WCI Quantification Method 2013 Addendum to Canadian Harmonization Version

Note: This addendum is intended to be used solely for British Columbia facilities at this time. Further review will be conducted by the WCI to ensure that the addendum is fully harmonized with those methods used in the U.S.

Summary:

The 2013 quantification method addendum responds to updates requested by industry and addresses technical issues brought up through the reporting process for the following source categories: WCI.350 – Transmission and Distribution Systems; WCI.360 – Upstream Oil and Gas; WCI.160/240 – Lead and Zinc; WCI.090 – Cement; WCI.180 – Mobile Combustion; WCI.132 Hydrogen; WCI.230 – Electricity Transmission; WCI.261 Nickel and Copper; WCI.340 Phosphoric Acid.

While the majority of updates incorporated are minor (e.g. allowing a specific electronic waste testing method), for six of the oil and gas methods the updates are substantive as there are updates to equations or allowed methods (acid gas removal, third party line hits, storage tanks, population count); a new exception clause (compressor venting); or incorporation of substantially improved emission factors (pneumatic devices). The substantive and non-substantive oil and gas updates are detailed in the two tables following.

Substantive Oil and Gas Updates		
Section	**Update**	**Rationale**
353(a), 352(a.1) 363(a), 363(a.1) Tables 350-6, 360-6 **High bleed pneumatic devices and pumps** and 353(b.1), 363(b.1) **Intermittent bleed devices**	Incorporates results of BC pneumatic field study, makes metering optional and provides for more detailed equations which would allow for more accurate quantification if a facility has sufficient information. Allows manufacturer data to be used for compressor starters.	Results of the Prasino field study of 765 BC pneumatic devices and pumps have been incorporated. Results provide high quality emission factors based on statistically valid data and replace previous inaccurate emission factors. Addresses data gap for some compressor starters
363(c) **Acid gas removal**	Prioritizes quantification using outlet meter data, provides flexibility for differing H2S content knowledge and clarifies calibration requirements for AGR inlet meters due to corrosivity of acid gas	Calculation using outlet gas volume removes approximate 6% high bias from inlet gas calculation.
353(c.1) and 363(g.1) **Third-party line hits**	Allows for use of method in development by the Canadian Energy Partnership for Environmental Innovation, quantification method for service tee drill or punch opening hits, and weighted average approach to be used for punctures. Corrects technical issues and modifies the delineation for use of the two quantification methods.	Existing third party line hit method was applicable to transmission and gathering systems, but not distribution systems. New method for distribution systems is in development and is incorporated by reference when complete.
353(e), 363(l) **Centrifugal compressor venting a**nd 353(f), 363(m) **Reciprocating compressor venting**	Clarifies the compressor's operational modes and ensures that all emissions from compressor modes are summed. Corrects overestimate for small centrifugal compressors using default emission factors.	Clarification, error correction and addresses potential safety issue.

	Addresses potential safety risk with some measurements.	
363(h) **Storage tanks**	Allows for two additional quantification methods (including new California method) to be used given the inherent uncertainty of storage tank emissions quantification	Allows for use of correlation equation methods currently used by industry which are the same or better level of accuracy as existing methods – storage tank quantification is inherently uncertain unless flash test method is used.
363(o) **Population count**	Clarifies interaction of population count and leak detection methods	Allows for higher accuracy leak detection method to be used for facilities where not required.
357 and 367 **Tables and Direction for use of Tables**	Updates tables for results of BC pneumatic study and revised EPA factors and adds missing column. Clarifies language and ensures that industry updated emission factors are required only when they can be reasonably developed using existing leak detection data	Incorporates revised BC and EPA tables, adds missing data. Clarifies application when previously a significant burden could have been interpreted to be the intent of the clause.

Non Substantive Oil and Gas Updates		
352(b)(2), 352(b)(8), 352(b)(9), 352(c)(2), 352(d)(2), 352(e)(2), 352(f)(4), 352(f)(5), 352(i)(11), 353(l), 354(a)(0.1), 364(a)(0.1), 354(a)(0.2), 364(a)(0.2) 356	Clarifying and technical corrections	For clarification and consistency of language
362(g)(19) **Component count**	Allows for one P&ID diagram to be used where several facilities (e.g. wells) have a similar design.	Reduces burden while maintaining accuracy and clarifies application.
353(g) **Leak detection**	Clarifies application for various facility sizes and other items	For clarification and consistency of language
353(h) **Population count**	Eliminates logical gap where there is no custody transfer meter regulating station. Other items add clarity	To eliminate logical gap and add clarification

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Unless otherwise indicated, these updates may be used for reporting of 2013 calendar year emissions.

1. **WCI.352(b)(2) is amended as follows:**
    a. The term 'size dependent' is deleted and replaced by 'refer to sections for instructions'
2. **WCI.352(b)(8) is amended as follows:**
    a. The word 'belowground' is struck and replaced with 'below grade'
3. **WCI.352(b)(9) is amended as follows:**
    a. b0(12) is replaced by b(12)
4. **WCI.352(c)(2), (d)(2) and (e)(2) are amended as follows:**
    a. ", refer to sections for instructions" is appended
5. **WCI.352(f)(4) and WCI.352(f)(5) are deleted**
6. **WCI.353(l) (Other venting or fugitive emissions) is amended as follows:**
    a. By replacing '2007' with '2013 (or latest edition)'
7. **WCI.356 definition of 'fugitive equipment leaks' is amended as follows:**
    a. The word 'the' is deleted
8. **The following footnote is placed following WCI.353(b) and WCI.363(b):**
    a. If an emission factor is listed in Table 350-6/360-6, (if practicable) it should be used for a low bleed device instead of the default in Table 350-1/2/360-5.

