Carbon Intensity Records under the Renewable and Low Carbon Fuel Requirements Regulation

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1. Background

The *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* (Act) sets low carbon fuel requirements for "Part 3 fuel suppliers". A Part 3 fuel supplier is a person that sells Part 3 fuel for the first time, or uses it after it is manufactured in or brought into British Columbia.

Section 11.071 of the Renewable and Low Carbon Fuel Requirements Regulation (Regulation) establishes the concept of a "Carbon Intensity Record", which sets out the carbon intensity of a Part 3 fuel and the provision of the Act relied on to determine the carbon intensity of the Part 3 fuel. Carbon Intensity Records are relevant to:

- Part 3 fuel suppliers, whose compliance reports must include a Carbon Intensity Record for each Part 3 fuel supplied in a compliance period (see also *Information Bulletin RLCF-003 Compliance Reporting Requirements*); and
- Suppliers, importers and manufacturers (in British Columbia) of low carbon fuels, who wish to buy and/or sell fuels under an Exclusion Agreement (see also *Information Bulletin RLCF-015 Exclusion Agreements and Reports*).

The purpose of this guide is to assist suppliers, importers and manufacturers of Part 3 fuels in determining carbon intensities for the purpose of creating a Carbon Intensity Record.

2. What is carbon intensity?

Carbon intensity is the measure of greenhouse gas (GHG) emissions associated with producing and consuming a transportation fuel, measured in grams of carbon dioxide equivalent per megajoule of energy (gCO_2e/MJ). Carbon intensity accounts for the GHG emissions associated with extracting, producing, transporting, and consuming a unit of energy of transportation fuel. It is a measure of the GHG emissions from the complete life cycle assessment (LCA) of a fuel.

The International Organization for Standardization (ISO) standards 14040 and 14044 have established a framework for conducting LCA which can be applied to transportation fuels. This framework forms the basis of the determination of carbon intensities for the purposes of the Regulation.

The Regulation defines the transportation fuel life cycle as consisting of twelve components, each of which has associated GHG emissions, as shown in Table 1. The carbon intensity of a transportation fuel is the sum of the carbon intensity of each of the twelve components. The details that describe each component for a specific fuel are collectively referred to as the "pathway" for that fuel.

Table 1: The components of the GHG life cycle for transportation fuels

Component		Explanation of what processes the component includes
1	Carbon dioxide and hydrogen sulphide removed from natural gas	Activities and processes associated with removing carbon dioxide and hydrogen sulphide from natural gas
2	Carbon from air incorporated in fuel	Processes by which carbon is incorporated in biological feedstock in the feedstock production process
3	Co-products production	Production of usable products, other than the fuel being analyzed, in a fuel production process, whether the co-product is produced at the point of feedstock recovery or at the fuel production facility

Component		Explanation of what processes the component includes
4	Direct land use change	Activities and processes associated with changing the use of land from another use to (a) feedstock production and recovery, (b) fuel production, (c) roads for access to feedstock or an energy source, (d) feedstock exploration activities, or (e) pipelines, transmission lines or other means of transporting feedstock or fuel
5	Feedstock production and recovery	Activities and processes associated with producing and recovering feedstock, including, without limitation, processing, handling and storage that occurs before transporting the feedstock to a fuel production facility
6	Feedstock transport	Activities and processes associated with transporting feedstock from the location of production or recovery to a fuel production facility, including, without limitation, the manufacture and maintenance of vehicles, vessels and pipelines used for transporting and leaks and spills that occur in the process of transferring the feedstock to a means of transportation
7	Fertilizer and pesticide manufacture	Activities and processes associated with the use of fertilizers and pesticides for agricultural feedstock, including, without limitation, recovering and transporting raw materials and manufacturing, transporting and using fertilizers and pesticides
8	Fuel dispensing	Activities and processes associated with the transfer of fuel from storage at a fuelling station into a vehicle or vessel for use in the engine of that vehicle or vessel or a device necessary for the intended use of the vehicle or vessel, including, without limitation, leaks and spills that occur in the transfer process
9	Fuel production	Activities and processes associated with manufacturing or producing fuel at a fuel production facility, including fugitive emissions, flaring and leaks of substances during the fuel production process
10	Fuel storage and distribution	Activities and processes associated with storing, handling and transporting fuel from the fuel production facility to and at the fuelling station
11	Leaks and flaring	Fugitive emissions, leaks and flaring of substances during feedstock production and recovery
12	Vehicle or vessel operation	Consumption of fuel in the operation of vehicles and vessels, including, in the operation of any device necessary to the intended operation or use of the vehicle or vessel

