstream oil and gas facilities a great many of the categories of venting will lead to no appreciable methane emissions, as there is little to no methane in the stream. But as it currently stands there is no guidance, outside of 4.13.1, for how little methane is too little to be worth quantifying.	For the purposes of consistency, a minimum quantity of methane should be defined for reporting purposes.	Sections reference diminimus or negligible quantities of methane emissions have been removed. Reporters should apply the definition of "negligible emission sources" to determine whether alternative methodologies may be applied for any particular emission sources.

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19	7		4.1.2				Editorial		Section 4.1.2 and section 4.21 would both appear to be the same section: General calculations for venting. The text from 4.21 could be placed prior to 4.1.2 to give some continuity of methodologies and context. As it stands the organizational scheme of the tier 4 requirement for general venting followed by pages and pages of specific venting examples followed by more requirements for general venting is confusing and disorganized.	Consolidate 4.1.2 and 4.21 into a general venting section.	Section 4.1.2 is applicable for all the venting emissions categories in the chapter. Section 4.21 is for other emissions that are not covered elsewhere in the chapter.
20	7		4.1.2				Editorial		Equation 4-1b is repeated several times throughout the chapter. Equations 4-3, 4-9, 4-12, 4-13, 4-18, 4-20, 4-21 are all essentially the same equation. The chapter could be significantly cleaned up and re-organized by simply having a method based on vent rates with tiers given for whether or not the vent rate is from some standard, measured, etc. with a short list of specifics given per equipment type. In the Stationary Combustion chapter there is one method for emission factors and a table with emission factors for different types of equipment. Instead of a section for every type of stationary combustion equipment repeating the same equation with slightly different formatting, the type of format in the Stationary Combustion Chapter should be considered. The following sections all use Equation 4-1b and could all be substantially revised and/or combined into one: 4.3 Routine Venting-Continuous Gas Analyzer Purge 4.7 Routine Venting-Pneumatic Control Instruments 4.8 Routine Venting-Pneumatic Pumps 4.9 Compressor Seal Venting 4.10 Glycol Dehydrator Venting 4.11 Glycol Refrigeration Venting 4.16 Non-Routine Venting- Well Tests, Completion, and Workovers 4.19 Non-Routine Venting-Engine and Turbine Starts	Include equations for determining venting rates for different types of equipment only when needed. As an example, see Equation 4-12a.	This structure was required in order to provide clarity in the parameters required for each type of emission scenario. We will continue to evaluate whether there are more appropriate ways to present methodologies.
21	8		4.1.2 (3)				Editorial		Including requirements for sampling frequencies in this chapter is confusing if one needs to reference sampling frequencies for equipment. Most of the requirements for sampling frequency and measurement of gas composition are currently located in in Chapter 17 of the Quantification Methodologies.	Remove requirements for sampling frequencies in Chapter 4 and put all requirements for sampling frequencies and gas composition measurement in one place, such as Chapter 17.	Centralizing the measurement requirement will be considered after all chapters are published and are merged into one quantification methodology. Currently, it is more convenient to keep them in the individual chapter.
22	10	8	4.3.1 (1)				Technical		Gas analyzers are used throughout the chemical industry and often on streams with negligible methane content.	Set a minimum limit on the methane content of a stream for which the analyzer vent emissions must be estimated. For example, if the expected or design composition is less than 0.5% (v/v) methane then the analyzer vent quantity can be assumed to be zero	Overall negligible sources criteria is applicable for analyzer. There is not a specific rule for gas analyzers.
23	10	16	4.3.1 (2)			4-3	Editorial		The direction given for Qv with equation 4-3 is to use the default value given if there is no manufacturer data. This conflicts with the guidance given on lines 15-17 of page 10. The given default is specific only to upstream oil and gas installations and specific to a natural gas transmission pipeline. This excludes any other application of this guidance for volume. UOG is given a special exemption consistently through the Quantification Methodologies and other industries are without similar guidance.	Create consistent guidance for all industry that uses this document for regulatory reporting	Updated.
24	10	20	4.3.1 (3)				Editorial		As aforementioned, including requirements for sampling frequencies in this chapter is confusing if one needs to reference sampling frequencies for equipment. Most of the requirements for sampling frequency and measurement of gas composition are currently located in in Chapter 17 of the Quantification Methodologies.	Remove requirements for sampling frequencies in Chapter 4 and put all requirements for sampling frequencies and gas composition measurement in one place, such as Chapter 17.	Centralizing the measurement requirement will be considered after all chapters are published and are merged into one quantification methodology. Currently, it is more convenient to keep them in the individual chapter.