9. **WCI.352(i)(11) is amended as follows:**
    a. In WCI.352(i)(11)(i) the phrase 'for provided' in the second sentence is deleted
    b. The following bracketed text is inserted prior to the first sentence in WCI.352(i)(11)(i): "(for sources quantified using WCI.353(h) only)"
    c. The first sentence in WCI.352(i)(11)(i) is struck and replaced with the following: "Component count for each source type for which a population emission factor is provided in Tables 350-1, 350-2, 350-3, 350-4 and 350-5, but excluding Below Grade M&R Stations, Distribution Mains and Distribution Services. For the purposes of this clause, a Below Grade M&R station is treated as a component unto itself."
    d. The following bracketed text is inserted prior to the first sentence in WCI.352(i)(11)(ii): "(for sources quantified using WCI.353(g) only)"

10. **WCI.362(g)(19) is amended as follows:**
    a. In subparagraph (i) the following sentence is appended at the end of the existing paragraph: "An operator may use one or more P&ID diagrams to determine component counts for groupings of similar sites."
    b. The following bracketed text is inserted prior to the first sentence in WCI.362(g)(19)(i): "(for sources quantified using WCI.363(o) only)"

c. The following bracketed text is inserted prior to the first sentence in WCI.362(g)(19)(ii): "(for sources quantified using WCI.363(n) only)"

11. WCI.353(a) and (a.1) and 363(a) and (a.1) are modified as follows:

a. The following is added prior to the start of the second sentence in the header: "If an updated Table 360-6 based on a statistical sample of BC pneumatic devices is not available by December 31, 2014, then"

b. In all instances "2014" in the header is replaced by 2015" and "2015" is replaced by "2016"

c. The EF_j parameter definition for Equations 350-2, 350-3, 360-2 and 360-3 is modified as follows:

EF_j = Natural gas-drive pneumatic device (or equivalent device), j, bleed rate volume in Table 350-6/360-6 (data within Table as revised from time to time and provided by the regulator) (Sm^3/h/device).

i. For individual pneumatic high-bleed controllers, except as noted in subparagraph 1 below, use the device (or equivalent device)-specific emission factor provided in Table 350-6/360-6.

1. The EF_j parameter may be calculated using Equation 350-2a/360-2a:

Equation 350-2a/360-2a: $EF_j = m \times SP_j$

Where:

m = the supply pressure coefficient in Table 350-6/360-6

SP_j= the supply pressure (kPa) of controller j

ii. For pumps, except as noted in subparagraphs 1 and 2 below, use the pump (or equivalent pump)-specific emission factor provided in Table 360-6

1. The EF_j parameter for pumps may be calculated using Equation 350-3a[1]/360-3a[1]:

Equation 350-3a/360-3a: $EF_j = (g * SP_j) + (n * DP_j) + (p * SPM_j)$

Where:

Bleed $Rate_j$ = The volume of natural gas bled per hour for pneumatic pump (or equivalent pump), j (Sm^3NG/h).

g = The supply pressure coefficient provided in Table 350-6/360-6 (kPa).

SP_j = The fuel supply pressure for pump (or equivalent pump) j.

n = The discharge pressure coefficient provided in Table 350-6/-6 (kPa).

DP_j = The discharge pressure of pump (or equivalent pump) j.

p = The strokes per minute coefficient provided in Table 350-6/360-6.

SPM_j = The strokes per minute of pump (or equivalent pump) j (spm).

2. The EF_j parameter may be calculated using Equation 350-3b/360-3b:

Equation 350-3b/360-3b: $EF_j = Q_j \times R_j$

[1] If the pump is operating at less than five strokes per minute, this equation is not applicable and the mean bleed rate or volume of chemical equation should be used instead.

Where:

Q_j = The volume rate of chemical injection for pump, j (L/h).

R_j = The pump specific factor expressed as the volume of gas vented per liter of chemical injected. The factor takes into account fuel supply pressure, piston size, and discharge pressure and is based on the chart published by the pump j manufacturer (Sm^3NG/L)

d. Paragraph (3) is struck and replaced with the following: "(3) If the device, or equivalent device, is not listed in Table 350-6/360-6, use the generic high bleed emission factor for all high bleed controllers and use the generic bleed rate for diaphragm or piston pumps, as appropriate."

12. WCI.353(b.1) and 363(b.1) (Natural gas pneumatic intermittent (low and high) bleed device venting), are amended as follows:

a. The EF_j parameter definition for Equations 350-5 and 360-5 is modified as follows:

EF_j = Natural gas-drive pneumatic device (or equivalent device), j, bleed rate volume in Table 350-6/360-6 (data within Table as revised from time to time and provided by the regulator) ($Sm^3/h/device$).

i. For individual intermittent pneumatic devices, except as noted below, use the device (or equivalent device)-specific emission factor provided in Table 350-6.

1. The EF_j parameter may be calculated using emissions from these devices may be calculated using Equation 350-5a/360-5a

Equation 350-5a/360-5a: $EF_j = m \times SP_j$

Where:

m = the supply pressure coefficient in Table 350-6/360-6

SP_j= the supply pressure (kPa) of controller j

ii. If the device (or equivalent device) is not present in Table 350-6/360-6, use the generic intermittent (high or low, as appropriate) bleed emission factor in Table 350-1/350-2/360-5

b. The description of the EF_j parameter for Equations 350-6 and 360-6 is struck and replaced by the following:

EF_j = Emission factor for natural gas-driven pneumatic compressor starter, j, as provided by the manufacturer for the operating condition ($Sm^3/min/device$). If an emission factor is not available from the manufacturer, an emission factor for a similar compressor starter may be used in its place.

c. The following note is added after the parameter descriptions for Equations 350-6 and 360-6: "Note: The volume of gas per start provided by the manufacturer may be used in place of the EFj and t variables."