Part 3 fuel suppliers should be aware of the following:

- The carbon intensity referred to in the Regulation is not adjusted for relative drive train efficiencies. The calculation prescribed in section 6 of the Act adjusts for drive train efficiencies using a factor defined as the energy effectiveness ratio (EER).
- Because the fuel user's vehicle is not normally known to suppliers, fleet average emissions are used for the "vehicle or vessel emissions" (component number 12).
- Emissions associated with vehicle materials, manufacture and transport are not included in the carbon intensity of a fuel, as the carbon intensity reflects emissions associated with the fuel and not the vehicle.
- Emissions associated with the construction of fuel production facilities are considered to be insignificant and treated as zero.
- Effects related to indirect land use change are not included in the Regulation.

3. What is a Carbon Intensity Record?

A Carbon Intensity Record is a record that contains information used to confirm the carbon intensity of a Part 3 fuel being supplied or sold. A Carbon Intensity Record must contain the carbon intensity of the Part 3 fuel, the method used to determine the carbon intensity, and any additional information as applicable (see Table 3). The method used to determine the carbon intensity must be identified by specifying the precise section of the Act as set out in section 11.071 (1) (b) of the Regulation.

A Carbon Intensity Record is required:

- For each Part 3 fuel supplied in a compliance period and subsequently included in the Part 3 Compliance Report, and
- For each Part 3 fuel sold under an Exclusion Agreement, if it is not petroleum-based gasoline or petroleum-based diesel fuel.

In some instances, a blend of Part 3 fuels may be supplied in a compliance period or sold to a Part 3 fuel supplier under an Exclusion Agreement. For a blend of Part 3 fuels, a Carbon Intensity Record must set out the proportion of each Part 3 fuel in the blend, and include Carbon Intensity Records for each Part 3 fuel in the blend.

4. The GHGenius model

GHGenius is a life cycle assessment model developed and maintained by Natural Resources Canada for the calculation of life cycle GHG emissions from transportation fuels. The model's analytical approach complies with ISO 14040 and ISO 14044 standards for LCA.

There are a number of LCA models for calculating GHG emissions from transportation fuels. GHGenius is the most complete model for transportation fuels in Canada. The U.S. GREET model, developed by Argonne National Laboratory, has similar system boundaries and fundamental assumptions, but does not contain data for fuels used in Canada. Other models often have different system boundaries and fundamental assumptions. To provide fair and equitable treatment of all transportation fuels, calculations must be based on the GHGenius model, or use the same system boundaries and fundamental assumptions.

Beginning with version 4.01, the GHGenius model split the life cycle component "Feedstock production and recovery" into two separate components known as "Feedstock recovery" and "Feedstock upgrading". The additional component was added to provide consistent analysis following more complete oil sands data. For the purpose of the Regulation, the carbon intensity of "Feedstock production and recovery" is considered to be the sum of "Feedstock recovery" and "Feedstock upgrading".

For more information regarding GHGenius, see *Information Bulletin RLCF-010 – Using GHGenius in B.C.*, and *Information Bulletin RLCF-011 – Approved Version of GHGenius*.

5. Determining carbon intensity

For the purposes of completing a Carbon Intensity Record, fuel suppliers need to make a series of decisions to ensure that they are identifying the appropriate provision of the Act used to determine the carbon intensity of each Part 3 fuel. To assist the reader, the relevant provisions of the Act are underlined below.

1) If the fuel is petroleum-based gasoline, then section 6 (5) (a) of the Act states that the carbon intensity is the value prescribed under the Regulation. In this case, section 11.02 (4) (b) of the Regulation prescribes the carbon intensity of petroleum-based gasoline supplied before January 1, 2017 to be 87.29 gCO_2e/MJ.

2) If the fuel is petroleum-based diesel fuel, then section 6 (5) (b) of the Act states that the carbon intensity is the value prescribed under the Regulation. In this case, section 11.02 (4) (a) of the Regulation prescribes the carbon intensity of petroleum-based diesel fuel supplied before January 1, 2017 to be 93.55 gCO_2e/MJ.

3) If the Director has posted the carbon intensity for a Part 3 fuel (see *Information Bulletin RLCF-012 – Approved Carbon Intensities*), then section 6 (5) (c) of the Act requires the supplier to use that carbon intensity. In addition, the Carbon Intensity Record must include the fuel code assigned to the Part 3 fuel in that publication.