25	10	22	4.4				Editorial		Section 4.4 would apply to any vessel that is depressured and emptied, either regularly or during shutdowns, for cleaning and maintenance.	Revise and rename Section 4.4 to Vessel Depressuring. Dryers can be provided as an example of a vessel that is routinely depressured and emptied.	Keep the title unchanged. Add a sentence as suggested for other depressurized or emptied sources.
26	10	28	4.4.1 (1)				Editorial		When discussing dryer regeneration, line 28 states how this is accomplished. There are many ways of regenerating a dryer, including recycling a portion of the product stream, or some other gas stream.	Instead of “natural gas”, the sentence should read just “gas”. As with other portions of this chapter, this should be more general in order to encompass all ways that dryers are regenerated.	Section updated.
27	10	30	4.4.4 (1)				Editorial		In line 30 when discussing venting during a dryer regeneration, it states that natural gas can be vented. As aforementioned, other gases can be used for dryer regenerations.	Instead of “natural gas”, the sentence should read just “gas”. As with other portions of this chapter, this should be more general in order encompass all ways that dryers are regenerated.	Section updated.
28	11		4.4.1 (2)			4-4	Technical		Equation 4-4 assumes that the vessel is a cylinder. This may not be a valid assumption. In fact, most vessels are not simple cylinders as the dished ends retain volume as well. This is especially relevant in short vessels like dryers. Obtaining the volume of the gas going through the vessel will depend on the vessel shape (e.g. cylindrical with dished ends, sphere, etc.) and the volume of the internals. A vessel can be assumed to be a cylinder, but knowledge of that particular vessel and sound technical judgment would be required to make that assumption.	Instead of π/4 D^2 H, equation 4-4 should include V, vessel volume. This volume can be determined through design or nameplate information, or from engineering calculations.	Section updated.
29	11		4.4.1 (2)			4-4	Technical		Equation 4-4 has an error with regards to standard state. This equation would only be applicable if the dryers were operating at 15℃ and the atmospheric pressure was 101.325kPa. Otherwise, a correction needs to be included as the density used in the equation is in standard cubic meters.	Recommendation: Instead of P_vessel/P_a the equation should read P_vessel/T_vessel ·288.15K/101.325kPa	Equation is updated.

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30	11	13	4.4.1 (3)				Technical		As mentioned previously, including requirements for sampling frequencies in this chapter is confusing if one needs to reference sampling frequencies for equipment. Most of the requirements for sampling frequency and measurement of gas composition are currently located in in Chapter 17 of the Quantification Methodologies.	Remove requirements for sampling frequencies in Chapter 4 and put all requirements for sampling frequencies and gas composition measurement in one place, such as Chapter 17.	See response to Item #24.
31	11	19	4.5				Editorial		The methods provided in Section 4.5 are much more general and apply to any system that is blown-down and purged to a vent system.	Combine Sections 4.5 and 4.17. Expand 4.5 to encompass all purges and blowdowns.	Section updated.
32	12	11	4.5.1 (2)			4-5a	Technical		Equation 4-5a appears to be based on the isothermal expansion of an ideal gas. Clarification should be added that the process is assumed to be isothermal. There are particular cases where this equation cannot be used because that assumption cannot be applied. Rapid depressurization, for example, would not be well modeled by an isothermal process. For reference, please see the guidance methods given in the EIIP Technical Report Series Volume 2 Chapter 16 Section 3.5 (https://www.epa.gov/air-emissions-inventories/volume-2-point-sources)	If that assumption is not applicable in some particular cases, then an alternative engineering model can be utilized. Resources can also be provided such as the EPA reference above.	Section updated.
33	12	16	4.5.1 (2)			4-5a	Technical		The ideal gas law becomes inapplicable under high pressures, even when the gas in question does not condense, which is the guidance provided. There are a wide range of situations wherein Equation 4-5a does not apply and this is not reflected in the guidance.	Additional clarification should be provided regarding the limitations of Equation 4-5a. This is a case where appropriate engineering judgement should be used.	Section updated.
34	12		4.5.1 (2)			4-5b	Technical		Equations 4-5a and 4-5b appear to be calculating different things. Equation 4-5a assumes equipment depressuring but with no account for purging, while Equation 4-5b assumes the equipment is purged with some material that may contain greenhouse gases.	These equations should be brought into alignment with one another as the only stated difference is that one assumes ideal gas and the other does not. However, there appear to be many more assumptions in play that are not documented. For further details see AER Manual 015. This can be documented as a reference in this section of the chapter	Section 4.5 has been updated.