13. WCI. 363(c) (Acid gas removal (AGR) venting or incineration process) is modified as follows:

a. Paragraph (c)(3) is amended as follows:

i. The existing Equation 360-8 is renamed Equation 360-8A

ii. The existing header is deleted and replaced with: "Calculation Methodology 3. If a CEMS or a vent meter is not available, the outlet gas flow rate of the acid gas removal unit must be used to calculate emissions for CO2 using Equation 360-8. If the outlet flow rate of the acid gas removal unit is not available, then the inlet gas flow rate and Equation 360-8A may be used, however volume correction must be made to account for gas combusted, vented, flared or leaked in the unit.

iii. Equation 360-8 is added immediately before the renamed Equation 360-8A, prior to the parameter definitions:

$$E_{CO2} = \frac{Y_{CO2,in} \times (1 - Y_{H2S,spec}) - Y_{CO2,out} \times (1 - Y_{H2S,in})}{1 - Y_{CO2,in} - Y_{H2S,in}} \times Q_{out} \qquad \textbf{Equation 360-8}$$

iv. The definition of the YH2S,spec parameter is modified to read:

$Y_{H2S,spec}$ = Mole fraction of H2S in the natural gas out of the AGR unit as determined by the performance specifications of the AGR. If the actual molar fraction of H2S in the gas stream out of the ARG unit is known, it must be used instead of that from the performance specifications. If H2S content is insignificant (as in the case of sweet natural gas), then $Y_{H2S,spec}$ and $Y_{H2S,in}$ are zero.

v. The definition of the Qin parameter is modified to change the reference from (c)(5) to (c)(4):

vi. A new parameter Q_{out} is added, defined as follows :

Q_{out} = Metered total annual volume of gas flow out of AGR unit (Sm3/y) as determined in paragraph (c)(5) of this section

b. Paragraph (c)(4) is amended by appending the following paragraph after the existing paragraph: "If inlet flow quantity is used to calculate the AGR emissions, ensure that the flow meter or vent meter monitoring the inlet stream is as accurate as that which otherwise would be installed and used at the outlet stream. Due to the presence of CO2 in the inlet stream, the calibration frequency for the inlet stream meter should be reasonably higher that for the outlet stream. "

14. WCI.353(c.1) and WCI.363(g.1) (Third-party line hits) are amended as follows:

a. The introductory sentence is changed by inserting 'fugitive' between 'Calculate' and 'emissions'

b. A new subtitle for Section 1 reading "**For transmission (WCI.350) and gathering (WCI.360) systems only. Use company gas release data used for regulatory purposes if available. If this data is not available, then**" is added prior to "for each dig-in incident"

c. Under Equation 350-9/360-19, the description of the A parameter is changed to the following:

A = cross-sectional flow area of the pipe (m^2, $A=\pi D^2/4000{,}000$)

d. The header for section (ii) is changed to the following:
For pipeline punctures use the following methodology either individually per puncture or in aggregate (using weighted averages) for all punctures of pipes of a given pressure and pipe type:

e. Under Equation 350-11/360-21, the description of the A_e and P_a parameters are changed to the following:
A_e = size of the hole in the pipe (as either measured or estimated using engineering estimation techniques) (m^2)
P_a = pressure inside the pipe (as either measured or estimated using engineering estimation techniques) at the puncture location (kPa)

f. Section (iii) is changed to the following:
Determine which quantification method to use

g. Section (iii)(A) is changed to the following:
If (P_{ATM}/P_a) is ≥0.546 or the third party line hit is on a distribution pipeline (WCI.350) or gathering pipeline (WCI.360), the reporter must use the equations in section (c.1) (ii) above.

h. Section (iii)(B) is changed to the following:
(B) If (P_{ATM}/P_a) <0.546 and the third party line hit is on a transmission main or intermediate pressure line, the reporter must use the equations in section (c.1)(i) above and A must be set to the cross sectional flow area of the pipe.

i. Section (iii)(C) is added:
(C) When flow is determined through a service tee drill or punch opening the reporter must use an appropriate industry standard quantification method.

j. The following Paragraph (2) is added:
(2) **For distribution systems only:** Until updated Canadian Energy Partnership for Environmental Innovation methods are published or otherwise made available and accepted, may use emission factors (45.32 m^3 natural gas / km-main year) and quantification methods available in the Radian Survey reports (Emission Factor Documentation Technical Memorandum, October 2001. Prepared by URS Corporation for the Canadian Energy Partnership for Environmental Innovation).

15. WCI.363(h) (Storage tanks) is amended as follows:

a. The end of the first sentence in the header is amended to read "... as specified in paragraphs (h)(1), (h)(2), (h)(3) or (h)(4)"

b. Section (h)(3) is added as follows: "Calculate CH4 and CO2 flashing emissions using a combination of the Vasquez-Beggs Correlation and the Standing Correlation" (see page 16 to 18 of the CAPP Guide: Estimation of Flaring Venting Volumes from Upstream Oil and Gas Facilities, May 2002 for further detail on these correlations).

c. Section (h) (4) is added as follows: "Calculate CH4 and CO2 flashing emissions using the California ARB Flash Liberation Test procedure in Appendix B of the California GHG reporting rule.