   In order to have the carbon intensity of a Part 3 fuel approved and published, the producer must apply to the Director (see *Information Bulletin RLCF-008 – Carbon Intensity Approvals*).

If none of the above applies, then the supplier must determine the carbon intensity of the fuel using one of the following three methods:

4) Select a default carbon intensity.

   Section 6 (5) (d) (i) of the Act states that the default carbon intensity established under the Regulation can be used in determining the carbon intensity of a Part 3 fuel. The supplier must select the appropriate carbon intensity for the fuel from the table in section 11.04 of the Regulation (duplicated in Table 2 below). The default carbon intensity values listed in Table 2 are for fuels supplied before January 1, 2017. This is the simplest determination method, and an understanding of LCA and GHGenius is not necessary.

   The default carbon intensities are set at a precautionary high value, placing the onus on fuel suppliers to prove that the carbon intensity of their fuel is lower than the default. The higher default values encourage fuel suppliers to determine the actual carbon intensity of their fuel, and to prevent suppliers of higher carbon intensive fuels from using a default value that is lower than the actual carbon intensity.

Table 2: Default Carbon Intensities for Fuels Supplied Before January 1, 2017

Fuel	Carbon Intensity (gCO_2e/MJ)
Renewable fuel in relation to diesel class fuel	93.55
Propane	75.35
Renewable fuel in relation to gasoline class fuel	87.29
Natural gas-based gasoline	90.07
CNG	62.14
LNG	63.26
Electricity	11.00
Hydrogen	95.51

Examples:

- Ethanol is a "renewable fuel in relation to gasoline class fuel" and suppliers would report a carbon intensity of 87.29 gCO_2e/MJ.
- Biodiesel or HDRD is a "renewable fuel in relation to diesel class fuel" and suppliers would report a carbon intensity of 93.55 gCO_2e/MJ.
- For liquefied natural gas (LNG) a supplier would report a carbon intensity of 63.26 gCO_2e/MJ.

5) Use an approved version of GHGenius.

Section 6 (5) (d) (ii) (A) of the Act allows a supplier to determine the carbon intensity of a fuel using an approved version of GHGenius (see *Information Bulletin RLCF-011 – Approved Version of GHGenius*). For fuels where the director has not published the carbon intensity and a supplier does not wish to use a default value, the supplier may use GHGenius to calculate the carbon intensity. This approach to determining carbon intensity allows a supplier to use either primary data or regional averages to determine a fuel's life cycle GHG emissions.

Suppliers who rely on this provision of the Act to determine carbon intensity must ensure that the carbon intensity record also includes a record of inputs to GHGenius, and any additional information necessary (see Table 3) to reproduce the results submitted. In addition, fuel suppliers are required to document and explain the values chosen. This may include a detailed narrative of the fuel life cycle assessment, an explanation of any unique features of the life cycle, and any information that would assist in reproducing the carbon intensity value.

An understanding of the principles of LCA as well as a working knowledge of GHGenius is necessary (see *Information Bulletin RLCF-010 – Using GHGenius in B.C.*).

If a fuel, including its production processes and conditions, cannot be modelled in an approved version of GHGenius, the supplier will not be able to use this provision of the Act to determine carbon intensity for the purposes of creating a carbon intensity record. Instead, a supplier can use an alternative method approved by the Director.

6) Use an alternative method approved by the Director.

Section 6 (5) (d) (ii) (B) of the Act allows a fuel supplier to use an alternative method to determine the carbon intensity of a life cycle component of a fuel. Under section 11.07 of the Regulation, a fuel supplier may apply to the Director for approval of an alternative method to determine the carbon intensity of a fuel, including the use of a version of GHGenius that is not approved for use under the Regulation.

A written application for approval of an alternative method must be received by the Director on or before the end of the compliance period for which approval is requested. An application for an alternative method must include all information as listed in section 11.07 of the Regulation. It is recommended that anyone wishing to use an alternative method apply as early as possible. An advanced understanding of LCA is necessary for this method.

If the carbon intensity for a Part 3 fuel was determined using an alternative method, the carbon intensity record must include:

- A copy of the Director's approval of an alternative method

- A record of inputs for that alternative method, as applicable, and any additional information necessary to reproduce the results submitted.