35	14		4.6.1				Editorial		Figure 4-1 is confusing and difficult to interpret. As an example, is a facility with a Tier 2 classification, one is expected to use Method 4 to calculate flashing losses, Method 2 or 3 to calculate breathing/working losses, and then not use those values and report the results of Method 6? Additionally Method 4 should only be used for tanks containing crude oils. It is not applicable to any other liquids, regardless of tier classification.	Provide clarity as to when each method should be used and for which tiers. Add clarification on Method 4, specifying that it can only be used for tanks containing crude oils.	Section updated. Clarification is provided on the use of methods for different tier classifications and that the Vazques and Beggs correlation may only be used for crude oils.
36	15		4.6.2			4-6b	Technical		This equation appears to be using a different set of standard conditions (the molar volume is 22.4 vs 23.645 m3/kmol). Furthermore, the constants given for molecular weight of methane are inconsistent with the rest of the Quantification Methodologies, i.e. MW methane truncated at 16 instead of 16.0425kg/kmol. This contradicts the requirement of section C.12 of the Quantification Methodologies ver 1.1 that states "[r]ounding of data and intermediate values used in the calculations should be avoided" with regards to the premature rounding of the methane molar weight.	This equation should be reviewed to ensure that the inputs are consistent with the requirements of the Quantification Methodologies, and any differences (e.g. reference a different standard state) are clearly reflected in the guidance. For example, with regards to the pressure difference, is that between the storage pressure and ambient atmospheric pressure? Or is it to an assumed standard state pressure? These details are important to ensure an accurate venting emission calculation.	Updated constants to reflect the required standard condition.
37	16		4.6.3 (2)			4-7b	Editorial		Elsewhere in this document MF refers to mole fraction, yet in Equation 4-7b it is being used for mass fraction.	Provide consistent nomenclature not only through the chapter, but also through the entire Quantification Methodologies document. It is recommended that a list of nomenclature be added to the document.	Update nomenclature for these.
38	15-22		4.6.3 to 4.6.7				Overarching		Not all of the given methods are appropriate for all tank systems and no awareness is given in the text of their limitations. Determining which model of tank venting is most appropriate for a given tank system should be determined by an engineer familiar with the process.	Methods 2 through 6 should be combined into one which lists potential models that could be used, by reference, and makes clear the engineering judgement needed in selecting the appropriate method. This falls under the scope of engineering practice as per the Engineering and Geosciences Professions Act.	Reporters are required to evaluate which methods would apply to their facility, which would require specific process knowledge and engineering judgement. For venting emission sources that are not covered in the Quantification Methodologies, the facility has the ability to apply alternative methods as described in section 4.21 (other venting emission sources) to quantify the emissions.
39	15-19		4.6.3 to 4.6.4				Technical		The TANKS software is no longer supported by the US EPA and its use is described as "at your own risk" (https://www3.epa.gov/ttn/chief/software/tanks/index.html) The EPA suggests using the equations from EPA AP-42 Chapter 7 directly in a spreadsheet. Additionally a redlined draft update to EPA AP-42 Chapter 7 was released in 2018 for comment (see https://www.epa.gov/air-emissions-factors-and-quantification/proposed-revisions-ap-42-chapter-7-section-71-organic) so presumably the model will be updated in the near future and these changes will not be captured in TANKS, again because it is no longer supported.	References to TANKS should be removed.	Updated section to remove this methodology.
40	20	3	4.6.5 (1)				Technical		The Vasquez-Beggs correlation is only applicable to crude oils; as such this introduction is deeply misleading.	Clarify in the first paragraph that this is only applicable to crude oils.	Section updated. See response to Item #35.

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41	22		4.6.7				Technical		API E&P Tanks should not be a recommendation, as per the API website "Please note: After December 31, 2018, American Petroleum Institute will discontinue the sale of E&P Tanks v3.0, and no new licenses for the software will be issued." (see https://www.eptanks.com/) It is unreasonable to expect industry to use a piece of software that is no longer being sold.	Remove reference to API E&P Tanks from the chapter.	Section updated. See response to Item #39.
42	34	32-34	4.9.1 (2)			4-13	Editorial		Equation 4-13 is inconsistent with the rest of the equations provided in the chapter when venting rates are used. Elsewhere, the sums are done per piece of equipment (e.g. Equation 4-12), whereas in this equation a factor N is included to be able to include reciprocating compressors into the same equation.	This equation should be changed to match 4-12 and guidance given for reciprocating compressors to multiply the given vent rate by the number of throws. For example, Equation 4-12a is used to determine the venting rate for use in 4-12. An analogous set up could be used here.	No updates to the equation at this time.