16. WCI 353(e) and WCI.363(l) (Centrifugal compressor venting) are amended as follows:

a. The introductory paragraph is struck and replaced with the following:
"Calculate emissions from all centrifugal compressor vents as follows. Dry seal and wet seal centrifugal compressors can enter the following operating modes (1) "operating, pressurized", (2) "stand-by, pressurized" and (3) "not-operating, depressurized".

b. Paragraph (1) is amended by inserting "portable utility grade (bellows) meter, high-flow sampler or" before "vane anemometer"

c. Paragraph (2) is amended by
   (i) Replacing $Y_{i,m}$ with Yi, in equation 350-17
   (ii) In the $Y_{i,m}$ parameter definition adding "Annual average" at the start before "mole"
   (iii) In the t_m parameter definition changing "operating" to "operational"
   (iv) In the $E_{s,i}$ parameter definition, removing the term "measured"
   (v) In the $Q_{s,m}$ parameter definition, adding "and (e)(7)" between "(e)(4) and (Sm3/h)", and changing "operating" to "operational"
   (vi) Adding the parameter *m*, defined as "The operational mode of a centrifugal compressor."

d. A new paragraph (2.1) is added: "To ensure that emissions for modes not found during the annual measurement are in included in reported estimates, Equation 350-17a/Equation 360-32a must be used to calculate total emissions:

Equation 350-17a/Equation 360-32a: $E_{s,i,c}=E_{s,i}+E_{m,nf}$
Where:
$E_{s,i}$ = Output of Equation 350-17/Equation 360-32
$E_{m,nf}$ = Estimate of emissions for the modes not found during the annual measurement as calculated from emissions for mode not found for the compressor during previous years and prorated for the time in the year for the mode not found. If the mode not found did not occur in previous years, estimates from a similar compressor or manufacturer emission factors may be used, in order of preference.

e. Paragraph (3) is amended by appending the following sentence at the end of the current paragraph:
" Alternatively, a source-specific emissions factor can be established by measuring the emissions from relevant sources during each operational mode".

f. Paragraph (4) is amended as follows:

   a. In the header:

      i. the term "As applicable," is added before "measure emissions" and "degassing vents," is added between "manifolded to common vents)" and "unit isolation"

      ii. The following sentence is appended to the existing header: "If there is a safety risk that cannot be (reasonably) mitigated with measuring emissions from a specific vent line, a request for exemption of measurement that is accompanied by documentation

(including photos showing and written description of the issue and measurement options contemplated) must be provided to the regulatory Director who may indicate that an emission factor approach be used instead. Given that there is not a requirement to measure in the winter months, winter safety would not be applicable evidence unless the site were winter access only. Consideration of practices of industry peers would need to be considered."

b. Paragraph (4)(i) is deleted and replaced with the following:
(i) Operating pressurized mode, blowdown vent leakage through the blowdown vent stack and wet seal oil degassing vent (if applicable); for wet seal and dry seal compressors.

c. Paragraph (4)(ii) is deleted and replaced with the following:
(ii) Standby pressurized mode.

d. Paragraph (4)(iii)(A) is amended by:

i. replacing "standby" with "not operating" in both instances where it occurs

ii. Appending the following to the first sentence "(if the compressor enters the not operating depressurized mode during normal service (i.e. excluding maintenance)"

e. Paragraph (7) is deleted and replaced with the following:

(7) Emissions from centrifugal compressor, blow down valve leakage and unit isolation valve leakage to open ended vents must be determined following the procedures set forth in WCI.354(c) and (d), or other industry standard method, as appropriate.

f. For WCI.363(l) only, amending paragraph (5) by:
i. replacing "the sum of" with "the sum of all"
ii. In the parameter $E_{s,i,}$ adding "i" between "GHG" and "emissions"
iii. In the parameter Count, adding "where their aggregate rated power is" between "centrifugal compressors" and "less than"
iv. Append the definition of parameter EFi with the following new sentence: "if the default emission factor does not appropriately quantify emissions for the compressor, use the manufacturer default emission factor instead"
v. Adding a new paragraph (i), reading:
(i) Adjust the emissions estimated in paragraph (5) of this section downward by the magnitude of emissions recovered using a vapour recovery system as determined by an engineering estimate based on best available data.

17. WCI.353(f) and WCI.363(m) "Reciprocating compressor venting" are amended as follows*:*

a. The introductory paragraph is amended by appending with the following new sentence: **"**A reciprocating compressor's operational modes include "operating, pressurized", "standby, pressurized mode" and "not operating, depressurized."

b. Paragraph (1) is amended by
(i) In the Y_i parameter definition adding "Annual average" at the start before "mole"

(ii) In the t_m parameter definition changing "operating" to "operational"
(iii) In the $E_{s,i}$ parameter definition, removing the term "measured"
(iv) In the $Q_{s,m}$ parameter definition, changing "operating" to "operational"
(v) Adding the parameter *m*, defined as "The operational mode of a reciprocating compressor."

c. A new paragraph (1.1) is added: "To ensure that emissions for modes not found during the annual measurement are in included in reported estimates, Equation 350-18a/Equation 360-34a must be used to calculate total emissions:

Equation 350-18a/Equation 360-34a: $E_{s,i,c}=E_{s,i}+E_{m,nf}$

Where:

$E_{s,i}$ = Output of Equation 350-18/Equation 360-34

$E_{m,nf}$ = Estimate of emissions for the modes not found during the annual measurement as calculated from emissions for mode not found for the compressor during previous years and prorated for the time in the year for the mode not found. If the mode not found did not occur in previous years, estimates from a similar compressor or manufacturer emission factors may be used, in order of preference.