6. General considerations

To ensure consistency and comparability in determining carbon intensities using either an approved version of GHGenius or an alternative method approved by the Director, fuel suppliers should be aware of the following:

- Carbon intensities must be calculated to two decimal places in units of grams of carbon dioxide equivalent per megajoule (gCO_2e/MJ).
- For determining carbon intensities for fuel produced before December 31, 2014, Intergovernmental Panel on Climate Change (IPCC) global warming potentials for the year 1995 must be used. For fuel produced after January 1, 2015, global warming potentials for the year 2007 must be used.
- High heat values (not low heat values) must be used.
- Reported carbon intensities must not be corrected for relative drive train efficiency. This correction is achieved through inclusion of EERs in the calculating of credits and debits.

In determining carbon intensity, Part 3 fuel suppliers using either an approved version of GHGenius or an alternative method approved by the Director must ensure that their carbon intensity determination conforms to ISO standards for LCA as well as the requirements of the Ministry. The following criteria should be considered when using one of these two methods for determining carbon intensity for the purposes of creating a carbon intensity record:

- *Relevance* – Documentation should outline how the unadjusted carbon intensity (in gCO_2e/MJ) was determined and be clearly understandable by those with an understanding of the principles of LCA as well as a working knowledge of GHGenius.
- *Completeness* – All changes made to the model in its default state should be documented so that the results are repeatable. All assumptions and estimation methods should be documented.
- *Consistency* – The methodologies used should be consistent to allow for meaningful comparisons over time.
- *Transparency* – All relevant issues are addressed and documented in a factual and coherent manner. All relevant assumptions and appropriate references to the methodologies and data sources are disclosed. Any estimates made are explained, with evidence of how bias was avoided so that the resulting carbon intensity accurately represents the fuel in question.
- *Accuracy* – The GHG emissions as represented by the carbon intensity are not consistently greater or less than the actual emissions and that best efforts have been made to reduce uncertainties in inventory data.

7. Carbon Intensity Record Summary Table

A Carbon Intensity Record must include: (1) the carbon intensity of the Part 3 fuel; (2) the method used to determine the carbon intensity, identified by the precise section of the Act; and (3) any additional information (as applicable). In all cases, records must be kept for seven years after the end of the compliance period to which they relate. For your convenience, Table 3 summarizes the different methods for determining carbon intensity for the purposes of creating a carbon intensity record.

Table 3: Summary of Methods for Determining Carbon Intensity

	Method	**Provision of the Act**	**Additional Information Required (if applicable)**
1)	Fuel is petroleum-based gasoline	Section 6 (5) (a)	
2)	Fuel is petroleum-based diesel	Section 6 (5) (b)	
3)	The Director has published the carbon intensity of the fuel	Section 6 (5) (c)	• Fuel code
If 1), 2), or 3) do not apply, then use one of:			
4)	Default carbon intensity	Section 6 (5) (d) (i)	
5)	Approved version of GHGenius	Section 6 (5) (d) (ii) (A)	• GHGenius inputs • Any additional information necessary to reproduce the results
6)	Alternative method	Section 6 (5) (d) (ii) (B)	• Copy of Director's approval of alternative method • A record of inputs for the alternative method • Any additional information necessary to reproduce the results

8. References

The following documents are referenced in this guide, but note that the content in these documents is neither endorsed nor approved by the Ministry:

Brander, M. et al, "Consequential and Attributional Approaches to LCA: a Guide to Policy Makers with Specific Reference to Greenhouse Gas LCA of Biofuels", Technical Paper TP-090403-A April 2009, Econometrica Press

Canadian Standards Association, CAN/CSA-ISO 14040:06 Environmental management – Life cycle assessment – Principles and framework, 2006

Canadian Standards Association, CAN/CSA-ISO 14044:06, Environmental management – Life cycle assessment – Requirements and guidelines, 2006

ILCD Handbook: General guide for Life Cycle Assessment – Detailed guidance, First edition, International Reference Life Cycle Data System, JRC, European Commission, 2010 [http://lct.jrc.ec.europa.eu/pdf-directory/ILCD-Handbook-General-guide-for-LCA-DETAIL-online-12March2010.pdf, accessed on November 9, 2010]

World Resources Institute & World Business Council for Sustainable Development, "Product Accounting and Reporting Standard: Draft for Stakeholder Review", November 2010 [http://www.ghgprotocol.org/files/ghg-protocol-product-standard-draft-november-20101.pdf, accessed on November 9, 2010]

Need more information?

Please see the Renewable and Low Carbon Fuel website at www.gov.bc.ca/lowcarbonfuels or email us at lcfrr@gov.bc.ca

This information is for your convenience and guidance only, and does not replace or constitute legal advice. The *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* and the Renewable and Low Carbon Fuel Requirements Regulation can be found on the internet at: http://www.bclaws.ca.