43	40	26	4.12.3				Technical		Acid gas removal systems are used in far more diverse applications than merely natural gas sweetening. The requirement to use AMINECalc is inappropriate in its technical application. Again, the chemical industrial sector utilizes the Quantification Methodologies, and not just UOG.	Deciding which model is most appropriate for a given process is in the scope of engineering practice and should be completed by a Professional Engineer. Remove entire focus of chapter to UOG and allow the use of chemical process based models.	As outlined in Figure 4-2, facilities have the opportunity to apply the method that would best represent their process operation regardless of sector.
44	41		4.13.2			4-15	Technical		Equation 4-15 is misleading and not transparent. A constant of 0.120 is meaningless, when instead it should just be dividing by R, the universal gas constant, in appropriate units. In the equation in EPA AP-42 5.2.2.1, the constant 12.46 is simply 1/R. This would be more transparent and obvious to those familiar with loading loss equations	To remain consistent with the rest of the Quantification Methodologies, and avoid premature rounding, the expression within the summation should be amended to: (⟦SF⟧_j P_(True,j) Q_j ⟦MW⟧_vapor F_(GHG,vapor))/(RT_j) with Tj in units of Kelvin and R, the universal gas constant being 8.3143kPa*m3/K*kmol. Also, to remain consistent with ACCO's direction of clear and transparent calculations, the equations should be set up as such.	No updates to the equation at this time.
45	41		4.13.2			4-15	Technical		Throughout Chapter 4, mole fractions are used. By utilizing mole fraction rather than mass fraction in this one equation would keep consistency across the chapter.	Using the mole fraction would simplify the calculations, with the expression within the summation becoming the following: (⟦SF⟧_j P_(True,j) Q_j ⟦⟦MW⟧_GHG MF⟧_(GHG,vapor))/(RT_j) Where MF is the mole fraction of the greenhouse gas in the vapour phase. This simplifies the calculations as the molar weight of the vapour phase does not need to be calculated.	No updates to the equation at this time.
46	42, 43		4.13.2		4-10	4-15b	Technical		The unit conversion of the ASTM D86 Slopes of the distillation curve to C/vol% was inappropriate as they cannot be used in the given correlation as is. The units must match the correlation curve.	Keep units consistent with the units utilized for the correlation curves.	Section updated.
47	41		4.13.2				Editorial		There are other equations that can be used for estimating tank venting than what is outlined in this section.	For consistency, Section 4.13.2 can reference to the EPA AP-42 model for tank venting, as is referenced in Section 4.6. By citing EPA AP-42 Section 5.2, it references a comprehensive resource instead of re-creating the equations in a mish-mash of SI and USC units. Furthermore, AP-42 contains more resources for calculating the vapour pressure of stored products than the two curves provided.	ACCO will continue to evaluate new methodologies that may be incorporated into the Quantification Methodologies. Section 4.21 is currently available to address venting emission sources that are not covered in this chapter.
48	5 & 31		4.0	paragraph 7			Overarching		Please note <REDACTED> operates pipelines and associated compressor stations that falls under the provincial CCIR but is regulated by NEB, not AER. Statement specifies AER sampling, measurement, etc. to be followed for UOG quantification. Does this requirement apply to all AB facilities even if they aren't AER-regulated?		Sections have been updated to provided clarity on the data requirements for each methodology for UOG and non-UOG facilities.
49	35		4.9.2 (2) & (3)				Technical		Equation specifies T as total time compressor is pressurized and data requirements specifies pressurized operational time – these have different meanings. Centrifugal compressors are typically pressurized while operating and during standby. Are you only concerned with pressurized operating time?		Section updated to reflect the pressurized time and not operating time.
50	36		4.9.4				Editorial		Section only talks about direct measurement of reciprocating compressors. Is there no Tier 4 direct measurement approach for centrifugal compressors?		Direct measurement methodology may be used for both types of compressors.
51	Multiple sections						Overarching		TC Pipeline reports Alberta GHG emissions as one regulated facility. For significant sources such as turbines a stream specific gas analysis is used for the calculations. However, for the vent emissions calculations we are currently using a system average gas analysis. Using the stream specific gas analysis for each vent source would create significant increase in our efforts without providing better accuracy of the calculations. Please allow us to use system average gas analysis for calculating GHG of the vented emissions.		Facilities may use an average fuel gas composition if it is representative of the vented gas. In other words, it does not need to measured from every vented source.