d. Renumbering paragraph (f)(6)(ii) to (f)(6.1)
e. Paragraph 2(ii) is amended by inserting "portable utility grade (bellows) meter or" before "vane anemometer"
f. Paragraph (4) is amended by:
    a. The paragraph (4) header is amended by:
        i. replacing "the mode" with "the operational mode
        ii. The following sentence is appended to the existing header: "If there is a safety risk that cannot be (reasonably) mitigated with measuring emissions from a specific vent line, a request for exemption of measurement that is accompanied by documentation (including photos showing and written description of the issue and measurement options contemplated) must be provided to the regulatory Director who may indicate that an emission factor approach be used instead. Given that there is not a requirement to measure in the winter months, winter safety would not be applicable evidence unless the site were winter access only. Consideration of practices of industry peers would need to be considered."
    b. Paragraph (4)(i) is deleted and replaced with the following:

        (i) Operating pressurized mode, blowdown vent leakage through the blowdown vent stack and reciprocating rod packing emissions.

    c. Paragraph (4)(ii) is deleted and replaced with the following:
    (ii) Standby pressurized mode.

    d. Paragraph (4)(iii)(A) is amended by:
        i. replacing "standby" with "not operating" in both instances where it occurs

ii. Appending the following to the first sentence "(if the compressor enters the not operating depressurized mode during normal service (i.e. excluding maintenance)"

g. For WCI.363 only, amending paragraph (7) by:

(i) replacing "the sum of" with "the sum of all"

(ii) In the parameter $E_{s,i,}$ adding "i" between "GHG" and "emissions"

(iii) Append the definition of parameter EF_i with the following new sentence: "if the default emission factor does not appropriately quantify emissions for the compressor, use the manufacturer default emission factor instead"

(iv) Adding a new paragraph (i), reading:

1. Adjust the emissions estimated in paragraph (7) of this section downward by the magnitude of emissions recovered using a vapour recovery system as determined by an engineering estimate based on best available data

18. WCI.353(g) (Leak detection and leaker emission factors) is amended as follows:

a. The following part of the first sentence is struck: "all sources listed in WCI.352 (b)(2) (where total emissions for a compressor station are 10,000 tonnes CO_2e or greater), (b)(5), (c)(2), (d)(2), (e)(2) and (f)(1) ", and replaced with "all sources listed in WCI.352(b)(2), (c)(2), (d)(2), (e)(2) (each where total emissions for the facility are 10,000 tonnes CO_2e or greater, or voluntarily by the operator (and replacing the requirement in WCI.353(h)) where emissions for the facility are less than 10,000 tonnes CO_2e), (b)(5) and (f)(1) "

b. Equation 350-19 parameter Y_i is amended as follows:

Y_i =For volumetric emissions in Equation 350-19, use 0.975 for CH4 for natural gas transmission, compression and underground natural gas storage and 1.1×10^{-2} for CO2; for LNG storage and LNG import and export equipment, GHGi equals 1 for CH4 and 0 for CO2; and for natural gas distribution, GHGi equals 1 for CH4 and 1.1 x 1 0^{-2} for CO2 or use the experimentally determined gas composition for CO2 and CH4. For mass emissions in Equation 350-20, use mass fractions of CH_4 and CO_2 from each unit of a distribution or transmission company within a jurisdiction that has similar gas composition or the 2013 Canadian Energy Partnership for Environmental Innovation (CEPEI) Methodology Manual, or latest edition.[2]

c. Equation 350-19 and 350-20 the t parameter is amended as read as follows:

t = Total time the component was found leaking and operational, in hours. If one leak detection survey is conducted, assume the component was leaking from the start of the year or the date of the last survey until the leak was repaired and then zero for the remainder of the interval between leak surveys. If the leak was not repaired, assume the component was leaking for the entire year or the entire leak survey interval. If multiple leak detection surveys are conducted, assume that the

[2] Clearstone Engineering Ltd. *Methodology Manual: Estimation of Air Emissions from the Canadian Natural Gas Transmission, Storage and Distribution System.* Prepared for Canadian Energy Partnership for Environmental Innovation (CEPEI). 2013

component found to be leaking has been leaking since the last survey during which it was determined to be not leaking, or the beginning of the calendar year. For the last leak detection survey in the calendar year or leak survey interval, assume that all leaking components continue to leak until the end of the calendar year or leak survey interval and until the component was repaired and then zero until the end of the year or leak survey interval.

19. WCI.353(h) (Population count and emission factors) is amended as follows:

a. Added reference to the exception created in 353(g) by modifying the start of the first sentence in the header to read: " This paragraph applies to emissions sources listed in WCI.352 (b)(2), (c)(2), (d)(2) and (e)(2) except as allowed within this document, where total emissions for the facility are less than 10,000 tonnes CO_2e,…"

b. The following sentence is added at the end of the first paragraph of the header of WCI.353(h). "In addition, emission sources at which a leak detection has been conducted and reported under WCI.353(g) (either voluntarily or required under Section 353(g)) are exempt from the following requirements)."

c. (h)(2) is amended by adding "(except storage at LNG import and export facilities which is covered in WCI.353(h)(3))"

d. (h)(4)(ii) is amended by inserting the following sentence immediately prior to the existing final sentence "The calculated facility emission factor…" in the first paragraph: "If a company does not have custody transfer meter-regulating stations, then the inputs to Equation 350-23 must use, in order of preference, (i) factors developed during leak detection surveys of the company's non-custody transfer meter-regulating stations, or (ii) industry developed leak factors for custody and/or non-custody transfer meter-regulating stations"

e. (h) (4) (iii) is revised to read: "For buried pipeline-main and service line leaks, Equations 350-21 and 350-22 and their inputs may be modified as outlined in the Canadian Energy Partnership for Environmental Innovation Manual. For example, the use of company-specific leak repair data and CEPEI Manual equations is permitted.

f. Equation 350-23, the $E_{s,i}$ and N parameter definitions are appended with the following: "Where a company does not have a custody transfer station, "custody transfer" should be read to read "non custody transfer"

g. In Equation 350-23 and its parameter definition, the 8760 parameter is deleted

h. Equation 350-21 and 350-22 the N parameter, and X(i) parameter is amended by replacing '2007' with '2013 or latest edition'

i. Equation 350-21 and 350-22 the definition of the $E_{s,i}$ parameter is deleted

j. Equation 350-21 and 350-22 $P_{s,i}$ in the parameter definitions is changed to $\rho_{s,i}$

k. Equation 350-21 parameter Y_i is amended to read as follows:

Y_i =For volumetric emissions in Equation 350-21, use 0.975 for CH4 for natural gas transmission, compression and underground natural gas storage and 1.1×10^{-2} for CO2; for LNG storage and LNG import and export equipment, GHGi equals 1 for CH4 and 0 for CO2; and for natural gas distribution, GHGi equals 1 for

CH4 and 1.1 x 10^{-2} for CO2 or use the experimentally determined gas composition for CO2 and CH4.

l. (i) is amended by replacing '2007' with '2013 (or latest edition)'

20. WCI.363(o) (Population count and emission factors)

a. The following sentence is added at the end of the first paragraph of the header of WCI.363(o). "In addition, emission sources at which a leak detection has been conducted and reported under WCI.363(n) (either voluntarily or required under Section 363(n)) are exempt from the following requirements)."

21. WCI.354(a)(0.1) and WCI.364(a)(0.1) are amended as follows:

a. The last sentence in paragraph (a)(0.1) is replaced with "A maximum of 36 months is allowed between leak detection surveys**."**

22. WCI.354(a)(0.2) and WCI.364(a)(0.2) are amended as follows:

b. **The existing text in paragraph (a)(0.2) is deleted and replaced with "**If there is no such legal requirement (as specified in paragraph (a)(0.1) of this section), then representative sampling is required using one of the methods outlined below in combination with best industry practices for use of the method– including service schedules for different components - to determine the count of leaks (and time leaking) required in WCI.353 (g) or WCI.363(n), as applicable. Representative sampling means establishing the most valid or credible sample of leaks that accurately characterizes the number of fugitive equipment leaks required per sample interval, under operating conditions. A baseline representative sample of leaks must be established under normal operating conditions for the 2011 and 2012 calendar years or upon acquisition of previously operated equipment or within the first year of operation of newly constructed or acquired equipment. Subsequent representative sampling must be based on random or stratified sampling, modeling, detection or measurement of leaks under normal operating conditions. After establishing the baseline representative sample of leaks per sample interval a maximum of 36 months is allowed between sampling. The interval is determined based on whether there are leaks. If a leak is found and immediately repaired, the existing schedule may be maintained. If a leak is found and not repaired the maximum interval between sampling is 18 months and the leak must be monitored (and optionally measured) on a regular basis until repaired. If the equipment is replaced the maximum sampling interval is 18 months until a baseline representative sample of leaks has been established under normal operating conditions.

23. WCI.357 Directions for the use of Tables 350-1 to 350-5 and WCI.367 Directions for the use of Tables 360-1 to 360-2 are struck and replaced with the following:

*Note for all tables: As the reference materials for these tables are updated periodically with newer information, all tables should be viewed to read "as amended from time to time".

(a) Starting with 2014[3] calendar year emissions, for each component listed in the Tables 350-1 to 350-5 / 360-1 to 360-2, or otherwise required by the quantification method referencing Tables 350-1 and 350-2 / 360-1 to 360-2:

(1) If statistically valid facility-specific emission factors for a component type are available they must be used. If statistically valid facility-specific emission factors can be reasonably developed using existing company leak detection data then they must be used.

(2) If facility-specific emissions factors for a component type are not available, an operator must use statistically valid company specific emission factors if they are available. If statistically valid company-specific emission factors can be reasonably developed using existing company leak detection data then they must be used.

(b) If statistically valid facility or company-specific emission factors for a specific component are not available, emission factors in the default Tables 350-1 to 350-5 / 360-1 to 360-2 may be used.

(c) If a facility-specific or company-specific emission factor has been used in a previous reporting year, it must continue to be used until any changes are approved by the jurisdiction.

(d) (For WCI.350) If an emission factor required by the quantification method referencing Tables 350-1 through 350-5 is not provided in the tables, emission factors from the 2013 Canadian Energy Partnership for Environmental Innovation Methodology Manual (as amended from time to time)or U.S. EPA 40 CFR Part 98.230 Tables W-3 through W-7 (in order of preference), may be used (as converted for use in the relevant equation). (For WCI.360) If an emission factor required by the quantification method referencing Tables 360-1 to 360-2 is not provided in the tables, emissions factors from either U.S. EPA CFR Part 98.230 Tables W1A or W2 or the Clearstone Engineering Ltd. A National Inventory of Greenhouse Gas (GHG), Criteria Air Contaminant (CAC) and Hydrogen Sulphide (H2S) Emissions by the Upstream Oil and Gas Industry, Volume 5, September, 2004 (as amended from time to time, or in updated format) may be used (as converted for use in the relevant equation).

(e) Documentation on the method used to update the emission factors, input data, sampling methodology and other relevant information must be kept by the operator and provided to the jurisdiction or verifier upon request.

(f) Updated emission factors can only be incorporated for reporting purposes at the start of a reporting period and not during a calendar year.

24. WCI.357 Table 350-1 and associated notes are struck and replaced by the following:

TABLE 350-1 –DEFAULT EMISSION FACTORS FOR TRANSMISSION

[3] The existing WCI.357 Directions for use of Tables 350-1 to 350-5/360-1 to 360-2 published on December 11, 2011 must be used for 2013 calendar year reporting.

Emission Factors - All Components, Natural Gas Service		
Transmission	**Population Emission Factor[1a] (tonnes/hr/component)**	**Leaker Emission Factor[1b] (tonnes/hr/component)**
Connector	4.471E-7	4.848E-5
Block valve	4.131E-6	1.275E-4
Control valve	1.650E-5	8.205E-5
Station or pressurized compressor blowdown valve	3.405E-3	5.691E-3
Pressure relief valve	1.620E-4	5.177E-4
Orifice meter	4.863E-5	2.076E-4
Other flow meter	9.942E-9	3.493E-7
Regulator	7.945E-6	1.125E-4
Open-ended line	9.183E-5	1.580E-4
Population Emission Factors - Other Components, Natural Gas Service		**Emission Factor (Sm^3/hour/component) Prasino Final Pneumatic Field Sampling Report* or Direct conversion of EF's in 2011 EPA Subpart W Table W-3** (scf to Sm^3)**
Low-bleed pneumatic device vents**		3.88 E-2
High continuous bleed pneumatic device vents*		2.605E-1
Intermittent high bleed pneumatic device vents*		2.476E-1
Intermittent low bleed pneumatic device vents**		6.65 E-2
Diaphragm Pumps*		1.0542 E-0
Piston Pumps*		5.917 E-1

1. Clearstone Engineering Ltd. *Methodology Manual: Estimation of Air Emissions from the Canadian Natural Gas Transmission, Storage and Distribution System*. Prepared for Canadian Energy

Partnership for Environmental Innovation (CEPEI). 2013. As these emission factors are updated from time to time, the intention is to incorporate such updates here as well as permit use of the most recent values published.

a. Table 9, p50

b. Table 12, p80.

2. US EPA, Mandatory Reporting of greenhouse Gases – Rules and Regulations, Subpart W Table 7, Dec 23, 2012.

25. The final portion of WCI.357 Table 350-2 and is struck and replaced by the following:

Population Emission Factors - Other Components, Gas Service	**Emission Factor (Sm^3/hour/component) Prasino Final Pneumatic Field Sampling Report* or Direct conversion of EF's in 2011 EPA Subpart W Table W-3** (scf to Sm^3)**
Low-bleed pneumatic device vents**	3.88 E-2
High continuous bleed pneumatic device vents*	2.605E-1
Intermittent high bleed pneumatic device vents*	2.476E-1
Intermittent low bleed pneumatic device vents**	6.65 E-2
Diaphragm Pumps*	1.0542 E-0
Piston Pumps*	5.917 E-1

26. WCI.367 Table 360-5 and is struck and replaced by the following:

Pneumatic Device Type	Emission Factor (Sm^3/hour/device) Prasino Final Pneumatic Field Sampling Report* or EPA Subpart W Table W-1A** or Table W-3***
Low-bleed pneumatic device vents**	0.0510
High continuous bleed pneumatic device vents*	0.2605
Intermittent high bleed pneumatic device vents*	0.2476
Intermittent low bleed pneumatic device vents***	6.65E-2
Diaphragm Pumps*	1.0542 E-0
Piston Pumps*	5.917 E-1

27. WCI.357 Table 350-5 and associated notes are struck and replaced by the following:

TABLE 350-5 –DEFAULT EMISSION FACTORS FOR DISTRIBUTION

Above Grade M&R Station Components, Natural Gas Service		
	CEPEI	CEPEI[1]
	Population Emission Factor*[a] (tonnes/hr/source)	**Leaker Emission Factor*[b]** **tonnes/hr/source**
Connector	8.227E-8	6.875E-6 [b]
Block valve	5.607E-7	1.410E-5 [b]
Control valve	1.949E-5	7.881E-5 [b]
Pressure relief valve	3.944E-6	3.524E-5 [b]
Orifice meter	3.011E-6	8.091E-6 [b]
Other flow meters	7.777E-9	2.064E-7 [b]
Regulator	6.549E-7	2.849E-5 [b]
Open-ended line	6.077E-5	1.216E-4 [b]
Population Emission Factors - Below Grade M&R Station		**Emission Factor**

Components, Natural Gas Service	**(Sm^3/hr/Station)**
Below grade M&R station, inlet pressure > 300 psig	3.681E-2
Below grade M&R station, inlet pressure 100 to 300 psig	5.663E-3
Below grade M&R station, inlet pressure < 100 psig	2.832E-3
Population Emission Factors - Distribution Mains, Natural Gas Service	**Emission Factor (Sm^3/hr/km)**
Unprotected steel	2.427E-1 [c]
Protected steel	6.829E-3 [c]
Plastic	7.969E-3 [c]
Population Emission Factors - Distribution Services, Natural Gas Service	**Emission Factor (Sm^3/hr/service)**
Unprotected steel	5.953E-3 [d]
Protected steel	6.270E-4 [d]
Plastic	4.036E-5 [d]
Copper	8.829E-4 [d]

1. Clearstone Engineering Ltd. *Methodology Manual: Estimation of Air Emissions from the Canadian Natural Gas Transmission, Storage and Distribution System.* Prepared for Canadian Energy Partnership for Environmental Innovation (CEPEI). 2013, as amended from time to time.
   A typical natural gas density is considered to be 0.70772 kg/m^3, p82.
   a—Table 9 Average emission factors for estimating fugitive equipment leaks at gas transmission and distribution facilities, p50.
   b—Table 12 Leak/No-leak emission factors for estimating fugitive equipment leaks at Canadian natural gas transmission and distribution facilities, p80.
   c—Calculation Form 4.2.1-3 ~ 4.2.1-6, pp107-110. Equivalent leak multiplier applied.
   d-- Calculation Form 4.2.1-7 ~ 4.2.1-10, pp111-114. Equivalent leak multiplier applied.
2. US EPA, Mandatory Reporting of greenhouse Gases – Rules and Regulations, Subpart W Table 7, Dec 23, 2012.

* The distribution emission factors in Table 350-5 should be used for equipment in odourized service and the transmission factors in Table 350-1 should be used for equipment in unodourized service, regardless of the actual classification or functionality of the facility

28. **The existing Table 350-6 and 360-6 are amended as follows** for the pneumatic controllers, intermittent bleed devices and pumps (or their equivalents as listed) in the table below (which must be used for the 2013 reporting year and onwards).

Pneumatic Device	Average Bleed Rate (m^3/hr)	Coefficients (supply pressure, injection pressure, strokes per min)	Equivalent Device
Generic High Bleed Controller	0.2605	0.0012	-
Generic High Bleed Intermittent Controller	0.2476	0.0012	-
Pressure Controllers			
Fisher 4150	0.4209	0.0019	4150K, 4150R, 4160, CVS 4150
Fisher C1	0.0649	-	-
Fisher 4660	0.0151	0.0003	4660A
Level Controllers			
Fisher 2500	0.3967	0.0011	2500S, 2503, L3
Fisher 2680	0.2679	0.0014	2680A
Fisher 2900	0.1447	-	2900A, 2901, 2901A
Fisher L2	0.2641	0.0012	-
Murphy LS1200	0.2619	0.0012	LS1100, LS1200N, LS1200DVO
Norriseal 1001	0.1868	-	1001A, 1001XL
SOR 1530	0.0531	-	-
Positioners			

Fisher Fieldvue DVC6000	0.2649	0.0011	6030, 6020, 6010
Temperature Controllers			
Kimray HT-12	0.0351	-	-
Transducers			
Fairchild TXI7800	0.1543	0.0009	TXI7850
Fisher 546	0.3547	0.0017	546S
Fisher i2P-100	0.2157	0.0009	-
Pumps			
Generic Piston Pump	0.5917	0.00202, 0.000059, 0.0167	-
Generic Diaphragm Pump	1.0542	0.0005, 0.000027, 0.0091	-
Morgan HD312	1.1292	0.00418, 0.000034, 0.0073	HD312-3K, HD312-5K
Texsteam 5100	0.9670	0.0003,0.000034, 0.0207	5100LP, 5100H
Williams P125	0.4098	0.00019, 0.000024, 0.0076	-
Williams P250	0.8022	0.00096, 0.000042, 0.0079	-
Williams P500	0.6969	0.00224, -0.000031, 0.0046	-

Notes:

1. If an updated version of this table is made available by the appropriate regulator, then the updated version must be used. If improved emission factors for pneumatic devices and pumps (such as low bleed devices and further intermittent devices) are published and then made available by the appropriate regulator, then they must be used in place of those listed in the combination of the table below and the existing Table 350-6 / 360-6.
2. This table provides a list of equivalent pneumatic controllers. If a controller is listed in the equivalents column, then the emission factor or coefficient(s) for the equivalent manufacturer and model provided must be used
3. Controllers that do not have a coefficient should use the mean bleed rate instead of the bleed rate equation
4. All data in Table 350-6/360-6 from Final Report – For Determining Bleed Rates for Pneumatic Devices in British Columbia. The Prasino Group. December 2013.

Addendum for Non Oil and Gas Sources

29. **WCI.244(a)(4) (Zinc Production – e-waste sampling) and WCI.164(a)(4) (Lead Production – e-waste sampling) are struck and replaced with the following:**

    (4) "For waste-based carbon-containing material, determine carbon content as follows:"

    (a) Use an average carbon content value from samples analyzed by a Leco instrument for percent carbon. Monthly composites of e-waste need to be riffled, ground to no less than 2 mm, split and then analyzed.
    (b) For 2012 reporting only, determine carbon content based on a 2010 or 2011 experimental value obtained by aqua regia Ewaste digestion

30. **WCI.244(a)(1) (Zinc Production) is amended** by appending ", or other ASTM method, as appropriate" to the existing text.

31. **WCI.230 (Electricity Transmission) is amended by adding WCI.234(c):**

    WCI.234(c) is added : "For electricity transmission and distribution operations with distributed use of SF6, the volume of gas added to equipment from up to 5% of cylinders in circulation may be estimated, for example if cylinder tags that account for the amount of gas used are not available"

32. **WCI.282(b) (Mobile Combustion) is amended** by changing "litres" to "kilolitres"

33. **WCI.132(b) (Hydrogen Production) is amended** by changing "litres" to "kilolitres"

34. **WCI.343(a) (Phosphoric Acid Production) is amended** by changing "carbonate" to "carbon":
    a. The Cf_i parameter definition is revised so that "carbonate" instead reads "carbon"
    b. The 3.664 parameter definition is revised to append "from Carbon to CO_2" at the end of the existing definition

35. **WCI.090 (Cement Production) is** amended by accounting for the contribution of organic carbon component
    a. In WCI.91, the word "natural" is replaced by "ordinary Portland"

36. **WCI.261 (Nickel and Copper Metal Production) is amended** by changing "three main processes" to "four main processes" and adding "as well as the SX-EW process" after "carbon electrodes in electric arc furnaces"